

## 2005 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

II B.TECH. I SEMESTER REGULAR EXAMINATIONS  
**PHYSICAL METALLURGY**  
 (METALLURGY & MATERIAL TECHNOLOGY)

MAY 2005

TIME: 3 HOURS  
 MARKS: 70

Answer any FIVE Questions  
 All Questions carry equal marks

1. (a) What are the steps to be taken to achieve optimum resolution?  
 (b) Name the steps to be taken to improve the depth of field.  
 (c) Comment on oil immersion objectives.
2. Write short notes on the following:  
 (a) Hume-Rothery classification of metals  
 (b) Packing efficiency of FCC structure.
3. (a) Define planar density and estimate the planar density value of (111) plane in BCC and FCC unit cells. Support with due calculations.  
 (b) Which crystallographic planes and directions in BCC, FCC and HCP structures have highest atomic density?
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.
5. (a) Show that the homogenous nucleation barrier  $\Delta G^* = 16\pi\gamma^3/3(\Delta G)^2$  neglecting strain energy effects.  
 (b) Write a short notes on super cooling.
6. Aluminum (melting point 6600C) and silicon (melting point 14200C) are assumed to be completely soluble in the liquid state and completely insoluble in the solid state. They form an Eutectic at 5780C, the Eutectic composition being 13% silicon and 87% Aluminum. Draw to the scale the phase diagram of the alloy system Al-Si, labeling the lines, fields and points. Describe the changes which take place during fall of temperature for an Al-5% Si alloy. Draw the cooling curve for this alloy.
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%
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.