

R13

Code No: 113AQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B.Tech II Year I Semester Examinations, November - 2015****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 the term composite material. What are natural composites? Give examples. [2M]
- b) Calculate the effective number of atoms in the HCP unit cell. Describe the basis for generating the HCP structure starting from the hexagonal space lattice. [3M]
- c) What is lever rule? [2M]
- d) What is annealing? [3M]
- e) What is carbon equivalent? [2M]
- f) Give reasons for extremely high hardness of martensite. [3M]
- g) What is temper- embrittlement phenomena? [2M]
- h) What is ASTM-grain size number? And what is its importance? [3M]
- i) What are the limitations of plain carbon steels? [2M]
- j) What is the effect of cobalt addition on hardenability? [3M]

Part-B**[50 Marks]**

- 2.a) Discuss the necessity of alloying.
- b) Determine the relationship between atomic radius and lattice parameter for FCC crystals. Find the lattice parameter and atomic structure for Al (FCC) having density 2700 kg/Cm^3 and atomic weight of Al is 26.98.
- c) Distinguish between intermetallic compound and interstitial compound. [3+4+3]

OR

- 3.a) What is the role of grain size on the properties of a material?
 - b) Discuss briefly the Hume-Rothery rules.
 - c) Distinguish between Interstitial solution and substitutional solution. [3+4+3]
- 4.a) Two elements A and B are completely soluble in the liquid state and are completely insoluble in the solid state. Their melting temperatures are 700°C and 400°C respectively they form an eutectic at A-70B at 250°C . Draw the phase diagrams label various phases and temperatures.
 - b) Discuss the phases present, their volumes and concentration at any two temperatures for the alloy 70A-30B. [5+5]

OR

- 5.a) Give the number of variables and the degree of freedom at the eutectic temperature of a binary phase diagram.
- b) What is Tie-line rule?
- c) What is coring and how it can be minimised. [4+3+3]

- 6.a) Compare the characteristics of nucleation growth transformation of austenite with that of a diffusion less transformation.

b) What is retained Austenite and how it can be minimized? [5+5]

OR

- 7.a) What is the effect of alloying elements on:

- i) Eutectoid temperature
- ii) Eutectoid composition
- iii) Critical cooling rate
- iv) Formation of carbide
- v) Austenite phase region
- vi) Gas content
- vii) Intermediate phases formed in steel.

b) What is spheroidizing Annealing and Normalising? [5+5]

- 8.a) Why hardening and tempering heat treatment is not practiced to a non –ferrous metals like aluminium?

b) Explain how duralumin is strengthened.

c) Explain how malleable iron is produced by heat treatment. [3+4+3]

OR

9. Write explanatory notes on:

- a) Titanium and its alloys
- b) Al-Cu phase diagrams
- c) Gray cast iron and nodular cast iron.

[3+4+3]

10. Enumerate the characteristics, properties and applications of cermets, glasses. [10]

OR

11. Enumerate the characteristics, properties and applications of composites and polymers. [10]

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