

**II B.Tech. I Semester Supplementary Examinations, May -2005**

**PHYSICAL METALLURGY  
(Metallurgy & Material Technology)**

**Time: 3 hours**

**Max Marks: 80**

**Answer any FIVE Questions  
All Questions carry equal marks**

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1. Give an account on the following:
  - (a) Condenser system
  - (b) Light filters
  - (c) Objective lens
2.
  - (a) Define octahedral and tetrahedral sites and discuss with reference to BCC and FCC structures.
  - (b) Give an account on bonding and material property.
3.
  - (a) Discuss polymorphism and allotropy with suitable examples.
  - (b) Explain stepwise determination of Miller indices of a plane with an example.
  - (c) Explain why gold, copper and aluminium exhibit good ductility.
4.
  - (a) What are the different types of solid solutions. Explain interstitial solid solution with suitable examples.
  - (b) Discuss in detail the necessity of alloying and explain the same with four specific examples.
5.
  - (a) Explain the influence of temperature on size of the critical nuclei and energy of formation of nuclei.
  - (b) Derive an expression for critical barrier to be overcome in homogeneous nucleation.
6. Discuss the following with suitable examples
  - (a) Thermal analysis curves
  - (b) Lever rule
  - (c) Composition rule.
7.
  - (a) Write note on order - disorder transformation.
  - (b) Explain the composition, properties & uses of
    - i. Alpha brass
    - ii. Beryllium copper
    - iii. Cupronickels
8.
  - (a) Differentiate between CCC & TTT diagrams.

(b) Explain about the bainitic transformation.

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1. (a) Name different types of electron microscopes and highlight the salient features associated with them.  
(b) Explain construction and working of a compound microscope.
2. (a) What are the seven important crystal systems and define them with reference to lattice parameters and angle between them.  
(b) Prove that the packing factor for BCC metals is 0.68.
3. (a) Discuss procedure for finding the Miller indices for directions with suitable examples.  
(b) Why titanium and magnesium exhibit poor ductility?
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. (a) Explain why is the grain boundary irregular.  
(b) Distinguish clearly between low angle, grain boundary and high angle grain boundary.
6. What are Monotectic & syntectic reactions. Explain fully with suitable examples.
7. The Microstructure of a Fe-Fe<sub>3</sub>C alloy consists of pro-eutectoid Ferrite & Pearlite. The mass fractions of these two-constituents are 0.286 & 0.714 respectively. Determine the concentration of carbon in this alloy.
8. (a) Differentiate between CCC & TTT diagrams.  
(b) Explain about the bainitic transformation.

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1. (a) Name various parts of an optical microscope and briefly explain each one of them.  
(b) Differentiate between optical microscope and scanning electron microscope.
2. With a neat sketch of HCP structure, discuss effective number of atoms packing factor and coordination number.
3. Write short notes on the following:
  - (a) Transformation of indices
  - (b) Miller indices of a plane and direction.
4. (a) Distinguish between a commercially pure metal and an alloy.  
(b) An alloy is more useful than pure metal? Discuss.  
(c) What is a master alloy? What are its chief characteristics?  
(d) What is an interstitial solid solution? Name the five elements which commonly form interstitial solid solutions.
5. (a) During grain growth in a single phase material the grain boundaries move toward their center of curvature. Explain.  
(b) Describe the factors that lead to intergranular precipitation and intragranular precipitation.
6. Explain any THREE of the following:
  - (a) Incongruent melting alloys
  - (b) PSUEDO-EUJECTIC alloys.
  - (c) Construction of phase diagrams by Metallographic method.
  - (d) Raoult's law.
7. Distinguish between peritectoid & Eutectoid reaction. What is the practical importance of the alloys undergoing these transformations [with examples]
8. (a) Differentiate between CCC & TTT diagrams.  
(b) Explain about the bainitic transformation.

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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.
2. (a) Name different types of unit cells and explain.  
(b) Write a short note on Crystal Systems.
3. (a) Give an account on Miller indices of planes with examples.  
(b) Explain Miller indices of direction with examples.
4. Justify the following statements:
  - (a) Lattice parameter of the solvent metal always increase when it forms an interstitial solid solution.
  - (b) A perfect super lattice is possible only at a critical and simple proportion of two types of atoms.
  - (c) Zn dissolves up to 38.4% in Cu, where as Cu dissolves up to only 3%.
  - (d) It is difficult to distinguish a pure metal from a solid solution under microscope.
5. (a) With reference to a hypothetical equilibrium a diagram describe how coring occurs during solidification, under normal industrial conditions of a solid-solution alloy.  
(b) Describe how coring a prevented or removed by
  - i. Cooling under equilibrium conditions
  - ii. Annealing after normal solidification.
6. (a) What is an equilibrium diagram?  
(b) List and explain the advantages of equilibrium diagrams.  
(c) How are equilibrium diagrams related to the mechanical properties of the system which they represent?  
(d) Illustrate the phase rule with the help of two different types of binary phase diagrams.
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.

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