

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**
