MINOR I

EPL 337- MATERIALS SCIENCE & ENGINEERING

16th February 2015

Answer **all** questions | Time **One** Hour | Maximum Marks **20**

Q.1. (i) How does the solute concentration vary across the length of the solid bar in a non-equilibrium solidification process?
(ii) How does it compare with that for equilibrium solidification?
(iii) How can a non-equilibrium process be helpful in purifying a solid? (2+1+2)

Q.2. The solubility of Sn in solid Pb at 200 C is 18% Sn. The solubility of Pb in the molten Sn at the same temperature i· 44% Pb. What is the composition of an alloy containing 30% liquid and 70% α-phase at 200 C ? (5)

Q.3. A liquid metal drop of radius 'r' making a contact angle $\theta = 30°$ with a solid substrate solidifies on cooling from its equilibrium melting temperature $T_e = 983°$ C to $T = 980°$ C. The enthalpy of fusion of the metal is 1.88 GJ m^{-3} (50 cal./gm). The liquid–solid interfacial energy is 0.144 J m^{-2}. Calculate the size of the critical radius and hence the critical nucleation barrier. (Show clearly the steps involved in the calculations). (3+2)

Q.4. What are the possible intermediate phases, which may form, if a Mo-Si alloy of initial composition 2.5 at.% Si is rapidly cooled from 2250 C to 1550 C and held there for long time? Give reasons. (Refer to the phase diagram given below). (5)