MEE1005 Materials Engineering and Technology B1+TB1

1. Draw a hypothetical eutectic phase diagram A-B with the help of following data:

- Melting point of A = 900°C.
- Melting point of B = 800°C.
- Eutectic reaction occurs at 700°C at 50% B composition.
- Maximum solubility of B in A and A in B at eutectic temperature is 20% and 10 % respectively which drops to zero at 0°C.

(i) Mark each line and area.
(ii) Write the invariant reaction with composition that occurs.
(iii) If eutectic alloy is cooled from liquid to just below the eutectic temperature, calculate the amount of each phase at just below the eutectic temperature.

2. For a hypo-eutectoid steel of 0.3 wt% carbon, calculate the following: (i) the amount of austenite and proeutectoid phase, just above the eutectoid temperature; (ii) the amount of ferrite and cementite just below the eutectoid temperature. Draw microstructure of this steel just above the eutectoid temperature and at room temperature and explain the microstructural evolution.

3. Using T-T-T diagram for an eutectoid steel alloy, determine the final microstructure of a small specimen subjected to the following time temperature treatments. In each case the specimen begins at 800°C and that has been held at this temperature long enough to have achieved a complete and homogeneous austenitic structure:
(a) Rapidly cool to 250°C, hold for 960 s, then quench to room temperature
(b) Rapidly cool to 600°C, hold for 7 s, then quench to room temperature
(c) Rapidly cool to 400°C, hold for hold for 1000s, then quench to room temperature
(d) Rapidly cool to 700°C, hold for 10 s, then quench to room temperature
(e) Rapidly cool to 550°C, hold at this temperature for 5 s, then quench to room temperature
(f) Rapidly cool to 350°C, hold for 300 s, then quench to room temperature.
(g) Rapidly cool to 665°C, hold for 10^3 s, then quench to room temperature.
(h) Rapidly cool to 350°C, hold for 10^3 s, then quench to room temperature.