Exam Date & Time: 23-Nov-2019 (09:00 AM - 12:00 PM)

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

THIRD SEMESTER B.TECH END SEMESTER EXAMINATIONS, NOV 2018

MATERIAL SCIENCE AND METALLURGY [AAE 2171]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) Explain Hume Rothary rules for the formation of substitutional solid solutions. & distinguish between an edge dislocation and screw dislocations (5)

A)

B) Define the following. i) Superheating ii) Supercooling (2)

C) Explain the Jominy hardness test for hardenability of steel with a neat sketch (3)

2) Explain the precipitation hardening with the relevant sketch? Explain how this process is different from conventional hardening and tempering process (3)

A)

B) Neatly sketch the Iron-Carbon equilibrium phase diagram and mark all the regions. Draw the cooling curve for the same and explain the solidification process at eutectic point (5)

C) Sketch the miller directions i. [0 1 1] ii. [2 1 2] (2)

3) A) Melting temperatures of Metal A and Metal B are 1280^0C and 830^0C respectively. The metals A and B are mutually soluble in the liquid state and partly soluble in the solid-state. A liquid phase alloy containing 65%B completely transforms into a mixture of two solid solutions at 480^0C. The maximum solubility of A in B and B in A is 15% and 10% respectively at 480^0C, 10% and 5% respectively at 500C. Assuming the solubility lines to be linear, draw phase diagram to scale and label the regions. For 70% An alloy determines the following: a) Weight percentage of liquid and solid solution present at 820^0C. b) The temperature where equal proportions of liquid and solid phases exist. (4)

B) Write a short note on i.) Biomaterials ii.) Shape memory alloys (3)

C) List the different types of imperfections present in the crystal structure. Explain any one with the neat sketch (3)

4) Explain the objectives of the heat treatment process. Explain the annealing and normalizing process (4)

A)

B) What are the properties of good tool materials (3)

C) With its differences explain the liquid carburizing and cyaniding (3)

5) With a neat sketch explain the steps involved in the T-T-T phase diagram. Mark all the regions (4)

A)

B) Classify the steels with respect to carbon content. List its properties, merits, and demerits (3)

C) Draw (1 0 1) & (1 1 1) planes in a cubic unit cell. Determine the Miller indices of direction which are common to both the planes (3)

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