Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III(New) • EXAMINATION – WINTER 2016

Subject Code:2131904 Date:04/01/2017

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.**

MARKS

Q.1 Short Questions 14

1 By virtue of "hardness" a material _____
(a) can be drawn into wires (b) breaks with little permanent distortion
(c) can cut another metal (d) can be rolled or hammered into thin sheets

2 The number of atoms in a unit cell of bcc, fcc and hcp metals are :
(a) 4, 2, 6, respectively (b) 6, 4, 2, respectively (c) 2, 4, 6, respectively (d) none of the above

3 A material is said to be allotropic, if it has _____
(a) fixed structure at all temperatures (b) atoms distributed in random pattern (c) different crystal structures at different temperatures (d) any one of the above

4 An eutectoid steel consists of _____
(a) wholly pearlite (b) wholly austenite (c) pearlite and ferrite (d) pearlite and cementite

5 During homogeneous nucleation, critical size of a particle _____ with increase in under-cooling.
(a) Increases (b) Decreases (c) Won't change (d) Not related

6 4. Above the following line, liquid phase exist for all compositions in a phase diagram. _____
(a) Tie-line (b) Solvus (c) Solidus (d) Liquidus

7 A solid phase results in a solid plus another solid phase up on cooling during _____ reaction.
(a) Eutectoid (b) Peritectoid (c) Eutectic (d) Peritectic

8 The hardenability is not affected by _____
(a) air (b) chemical composition of steel (c) critical cooling rate
(d) quenching medium and method of quenching

9 The alloy, mainly used for corrosion resistance in stainless steels is_____
(a) Silicon (b) Manganese (c) Carbon (d) Chromium

10 Nodular cast iron is produced by adding _____ to the molten C.I.
(a) Nickel (b) Chromium (c) Copper (d) Magnesium

11 In Grey Cast Iron, the carbon is present in the form of_____
(a) cementite (b) free carbon (c) flakes (d) spheroids

12 Addition of manganese to Aluminum results in_____
(a) Improvement of casting characteristics (b) Improvement of corrosion resistance (c) One of the best known age and precipitation hardening systems (d) Improving machinability

13 Which of the following method is used to make powder for brittle metals? _____
(a) Mechanical pulverisation (b) Electrolytic process (c) Chemical reduction (d) Atomization

	14	Which among the following is the last step in magnetic particle test method? (a) observation and inspection (b) circular magnetization (c) demagnetization (d) magnetization	
Q.2	**(a)**	Explain the structure-property-performance relationship with suitable example.	**03**
	(b)	Explain the strain hardening process. Also mention the effect of strain hardening on properties of metals.	**04**
	(c)	Differentiate between Edge and Screw dislocation with sketch.	**07**
		OR	
	(c)	Differentiate between Homogeneous and Heterogeneous nucleation processes. Also discuss the conditions under which growth may be of planar and dendritic type.	**07**
Q.3	**(a)**	Mention the important critical reactions that appear on iron-iron carbide diagram.	**03**
	(b)	What is coring? Why it is observed?	**04**
	(c)	Explain in detail, the Pearlitic and Bainitic transformations using TTT diagram.	**07**
		OR	
Q.3	**(a)**	Explain the allotropic behavior of Iron with sketch.	**03**
	(b)	What is Gibb's phase rule? Calculate the degree of freedom, for eutectic composition in binary phase diagram.	**04**
	(c)	Draw the phase diagram of isomorphous system of binary alloy A and B. explain the equilibrium cooling of 30A-70B composition from liquid to solid state (up to room temperature).	**07**
Q.4	**(a)**	Evaluate – Annealing is never a final heat treatment process for hypereutectoid steel.	**03**
	(b)	Completely describe the Martensitic transformation.	**04**
	(c)	Explain the "Hune-Rothery Rules" for solid solution, with suitable case study.	**07**
		OR	
Q.4	**(a)**	Evaluate – size and distribution of graphite flakes govern the properties of a grey cast iron.	**03**
	(b)	Explain the graphitization process. Also enlist the factors affecting the graphitization in cast iron.	**04**
	(c)	Define tool steel. Explain any five tool steels by describing their properties.	**07**
Q.5	**(a)**	Discuss the effect of adding nickel and chromium to steels.	**03**
	(b)	Differentiate between malleable and nodular cast iron.	**04**
	(c)	Completely describe the "sintering" process with sketch. Mention the condition for which "pre-sintering" is required.	**07**
		OR	
Q.5	**(a)**	Define metallography. Differentiate between micro and macro structures of materials.	**03**
	(b)	Describe the important constituents, properties and application of following alloys: (1) Monel (2) Invar (3) Nichrome (4) Babbitt metal	**04**
	(c)	Explain in detail, the ultrasonic testing method with its benefits and limitations.	**07**

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