

Code No: 113AQ

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B.Tech II Year I Semester Examinations, December-2014****METALLURGY AND MATERIALS SCIENCE****(Common to ME, MCT, AME)****Time: 3 Hours****Max. Marks: 75****Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

**Part- A****(25 Marks)**

- 1.a) Define grain boundaries, unit cell, and space lattice. [2M]
- b) Define intermediate alloy and electron compound. [3M]
- c) Define liquidus line and solidus line. [2M]
- d) Define crystalline and non-crystalline materials. [3M]
- e) Define ledburite, pearlite and austenite. [2M]
- f) Why is heat treatment of steels done? [3M]
- g) Give two advantages of steels over the family of cast irons. [2M]
- h) Give composition properties and uses of muntz metal. [3M]
- i) Write the classification of polymers and define them. [2M]
- j) Give a few important applications of ceramics. [3M]

**Part-B****(50 Marks)**

- 2.a) Explain in brief about Hume-Rothery rules.
- b) Find the miller indices of a plane that makes an intercept of one on the x-axis and two on the y-axis and is parallel to the z-axis.
- c) Calculate the critical radius ratio for tetrahedral and octahedral around a central cation in a crystal.

**OR**

- 3.a) Distinguish between atomic sites and lattice points in a monoatomic crystal and a NaCl crystal.
- b) Write the necessity of alloying.
- c) Determine the three methods of grain size measurements.

4. From the data given below for Bi-Cd system plot the equilibrium diagram to scale and find:

a) Amount of eutectic in 20% Cd alloy,

b) Free Cd in 70% Cd alloy

Given Melting temperature of Bi is 271 °C

Melting temperature of Cd is 321 °C

Eutectic temperature 144 °C

Eutectic composition 39% Cd

- c) What are the effects of non equilibrium cooling?

**OR**

- 5.a) What is coring? Which alloys show cored structures and under what conditions?
- b) Draw a typical eutectic type diagram and explain its important features.
- c) What is a dendrite? Explain the mechanism of formation of dendrites.

- 6.a) Write the classifications and applications of steels.  
b) Explain the austenite to pearlitic transformation in detail.  
c) What is the purpose of Normalizing and Hardening?

**OR**

- 7.a) Define hardenability and explain the Jominey end quench test.  
b) What is the purpose and process of Tempering for steels?  
c) What are the effects of retained austenite?
- 8.a) How are cast irons classified? Write the characteristics of cast irons as compared to steels.  
b) What are the important alloys of copper and write their applications?  
c) Define season cracking of brasses.

**OR**

- 9.a) Write the properties of alpha and alpha-beta titanium alloys.  
b) Write the applications and properties of aluminum bronze alloys.  
c) Write the properties of titanium and explain why two-phase titanium alloys are stronger than single phase alpha alloys.
- 10.a) Explain polymerization with an example.  
b) What are the factors effecting the properties of polymers?  
c) Write the properties of carbon reinforced composites.

**OR**

- 11.a) Write about Polymer Matrix Composites.  
b) Differentiate between matrix and fibers.  
c) Differentiate between ceramics and composites.

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