Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-III Remedial Examination March 2010

Subject code: 131904

Subject Name: Materials Science & Metallurgy

Date: 10 / 03 / 2010 **Time:11.00 am – 01.30 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)** State the importance of study of "Materials Science" and briefly explain "Engineering Requirements" of materials. **07**

(b) What is Gibb's phase rule? Define system, phase and degree of freedom. Show that the degree of freedom at eutectic point in a binary phase diagram is zero. **07**

Q.2 **(a)** With the aid of steel portion of an iron-iron carbide equilibrium diagram, showing solid state transformations compare the transformations during cooling under equilibrium conditions from solidus to room temperature of typical hypereutectoid steel and hypoeutectoid steels. Compare the resulting microstructure at room temperature and related properties. **07**

(b) Evaluate: "After etching the micro specimen structure is visible". Also write a short note on "Macro-examination". **07**

OR

(b) The following data is for Pb-Sn alloy system : (Lead-Tin Solder) **07**

· Melting point of lead (Pb) - 327°C
· Melting point of Tin (Sn) - 232°C
· Eutectic alloy is formed at 183°C with 62% Sn –38% Pb
· Maximum solid solubility of tin in lead at 183°C –19%
· Maximum solid solubility of lead in tin at 183°C –3%
· Maximum solubility of tin and lead at room temperature is negligible.

(1) Draw the phase diagram with the help of above data and label all the points, lines and regions on it.
(2) For 70%Pb – 30%Sn alloy composition, determine the amounts of proeutectic and eutectic constituents at room temperature.

Q.3 **(a)** What are the factors affecting rate of corrosion? Explain the hydrogen evaluation & oxygen absorption mechanism of corrosion. **07**

(b) Define "Alloy". Also state composition, properties & uses of any two copper alloys. **07**

OR

Q.3 **(a)** Differentiate between gray cast iron & spheroidal cast iron in terms of microstructure, properties, composition & applications. **07**

(b) Discuss the Cathodic protection method of corrosion prevention for underground pipelines. **07**

Q.4	**(a)**	Define Critical Cooling Rate of steel and show the same on a TTT diagram with complete labelling.	**07**
	(b)	List the purposes of heat treatment. Differentiate between annealing & normalizing.	**07**

OR

Q.4	**(a)**	Discuss mechanisms of quenching of steel. State the advantages and drawbacks of water & oil as quenching media.	**07**
	(b)	What is "Wrought Iron"? Enlist the properties and uses of it.	**07**
Q.5	**(a)**	State the advantages or importance of nondestructive testing over destructive testing of materials. Differentiate between X-ray radiography & γ-ray radiography of materials	**07**
	(b)	What is powder metallurgy? Describe various steps involved in powder metallurgy with each step controlling properties of final sintered component.	**07**

OR

Q.5	**(a)**	Explain Ultrasonic method of inspection with reference to its working principle, advantages, limitations & applications.	**07**
	(b)	Give advantages, limitation & applications of powder metallurgy.	**07**

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