Engineering Materials (UES012)
School of Physics and Materials Science
Tutorial Sheet No 7

1. For a binary A-B alloy the following data are given:
   Melting point of A = 1250°C
   Melting point of B = 1450°C
   A is soluble in B 5% at invariant temperature 1000°C. B is soluble in A 10%.
   The solids drops down zero at room temperature in both cases.
   Triple point is taken place at 50% B.
   Draw the corresponding phase diagram.
2. Discuss the micro structural changes that occur on slow cooling from the liquid state of a Cu-Ni alloy of a given overall composition.
3. Consider the binary phase diagram of Al_2O_3-Cr_2O_3 system. At 2180°C the %age of Cr2O3 in the liquid and solid phase equal 57 and 82 resp. For an overall composition 30 wt% Al_2O_3- 70 wt% Cr_2O_3. Estimate the wt. fraction of the liquid and solid phases in the system.
4. In a binary system, what can be the (a) maximum number of phases coexisting in equilibrium? (b) maximum possible degrees of freedom?
5. When the grain diameter of a polycrystalline material is changed from 0.04 mm to 0.01 mm, the yield strength increases from 120 Mpa to 220 Mpa. Calculate the yield strength if its grain diameter is 0.0159 mm.
6. A grain size of ASTM 7 in mild steel is refined to ASTM 14 by the addition of microalloying elements. Estimate the increase in the yield strength of the steel.
7. An alloy of two components A and B exists in two phase state (α + β phase). Find the volume fractions of the two phases, given the density of α – phase is 10640 kg/m^3 and the density of β – phase is 7290 kg/m^3.
8. Composition of copper and nickel of a Cu-Ni alloy is 68 atomic % Cu and 32 atomic % Ni. Find the weight fraction of the two components in the alloy.