

II B.Tech II Semester Regular Examinations, Apr/May 2007
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. [8+8]
2. (a) How alloy systems are classified based on the number of elements in it. Explain them with suitable examples.
(b) Distinguish between alloy and alloy system.
(c) Distinguish between homogenous alloys and Heterogeneous alloys. [7+3+6]
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. Discuss the various types of cast irons with regard to their manufacture, composition, microstructure and appearance of fractures. [16]
5. Distinguish between the following:
 - (a) Carburizing and Nitriding
 - (b) Annealing and Normalizing [8+8]
6. (a) Discuss the various types of Titanium alloys giving their composition, properties and uses.
(b) What are the major differences between ferrous and Non ferrous metals? How are non ferrous metals classified? Explain. [8+8]
7. (a) What are natural ceramics? Give few examples. Give their composition and uses.
(b) How corborondum or silicon carbide abrasive is manufactured? [8+8]
8. (a) Explain the rule of mixtures in composites, How this rule is useful in analyzing the strength of composites.
(b) What is the most serious problem associated with ceramic matrix composites. How is this problem addressed?
(c) What are the properties of reinforced materials? [7+5+4]

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1. Differentiate between:
 - (a) Directional bond and non-directional bond
 - (b) Bond length and bond energy
 - (c) Ionic bond and covalent bond
 - (d) Hydrogen bond and vanderwall's bond. [4 × 4 = 16]

2.
 - (a) Distinguish between microstructures and macrostructure.
 - (b) Explain what do you mean by congruent melting phase.
 - (c) Write a short notes on 'inter- metallic compounds'.
 - (d) Compare and contrast ordered and disordered solid solutions. [4+4+4+4]

3.
 - (a) what is the curie temperature? Give the curin temperature for pure Iron.
 - (b) Explain the limitations of Iron-Iron carbide phase diagram.
 - (c) Calculate the relative amounts of the structural constituents present in furnace cooled steel containing.
 - i. 0.3%C
 - ii. 0.6%C
 - iii. 0.8%C
 - iv. 1.25%C [4+4+8]

4.
 - (a) Compare the properties of plain carbon steels with those of alloy steels.
 - (b) Explain AISI-SAE classification of steels. [8+8]

5.
 - (a) Explain the effects of
 - i. Sub-zero treatment
 - ii. Addition of carbon
 - iii. quenching media on the hardness of steels.
 - (b) Explain the various stages in an heat treatment cycle. [9+7]

6.
 - (a) Discuss the physical and mechanical properties of copper. write down the applications of pure copper.
 - (b) Name any two important brasses from alpha(α) brass group. Give their composition, properties and important applications. [8+8]

7. (a) What are the reasons attributed for the high hardness and high temperature resistance in case of ceramics? Explain.
- (b) Explain the manufacture of any one clay product used for engineering applications. [9+7]
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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1. (a) Describe with the aid of sketches about the mechanism of crystallisation in pure metals.
(b) Discuss various types of bonds in solids and explain them.
(c) Define and explain grain and grain boundaries. [6+6+4]
2. (a) Explain about the necessity of alloying. Why alloys are more preferred over metals, for industrial applications?
(b) Name Hume-Rothery's rules and explain all of them. [8+8]
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) Compare the properties of plain carbon steels with those of alloy steels.
(b) Explain AISI-SAE classification of steels. [8+8]
5. Outline the principle of induction hardening .How is induction hardening carried out? Mention its advantages ,disadvantages and applications. [16]
6. (a) Explain ,what you understand by season cracking in brasses and how can it be prevented?
(b) What characteristics of Aluminium make it resistant to corrosion ?
(c) How does anodisation increases the corrosion resistance of Aluminium? Explain
(d) Do soldered Aluminium joints have good resistance to corrosion? Why? [4 × 4 = 16]
7. (a) Classify different varieties of silicate ceramic materials.
(b) What are abrasive materials? Explain properties and applications of abrasive materials.
(c) What is primary clay? Give its constituents.
(d) Give a brief account of manufacture of glass. [3+6+3+4]
8. Discuss the advantages and disadvantages of each one of them. [16]

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1. (a) Explain why a covalent bond is directional while ionic and metallic bonds are non-directional.
(b) What is bond energy? What are the ranges of bond energies (approximate) for primary and secondary bonds?
(c) Explain valence bond (VB) theory. [5+5+6]
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) Write down the Indian standard code for designation of plain and alloy steels.
(b) What is a stainless steel? Explain about austenetic stainless steels. [8+8]
5. (a) Explain the effects of
 - i. Sub-zero treatment
 - ii. Addition of carbon
 - iii. quenching media on the hardness of steels.
(b) Explain the various stages in an heat treatment cycle. [9+7]
6. (a) Explain ,what you understand by season cracking in brasses and how can it be prevented?
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(d) Do soldered Aluminium joints have good resistance to corrosion? Why? [4 × 4 = 16]

7. (a) 'Glass is a super cooled liquid'. Justify the statement.
- (b) Give the composition, properties and applications of the following. [6+10]
- i. Soda lime glass
 - ii. Flint glass.
8. (a) What are the properties that are to be considered for good bonding between fibres and matrix. Explain them with suitable examples.
- (b) Explain how the delamination at the fibre-matrix interface can enhance the fracture toughness of composites. [8+8]
