Code No: RR211801 **Set No. 1**

II B.Tech I Semester Supplementary Examinations, November 2006
PHYSICAL METALLURGY
(Metallurgy & Material Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. Name various microscopy methods for enhancing contrast and briefly explain any three of them. [16]

2. (a) The atomic radius of FCC Nickel is 1.243 A^0. Calculate
   i. The lattice parameter
   ii. Density of nickel.
   (b) Calculate the packing factor for FCC of Iron. [10+6]

3. (a) Give an account on Miller indices of planes with examples.
   (b) Explain Miller indices of direction with examples. [8+8]

4. (a) Describe Vegards Law with examples.
   (b) Explain why alloy find more applications than pure metals?
   (c) Explain why if one element is highly electronegative and other highly electro positive the intimate mixture of them is not an alloy? [5+5+6]

5. (a) Show that the homogenous nucleation barrier $\Delta G^* = \frac{16\pi\sigma^3}{3(\Delta G)^2}$ neglecting strain energy effects.
   (b) Write a short notes on super cooling. [8+8]

6. (a) Distinguish between
   i. terminal phase and
   ii. an intermediate phase [4+4]
   (b) Explain the differences between a congruently melting alloy and incongruently melting alloy. [8]

7. (a) Classify copper alloys. Discuss the mechanism of increasing strength of copper alloys.
   (b) Calculate the relative amounts of various phases that are present in 0.5% C steel, just above & just below the peritectic temperature. [8+8]

8. (a) Differentiate between CCC & TTT diagrams.
   (b) Explain about the bainitic transformation. [10+6]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: RR211801 **Set No. 2**

II B.Tech I Semester Supplementary Examinations, November 2006
PHYSICAL METALLURGY
(Metallurgy & Material Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Discuss the features associated with the following light sources:
   i. low-voltage tungsten filament lamp
   ii. carbon arc
   iii. xenon arc.
   (b) Name microscope variables and briefly explain. [9+7]

2. (a) Determine the density of BCC iron which has a lattice parameter of 2.866 A^0.
   (b) Calculate the change in volume that occurs when BCC iron is heated and changes to FCC iron. At the transformation temperature, the lattice parameter of BCC iron is 2.863 A^0 and the lattice parameter of FCC iron is 3.591 A^0.

   [6+10]

3. (a) Discuss procedure for finding the Miller indices for directions with suitable examples.
   (b) Why titanium and magnesium exhibit poor ductility? [8+8]

4. (a) How does an interstitial solid solution differ from interstitial compound? Discuss various factors suggested by Hume-Rothery that control the range of solubility in solid solution.
   (b) Explain the effect of alloying elements on plain carbon steels. [8+8]

5. (a) Suppose that the solid nickel was able to nucleate homogeneously with an under cooling of only 22^0C. How many atoms would have the group together spontaneously for this to occur.
   Assume that the lattice parameter of the solid FCC nickel is 0.356 nm.
   Data
   Nickel freezing temperature : 1453^0 C
   Surface energy : 255×10^{-3} J/m^2
   Latent heat of fusion : 2756×10^6 J/m^2
   (b) Explain the difference between planar growth and dendritic growth. [8+8]

6. (a) What is Gibb's phase rule? Explain it's importance.
   (b) Explain the method of plotting an equilibrium diagram for a binary alloy by the use of cooling curves. [4+12]

7. Explain the following

(a) Eutectiod & peritectiod reactions in Fe-Fe_3C diagram.

(b) Effect of Alloying elements on steel. [8+8]

8. (a) Draw the T-T-T diagram for a eutectoid steel label the various regions & lines. Explain the effect of various elements on the position and shape of T-T-T diagram..

(b) Explain the Pearlitic & Martensitic transformation. [8+8]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: RR211801 **Set No. 3**

II B.Tech I Semester Supplementary Examinations, November 2006
PHYSICAL METALLURGY
(Metallurgy & Material Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Name various methods of illumination in metallurgical microscope and briefly explain each one of them.
   (b) What is conical stop illumination? Discuss its features. [8+8]

2. (a) What are the various interstitial elements. Explain interstitial as a defect and also as the most useful phenomena.
   (b) Chromium has a lattice parameter of 2.8844 A^0 and a density of 7190 kgf/m^3. Determine by suitable calculations whether chromium is simple cubic, BCC or FCC. [8+8]

3. Write short notes on the following:
   (a) Transformation of indices
   (b) Miller indices of a plane and direction. [8+8]

4. (a) What is the necessity of alloying?
   (b) Distinguish between substitutional and interstitial solid solutions.
   (c) Explain the Hume-Rothery rules for the formation of extensive solid solution. [2+6+8]

5. (a) Explain the advantages and disadvantages of a cored-dendritic structure.
   (b) Which determine the micro structure of an alloy. Explain them carefully.[8+8]

6. What is meant by a 'peritectic' reaction? Sketch an Equilibrium diagram of a system containing such a reaction and describe the Equilibrium cooling of two typical alloys, at least one of which undergoes a peritectic reaction. What is the effect of faster cooling on the reaction. [16]

7. Explain the following
   (a) Eutectiod & peritectiod reactions in Fe-Fe_3C diagram.
   (b) Effect of Alloying elements on steel. [8+8]

8. (a) Differentiate between CCC & TTT diagrams.
   (b) Explain about the bainitic transformation. [10+6]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: RR211801 **Set No. 4**

II B.Tech I Semester Supplementary Examinations, November 2006
PHYSICAL METALLURGY
(Metallurgy & Material Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Name various methods of illumination in metallurgical microscope and briefly explain each one of them.
   (b) What is conical stop illumination? Discuss its features. [8+8]

2. (a) The atomic radius of FCC Nickel is 1.243 A^0. Calculate
      i. The lattice parameter
      ii. Density of nickel.
   (b) Calculate the packing factor for FCC of Iron. [10+6]

3. Write short notes on the following:
   (a) Transformation of indices
   (b) Miller indices of a plane and direction. [8+8]

4. (a) What are the possible alloy structures. Explain briefly the different alloy structures with suitable examples.
   (b) Explain in detail Vegards law. [10+6]

5. (a) Assuming a spherical nucleus and negligible strain effects, calculate the critical radius of nuclei for homogeneous nucleation.
   (b) Determine the effect of temperature and time on nucleation rate. [9+7]

6. (a) Draw the cooling curves for the following and Explain the salient points in the curves.
      i. Pure metal
      ii. Hypo EUTECTIC Binary alloy
      iii. EUTECTIC Binary alloy
   (b) Explain important information may be what obtained from an equilibrium diagram. [9+7]

7. (a) What is cementite ? What type of compound is it. Explain its properties.
   (b) Why does proeutectoid product form at grain boundaries of Austenite.
   (c) What is normally the form in which proeutectic ferrite & Pro eutectoid cementite form?.How to distinguish between these phases, particularly when the two steels have a carbon content of 0.7% & 0.9% [6+5+5]

8. (a) Draw the T-T-T diagram for a eutectoid steel label the various regions & lines. Explain the effect of various elements on the position and shape of T-T-T diagram..

   (b) Explain the Pearlitic & Martensitic transformation. [8+8]

⋆ ⋆ ⋆ ⋆ ⋆