$$\boxed{\textbf{Set No. 1}}$$

II B.Tech II Semester Regular Examinations, Apr/May 2008
METALLURGY AND MATERIAL SCIENCE
(Common to Mechanical Engineering, Mechatronics, Production Engineering and Automobile Engineering)

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Explain briefly bonds in solids.
   (b) Give the properties of covalent bonded solids or compounds?   [8+8]

2. (a) Describe the importance of Hume-Rothery rules in the development of alloys.
   (b) How are the intermetallic compounds classified? Compare intermetallic compounds with the interstecial compounds.   [8+8]

3. (a) What is an invariant reaction? List and explain three reactions present in the $Fe - Fe_3C$ equilibrium diagram.
   (b) Distinguish between Terminal phases and Intermediate phases.   [10+6]

4. (a) What are cast Irons? Why are they named so? Give the importance of cast irons in the metallurgical curriculam.
   (b) Explain the microstructure, properties and applications of
      i. White Cast Iron
      ii. S.G. Cast Iron.   [8+8]

5. (a) Define the term heat treatment and explain why are the steels heat treated.
   (b) Define and explain hardness and Hardenability.
   (c) Discuss the use of hardenability curves.   [5+6+5]

6. (a) Explain about Alpha and Alpha-Beta Alloys of Titanium .
   (b) Which Aluminium casting alloy develops the highest mechanical properties?. Why?
   (c) What is meant by anodizing of Aluminium? Explain .   [6+5+5]

7. (a) Discuss fully the various crystal structures of crystalline ceramics.
   (b) Compare the physical, chemical and mechanical properties of ceramics with those of metals.   [8+8]

8. Explain the following in detail:
   (a) Matrix
   (b) Reinforcement
   (c) Interface

(d) C-C Composites. $[4 \times 4 = 16]$

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$[4 \times 4 = 16]$

Set No. 2

II B.Tech II Semester Regular Examinations, Apr/May 2008
METALLURGY AND MATERIAL SCIENCE
**(Common to Mechanical Engineering, Mechatronics, Production
Engineering and Automobile Engineering)**

Time: 3 hours   Max Marks: 80

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

1. (a) Describe about Ionic bond with suitable examples.
   (b) Describe co-valent bond formation using electron dot formula.   [8+8]

2. (a) Explain substitution and interstitial solid solutions with neat sketches.
   (b) What are the three most common intermediate alloy phases? Explain any two
   of them.   [8+8]

3. (a) Differentiate between the following:
      i. Phase and component
      ii. A system and a state.
   (b) Discuss the Gibb's phase rule. In this light, narrate total number of variables
   and degrees of freedom.
   (c) Explain the advantages and disadvantages of a cored dendritic structure.
                                                                        [6+6+4]

4. (a) Explain the following types of malleable cast irons.
      i. Ferritic malleable cast iron
      ii. Pearlitic malleable cast iron.
      iii. Ferrito-Pearlitic malleable Cast Iron.
   (b) Explain the different kinds of carbon steels. Explain them. Also give their
   carbon contents.   [9+7]

5. (a) Discuss the characteristics of quenchants for effective removal of heat from a
   work piece.
   (b) Explain the effect of current on the depth of hardness during the induction
   hardening process.
   (c) Distinguish between ATHERMEL process and isothermal process.   [6+5+5]

6. (a) Explain about Alpha and Alpha-Beta Alloys of Titanium .
   (b) Which Aluminium casting alloy develops the highest mechanical properties?.
   Why?
   (c) What is meant by anodizing of Aluminium? Explain .   [6+5+5]

7. (a) Discuss fully the various crystal structures of crystalline ceramics.

(b) Compare the physical, chemical and mechanical properties of ceramics with those of metals. [8+8]

8. (a) What are the factors that are to be considered while designing a fibre reinforced composite? Explain fully with examples.

(b) What is a matrix? What are the various types of matrices used in the composite materials. Explain the advantages, disadvantages and applications of each one of them. [8+8]

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Set No. 3

II B.Tech II Semester Regular Examinations, Apr/May 2008
METALLURGY AND MATERIAL SCIENCE
(Common to Mechanical Engineering, Mechatronics, Production
Engineering and Automobile Engineering)

Time: 3 hours   Max Marks: 80

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

1. (a) Explain the principle of bond formation in solids, with a suitable examples.
   (b) Describe the reasons for high thermal and electrical conductivity in metallic bonded solids.   [7+9]

2. (a) Explain chemical compounds, metallic compounds and interstecial compounds with suitable examples.
   (b) Explain the effect of alloying elements on the properties of steel as substitutional and interstecial alloying elements.   [9+7]

3. (a) What is polymorphism? Explain Polymorphic transformations with suitable examples.
   (b) Discuss the importance of phases and phase diagrams to a metallurgist or a material scientist.   [8+8]

4. (a) Which stainless steel is best suited for surgical instruments? Explain
   (b) Why are graphite flakes in gray iron very often surrounded by ferrite areas?
   (c) Explain why is malleable iron made from hypo eutectic cast iron.   [6+5+5]

5. (a) Define the term heat treatment and explain why are the steels heat treated.
   (b) Define and explain hardness and Hardenability.
   (c) Discuss the use of hardenability curves.   [5+6+5]

6. (a) What are bronzes? How are they classified? Give the composition, microstructure, properties and applications of any three of them.
   (b) Write briefly about phosphor bronze.   [4+12]

7. (a) Define the term ceramics. Give example for different traditional ceramics.
   (b) What are structural ceramics? Discuss the important structural ceramics with examples and applications.
   (c) What are the important characteristics of ceramics.   [6+6+4]

8. (a) Sketch and explain various reinforcing patterns of fibres being used in composites. How is 'strand' different from yarn.
   (b) Draw stress-strain curves for
       i. Various fibres

ii. Various composites

iii. Different matrices.

Explain the curves (Very briefly) considering one from each of them.   [7+9]

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$$\boxed{\textbf{Set No. 4}}$$

II B.Tech II Semester Regular Examinations, Apr/May 2008
METALLURGY AND MATERIAL SCIENCE
(Common to Mechanical Engineering, Mechatronics, Production Engineering and Automobile Engineering)

Time: 3 hours   Max Marks: 80

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

1. (a) Explain briefly bonds in solids.

   (b) Give the properties of covalent bonded solids or compounds? [8+8]

2. (a) Find out the electron to-atom ratio for the following compositions. Ag3Al, Cu_5Zn8, cu_9Al_4, $CuZn_3$ and Cu_3Si .

   (b) Explain why alloys find more applications than pure metals. [10+6]

3. (a) What is an eutectic temperature? Explain.

   (b) Describe the allotropic transformations of iron and explain their important applications.

   (c) Explian the following:
      i. Peritectic reaction.
      ii. Eutectoid reaction. [5+5+6]

4. (a) Why is welding of pearlitic malleable iron not recommended?

   (b) Give atleast four advantages of maraging steels as compared to regular stainless steel.

   (c) Explain how alloying elements that dissolve in ferrite increase its strengths.

   (d) What effect would the addition of 1% chromium have on the properties of steel? [4+4+4+4]

5. (a) What are the advantages of gas carburizing compared with pack carburizing?

   (b) What are the limitations of Austempering?

   (c) What are the principal advantages of Austempering compared with the conventional quench and temper method? [6+4+6]

6. (a) What are bronzes? How are they classified? Give the composition, microstructure, properties and applications of any three of them.

   (b) Write briefly about phosphor bronze. [4+12]

7. (a) Define the term ceramics. Give example for different traditional ceramics.

   (b) What are structural ceramics? Discuss the important structural ceramics with examples and applications.

   (c) What are the important characteristics of ceramics. [6+6+4]

8. (a) Sketch and explain various reinforcing patterns of fibres being used in composites. How is 'strand' different from yarn.

   (b) Draw stress-strain curves for

      i. Various fibres
      ii. Various composites
      iii. Different matrices.

   Explain the curves (Very briefly) considering one from each of them. [7+9]

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