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## MANIPAL INSTITUTE OF TECHNOLOGY Manipal University, Manipal – 576 104 III SEM. B.TECH. MECH/IP ENGG. DEGREE EXAM., NOV / DEC. 2015 MATERIAL SCIENCE & METALLURGY – MME 2104

ENOWLEDGE IS POWER

 Time: 3 Hours
 Max

 Instructions to candidates:
 (1) Answer All the questions.

 (2) Missing data, if any, may be suitably assumed.

- (3) Use Graph sheets if required.
- 1 (A) Neatly sketch labelled Fe-C equilibrium diagram. Name the alloy nucleus formed and write its crystal structure during the solidification of 5% Carbon alloy on equilibrium 5 cooling.
- 1 (B) With a part of phase diagram and cooling curve explain the phase transformation of eutectoid steel from austenite to room temperature structure.
- 1 (C) Write short notes on the following: i) Grey cast iron ii) HSS.
- 2 (A) The approximate melting temperatures of pure metals A & B are respectively 2000°C and 1600°C. An alloy of 60%B solidifies isothermally at 1000°C. A & B are having complete liquid and partial solid solubilities. The maximum solubility of B in A is 20% and that of A in B is 10% at 1000°C. The solubility of B in A at 500°C is 10% and solubility of A in B at 500°C is 5%. Name and draw the phase diagram for the above binary alloy system to a suitable scale on a graph sheet assuming all solubility lines to be linear.

For an alloy of 30% B, draw the cooling curve and determine the following:

- (i) The temperature at which the alloy has equal proportions of liquid and solid phases. 5
- (ii) Weight of the eutectic mixture formed in the 2 kg alloy sample.
- 2 (B) Draw temperature versus time curve and briefly explain the steps involved in 3 homogeneous solidification process.
- 2 (C) Differentiate annealing and normalizing treatments with respect to purpose, resulting 2 structure, cooling rate and heat treatment temperature range.
- 3 (A) What is hardenability? With relevant sketches explain the standard hardenability test. 5
- 3 (B) Sketch the following Miller Indices.
  i) [203] ii) (312) iii) (210)
  3
- 3 (C) What do you mean by edge dislocation? Name and sketch both types of edge dislocations.
- 4 (A) Explain the procedure of constructing isothermal transformation diagram. Sketch neatly the isothermal transformation diagram for eutectoid steel and label all the important phases.

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Max. Marks: 50

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4 (B)	) Sketch neatly FCC and HCP unit cells and mention the coordination number, packing factor and effective number of atoms in both unit cells.				
4 (C)	Define Gibb's phase rule and show that degrees of freedom is zero during an invariant binary reaction.	2			
5 (A)	Write short notes on the following:				
	i) Bronze ii) Induction Hardening iii) Carburizing.	5			
5 (B)	With phase diagram and cooling curves, explain the binary system where the				
	components show complete liquid solubility and solid insolubility. Name the system.	3			
5 (C)	Differentiate between interstitial solid solution and interstitial compound. Give one				
	example to each.	2			

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