

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

**CLASS: BE  
BRANCH: MECH/PROD.**

**SEMESTER : III  
SESSION : MO/18**

**SUBJECT: PE3001-METALLURGY**

**TIME: 03:00**

**FULL MARKS: 60**

**INSTRUCTIONS:**

1. The question paper contains 7 questions each of 12 marks and total 84 marks.
  2. Candidates may attempt any 5 questions maximum of 60 marks.
  3. The missing data, if any, may be assumed suitably.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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- Q.1(a) Define Engg. Materials. How can you classify and characterize the Engg. Materials? [2]  
(b) What are the main function of a blast furnace? What are the amounts of raw materials used for the production of one Ton pig iron? Mention the sequence of reduction of iron ore in blast furnace. [4]  
(c) What are the recent developments in blast furnace operation? What are their purposes. [6]
- Q.2(a) What are the requirement of metallurgical coke for the blast furnace operation? What do you mean by coke rate? [2]  
(b) Discuss in short about the principles involved in steel making process. What is duplexing? Give a brief note on super referring of steel. [4]  
(c) Differentiate between substitutional and Interstitid solid solution. Explain in brief the Hume. Rothery rule for the formation of substitutional solid solution. Explain methods of eliminating cored structure in alloys. [6]
- Q.3(a) What do you mean by allotropy? Draw the cooling curve of pure iron. [2]  
(b) An equilibrated Fe<sub>c</sub> alloy contains 15% cementite at the room temperature, assuming a new equilibrium, What fraction of alloy is austenite at just above Ac<sub>1</sub> line. [4]  
(c) Draw an iron carbon equilibrium diagram and explain the significance of various lines and regions enclosed by them. With reference to Fe<sub>c</sub> diagram, give the equation involved in  
(i) Peritectic reaction (ii) Eutectic reaction (iii) Eutectoid reaction. Indicate the temperature and composition also for the above mentioned reactions. [6]
- Q.4(a) Define phase transformation. Discuss the factors affecting the phase transformation. [2]  
(b) Why CCT Curve is important to the steel manufacture? Low carbon steel is not given quenching treatment to increase its strength. Why? [4]  
(c) Explain briefly hardening for the hypereutectoid steels, they are not heated above Ac<sub>m</sub> line rather just above Ac<sub>1</sub> line. Why? [6]
- Q.5(a) Define Heat treatment. What is the basic objective of heat treatment? [2]  
(b) Differentiate between an tempering and mar tempering. [4]  
(c) Explain briefly the advantage of addition of BaCl<sub>2</sub> in to molten salt bath during high temperature cyaniding. [6]
- Q.6(a) Why S.G. iron is more machinable than Grey cast iron? [2]  
(b) Describe briefly the suitable method for the protection of underground and underwater pipe line against corrosion. [4]  
(c) For cathodic protection a ship hull requires used a current density of 15 mA/m<sup>2</sup>. Magnesium is used as the sacrificial anode. What is quantity of magnesium required per m<sup>2</sup> of the dull surface for protection to last 10 years. What will be the coating thickness of magnesium? [6]  
Give Atomic wt of magnesium = 24.  
Density of magnesium = 1.74gm/cc.
- Q.7 Write in short about the following. [3x4]  
(i) Ductile and Brittle fractures  
(ii) Munte metal and Duralumin.  
(iii) Metallurgical aspect of welding  
(iv) Principle of chemical treatment of steel surface.