BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR
B.E. (MET-PART-III) 5TH SEMESTER FINAL EXAMINATION, 2013

PHASE TRANSFORMATION
(MT 501)

Time: 3 hours   Full marks - 70

Answer any seven questions

1. (a) What are the prerequisites for an alloy to be age hardenable?
    (b) Briefly outline the age-hardening heat treatment for duralumin alloy.
    (c) Discuss the effect of (i) concentration of solute elements and (ii) ageing temperature on ageing kinetics as well as level of achievable maximum hardness.
    (d) State and justify the microstructural state related to the peak-aged condition.

    [3+2+3+2 =10]

2   (a) Define *spinodal decomposition*? Mention the characteristics of *spinodal decomposition*.
    (b) Differentiate between *coherent spinodal* and *chemical spinodal*.
    (c) Derive the expression of minimum possible wavelength of composition modulation for *coherent spinodal*.

    [(1+2)+3+4 =10]

3. (a) Distinguish between *embryo* and *nucleus* from *free energy* concept.
    (b) Derive the expression of r^* and ΔG^* from *free-energy* consideration for *heterogeneous* solidification.
    (c) Discuss the role wetting angle in *heterogeneous* solidification.

    [3+4+3 =10]

4. (a) State and explain how rate of nucleation varies with the degree of supercooing.
    (b) Explain why – 'solidification requires some degree of supercooling to start but melting occurs without any superheating'.
    (c) Discuss the selection criteria of inoculants with examples.

    [3+4+3 =10]

5. (a) Compare the Hull-Mehl model and Smith Hillart concept of pearlitic transformation.

   (b) What are apparent and true interlamellar spacing of pearlite?

   (c) Explain why pearlitic transformation reaches a maximum value at an intermediate temperature?

   [5+2+3 =10]

6. (a) Discuss briefly the effect of cold work on tensile properties of an alloy.

   (b) Illustrate the nucleation mechanisms for recrystallisation. behavior of material

   (c) What are the main variables which influence recrystallisation behaviour?

   [3+4+3 =10]

7. (a) Discuss the mechanism of formation of austenite in hypoeutectoid steel.

   (b) Illustrate with a suitable diagram the factors. on which formation of homogenous austenite depends

   [5+5 =10]

8. (a) What are the effects of alloying elements on the growth of pearlite?

   (b) How does inter-lamellar spacing vary with transformation temperature?

   (c) Differentiate between sorbite and troostite.

   [3+4+3 =10]

9. (a) What is bainite? Differentiate it from pearlite. Distinguish between upper-bainite and lower bainite.

   (b) Why bainitic transformation is referred as intermediate transformation?

   (c) "Bainitic transformation does not got to completion" Justify the statement.

   [4+3+3 =10]

10. (a) What is Bain distortion mechanism?

    (b) Define reversibility of martensitic transformation.

    (c) Explain with a neat sketch of austempering operation and mention the advantages of its operation.

    [3+3 +4=10]