Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III • EXAMINATION – SUMMER 2013

Subject Code: 131904 **Date: 04-06-2013**

Subject Name: Materials Science & Metallurgy

Time: 02.30 pm - 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.**

Q.1	**(a)**	(i) Differentiate metal and non metal and enlist the engineering requirements of material.	**04**
		(ii) Correlate the property of thermal conductivity and hardness with internal structure of the material.	**03**
	(b)	Establish the co-relationship between number of phase, component and degree of freedom. Also state the significance of this relationship and show that at a eutectic point in a binary phase diagram, degree of freedom is zero.	**07**
Q.2	**(a)**	State different types of corrosion and explain their probable causes of occurrence. Enlist common methods to protect corrosion.	**07**
	(b)	With the aid of an iron-iron carbide equilibrium diagram show and explain eutectic, peretectic and eutectoid transformation. Also mention the significance of these transformations.	**07**
		OR	
	(b)	Compare cooling curves for pure metal, isomorphous and non-isomorphous alloys. State the information revealed by these cooling curves.	**07**
Q.3	**(a)**	(i) Compare and contrast: micro and macro examination.	**03**
		(ii) ñOn the basis of colour and pattern of spark, material identity can be established to an extent.ò ï Evaluate.	**04**
	(b)	Explain the process steps involved in making of a powder metallurgical product. As regards to powder metallurgy, explain the role of process parameters, positive features and limitations of this method.	**07**
		OR	
Q.3	**(a)**	Compare and contrast ultrasonic testing with radiographic testing as regards to flaw detection capabilities, operational safety, process features and parametric control.	**07**
	(b)	(i) State the properties and applications of monel metal and inconel.	**04**
		(ii) Draw the microstructure of wrought iron and enlist the properties and uses of wrought iron.	**03**
Q.4	**(a)**	(i) Why is heat treatment needed? Compare annealing and normalizing process as regards to their objectives, applications, process limitations and process merits.	**04**
		(ii) Differentiate flame hardening and induction hardening process on the basis of parametric control, process features, operational safety and productivity.	**03**
	(b)	Compare and contrast carburizing and nitriding process with reference to parametric controls, process features, process limitations and applications.	**07**
		OR	
Q.4	**(a)**	Compare the hardenability curves obtained from Jominy endquench test for	**07**

plain carbon steels with hypoeutectoid and hypereutectoid composition and comment on the hardenability of these two steels.

(b) Compare malleable cast iron and spheroidal graphite iron on the basis of microstructure, properties and applications. **07**

Q.5 **(a)** Enlist the properties of pure copper and mention the composition, properties and application of phosphorus bronze. **07**

(b) Differentiate martempering and austempering process on the basis of structure property co-relationship and process application. **07**

OR

Q.5 **(a)** Enlist the properties of pure aluminum and mention the composition, properties and application of any one aluminum alloy. **07**

(b) Compare and contrast flame hardening and induction hardening on the basis of uniformity of case depth, parametric controls, process features, process limitations and applications. **07**

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