Engineering Materials and Metallurgy
(ME-202/205, Dec 2005)

Time: 3 Hrs   Max Marks: 60

Note: Section A is compulsory. Attempt any five questions from Section B and any two questions from Section C.

Section-A
1. (a) What is the difference between alloy and a composite?
   (b) Calculate the number of atoms in BCC structure.
   (c) Define allotropy.
   (d) What do you mean by recovery?
   (e) Define Gibb's phase rule.
   (f) What is triple point?
   (g) What is martensitic phase?
   (i) Define engineering stress.
   (j) What is tempering?

Section-B
2. Draw [111] and (111) in FCC unit cell.
3. What is critical size of nucleation that nucleates from melt? Deduce the expression from free energy concept.
4. What are dislocations? Give their classification. Show them on plane of paper.
5. A copper rod is mechanically deformed. If the lattice parameter of Cu is 3.61 A, find the minimum distance that a dislocation can move.
6. What are different equilibrium phase reactions that occur in phase diagram? Describe them. Draw an eutectic phase diagram and mark all points and lines.

Section-C
7. (a) Draw iron-iron carbide phase diagram to scale. Mark each line, area and transition point.
   (b) Differentiate between annealing and normalizing.
8. (a) Draw a hypothetical phase diagram A-B with the help of following data
   (i) Melting point of A = 1000ºC
   (ii) Melting point of B = 1200ºC
   (iii) Eutectic reaction occurs at 900ºC at 40% B composition
   (iv) Maximum solubility of B in A and A in B at eutectic temperature is 10% and 5% respectively which drops down to zero at 0ºC.
   Mark each line and area. How the structure of alloy will change if alloy containing 10% B composition is cooled from liquid state.
9. Write short notes on any two of the following.
   (a) Heat treatment defect – their remedies
   (b) Role of alloying element in stabilizing austenite phase.
   (c) Hardenability and its measurement