

**Engineering Materials and Metallurgy**  
(ME-202/205, May 2007)

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) A FCC structure transforms to BCC structure. Schematically show this transformation showing atom positions.  
(b) What is Schottky defect?  
(c) The deformation which occurs less than one inter-atomic distance falls under which category? Name it.  
(d) An alloy contains two phases and a composite also contains two phases. What will be basic difference at the interface of these two phases in both cases?  
(e) From stress-strain curve of a ductile material show the area designated as resilience.  
(f) A cold rolled copper strip (x) and also a melted and casted copper rod (y) of same high purity has been subjected to tensile test. Which one will exhibit high yield strength, low ductility and also comment on their Young's modulus.  
(g) An alloy exhibiting complete range of solid solubility has been melted and cooled slowly. Draw the cooling curve for it.  
(h) Define solid solubility.  
(i) Write down the reaction for eutectic and eutectoid transformation.  
(j) Write two applications of steel containing Mn and Mo.

**Section-B**

2. Explain the phenomenon of dislocation movement in a crystalline solid. What do you mean by dislocation glide and dislocation climb?
3. Deduce the expression for the measurement of hardness on Vicker's scale.
4. Draw a phase diagram A-B for system showing complete solubility in liquid as well as solid state from the following data.
  - (i) Melting point of A = 1100°C
  - (ii) Melting point of B = 1500°C
  - (iii) For 20% B, 40% B, 60% B and 80% B the liquid points are 1200°C, 1250°C, 1350°C and 1400°C and solid points are 1150°C, 1200°C, 1300°C and 1350°C respectively. Mark lines and phases.
5. Find the relative amount of ferrite and cementite in a steel containing 0.8% carbon.
6. Describe the role of Si and Al as alloying elements in steel? How it influences phase stabilization? Explain.

**Section-C**

7. (a) Draw  $[2\bar{1}\bar{1}1]$  plane in HCP unit cell.  
(b) What is peritectic reaction? With suitable phase diagram explain it.
8. (a) Deduce the expression for critical size of nucleation in a liquid considering homogenous nucleation case.  
(b) What are possible heat treatment defects? Describe them and give the remedial solution.
9. Draw Fe-Fe<sub>3</sub>C equilibrium phase diagram and mark each line and phases. Also describe the possible phase reactions giving its detail.