Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III • EXAMINATION – WINTER 2013

Subject Code: 131904 **Date: 07-12-2013**

Subject Name: Materials Science and 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) State the four major materials groups for materials classification, bring out the basis of its classification and mention the important characteristics of each group.	**04**
		(ii) Differentiate: Ductility and Malleability.	**03**
	(b)	(i) Compare and Contrast: Destructive test with Non Destructive test	**04**
		(ii) Suggest with suitable reasoning the non destructive tests required to determine slag inclusions and porosity in the fusion weld joint. The fusion weld butt weld joint is made in 5 mm thick plain carbon steel sheet (carbon 0.15% by wt) by the arc welding process.	**03**
Q.2	**(a)**	With the aid of steel portion of an iron-iron carbide diagram discuss the transformation of 0.8% C plain carbon steel from liquidus to room temperature and establish structure property relationship.	**07**
	(b)	(i) Differentiate: Macrostructure and Microstructure Examination.	**04**
		(ii) On the basis of colour and sparking pattern in the spark test, differentiate gray cast iron from malleable iron.	**03**
		OR	
	(b)	(i) Establish the co-relationships of microstructure with properties in Wrought Iron and thereby suggest the suitable applications of Wrought Iron.	**04**
		(ii) Explain the method of Sulphur Printing for steels and state the inferences that could be drawn out by the technique.	**03**
Q.3	**(a)**	(i) State the types of solid solution and explain Hume Rothery's rule for the formation of solid solution.	**04**
		(ii) Explain the thermal equilibrium diagram for a case wherein two metals are completely soluble in liquid and solid state forming an isomorphous alloy system.	**03**
	(b)	Mention in brief the role of Nickel, Chromium, Molybdenum and Vanadium as alloying element in steel.	**07**
		OR	
Q.3	**(a)**	Draw TTT diagram for 0.8% eutectoid steel and explain the change of microstructure at varied isothermal transformations and correlate it with properties. Also explain the concept of critical cooling rate and its implications on hardenability.	**07**
	(b)	Explain the allotropic transformation of Iron on an Iron-Iron Carbide phase equilibrium diagram and mention the characteristic features of each allotropic form.	**07**
Q.4	**(a)**	Define corrosion, briefly explain the types of corrosion and suggest the useful applications of corrosion.	**07**
	(b)	On the basis of microstructure and chemical composition explain the properties obtained in high speed steel and stainless steel.	**07**

OR

Q.4	**(a)**	Explain the mechanism of electrochemical corrosion and explain the significance of EMF series as regards to electroplating process.	**07**
	(b)	On the basis of microstructure and chemical composition explain the properties obtained in bearing alloys and aluminum silicon alloys.	**07**
Q.5	**(a)**	On the basis of structure property relationships explain Grey Cast Iron and Spheroidal Graphite Iron.	**07**
	(b)	How can we produce porous self lubricating bearings through powder metallurgy? Explain the process steps and process limitations for manufacturing the same.	**07**

OR

Q.5	**(a)**	Compare and Contrast: Spheroidal Graphite Iron and Malleable Cast Iron	**07**
	(b)	How can we produce cemented carbide tools through powder metallurgy? Explain the process steps and process limitations for manufacturing the same.	**07**

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