

MT30001, Autumn 2016, IIT Kharagpur

Date on which the problems were given: 04 September 2016

You do not need to submit this assignment

Assignment 3:

1.
 - a. What are the primary (pro-eutectic) phases for the following alloys:
 - i. Fe-3wt.%C
 - ii. Fe-6 wt.%C
 - b. What is the pro-eutectoid phase in a Fe - 1.5 wt.%C steel? How much (in wt. %) is the pro-eutectoid phase in this alloy?
 - c. For a Fe- 0.4 wt.% C steel, just below the eutectoid steel, what is the amount of
 - i. Pearlite?
 - ii. Eutectoid ferrite
 - iii. Pro-eutectoid ferrite
 - d. What is the degree of freedom at the eutectoid point. Show your work.

2.
 - a. Draw the homogeneous nucleation rate vs. temperature curve and explain the reason for the shape of the curve.
 - b. If you increase the undercooling by 20%, how much the critical nucleus size will increase or decrease?
 - c. What is a TTT diagram? How do the transformation curves look like in this diagram?
 - d. What is the nature or shape of an isothermal transformation curve? In which direction does the curve shift if the temperature is increased?

3.
 - a. What are the bravais lattices of the matrix phase and the main strengthening phase in a Ni based superalloy?
 - b. For which of the following two applications, usually polycrystalline Ni based superalloy is used: Turbine disc, Turbine blade?
 - c. Among Ti alloy and Ni based superalloy, which one is used at higher temperature application?

4.
 - a. For under-water drill applications in oil and gas sector, usually which material is used the most? Why is each of the following alloying elements added in the steel for this application: Ni, Cr, Ti, Mo.
 - b. Write down a few applications of 3-d printing technology.
 - c. How does magnetic storage work? What are the disadvantages of magnetic storage?