	Reg.No.		
प्रज्ञानं ब्रह्म प्रिकृति Manipal INSPIRED BY LIFE	INTERNATIONAL CENTRE FOR APPLIED SCIENCES (Manipal University) IV SEMESTER B.S. DEGREE EXAMINATION - MAY 2016 SUBJECT: MATERIAL SCIENCE AND METALLURGY (ME 245) 16 TH MAY, 2016		
Time:	: 3 Hours Max. Marks:	: 100	
\checkmark	Answer ANY FIVE full Questions. Draw neat and proportionate sketches wherever necessary.		
1A) 1B) 2A)	Show that the empty space available in FCC unit cell is 26 % List the differences between Edge Dislocation and Screw Dislocation Represent the following planes / directions (214); (324) ; $[125]$; $[312]$; (102)	(10) (10) (10)	
2B) 3A) 3B) 4A)	State and prove Willard Gibb's Phase Rule Explain with examples the Hume – Rothery rules governing the formation of substitutional solid solution. Explain the importance and influence of super cooling in the process of homogeneous nucleation Explain with the help of binary phase diagram and cooling curves the changes taking place in the microstructure of an alloy whose components A and B are completely and mutually soluble in liquid state and insoluble in solid state which is cooled from liquid state to room temperature. Name the type of alloy. Take the composition of the alloy which produces a separate cluster of metal A.	(10) (10) (10) (10) (10)	
4B)	Draw the equilibrium diagram of Cu – Ni equilibrium diagram from the following details The freezing point of Cu - 1084 ^o C and Ni-1455 ^o C. An alloy with 30 % N is cooled from liquid state to room temperature. The freezing range of the alloy is 1250 ^o C to 1150 ^o C. At 1200 ^o C, the alloy with 30 % Ni, is a mixture of liquid with 20 % Ni and solid with 65% Cu by weight. Another sample of alloy with 80 % Ni has a freezing range of 1400 ^o C to 1300 ^o C. For 200 gms of the alloy with 30 % Ni by weight, i) What is the composition of the first grain of precipitate. ii) What is the mass of precipitate at 1200 ^o C. iii) Determine the temperature at which 80 % of liquid present. iv) Determine the composition of precipitate at 1175 ^o C. v) What is the degrees of freedom at 1200 ^o C	; f , (10)	
5A)	Draw the iron – iron carbide equilibrium diagram and lable the regions. Also indicate the invariant reactions.	(10)	

5B) Explain the following annealing processesi) Spheroidising ii) Diffusion annealing iii) Process annealing

(10)

- 6A) Superimpose the cooling curves on TTT diagram and explain the influence of cooing rate on the transformation of austenite into course (10) pearlite, bainite and marensite at subcritical temperatures.
 6B) Explain with neat sketch the end quench test for finding hardenability of (10) steel.
- 7 Distinguish Between,
 i) Annealing and Normalising
 ii) Hardness and Hardenability (20)
 iii) Austempering and Tempering
 iv) Case Hardening and Surface Hardening
 v) Space Lattice and Superlattice
 8A) Explain the influence of the following alloying elements on the properties of steel i) Cr ii) W iii) Si (06)
 8B) Explain the effect of i) Mn and ii) P on the properties of Cast Iron (04)
- **8C)** Write note on Age Hardening of AI- Cu Alloy

(10)