

Code No: A109210306

R09**Set No. 2**

II B.Tech I Semester Examinations, MAY 2011
METALLURGY AND MATERIALS SCIENCE
Common to Mechanical Engineering, Mechatronics, Production
Engineering, Automobile Engineering

Time: 3 hours

Max Marks: 75

Answer any FIVE Questions
 All Questions carry equal marks

1. (a) Explain the factors affecting the cooling rate.
 (b) Select giving reasons suitable annealing and normalizing temperatures for Hypoeutectoid and Hyper eutectoid steels. Draw the resulting microstructures and explain. [4+11]
2. (a) Distinguish between commercially pure metal and an alloy?
 (b) What is a master alloy? What are its chief characteristics?
 (c) Justify the statement "Alloy is a material which is expected of a metal, but it is not a pure metallic element". [6+5+4]
3. (a) Name and discuss atleast four important metallic properties?
 (b) What causes metals to show alloying behavior? [7+8]
4. (a) What is eutectoid reaction? Explain eutectoid reaction in Fe-Fe₃C diagram?
 (b) Describe the slow cooling history of 0.8% C in Fe-Fe₃C diagram from austenite zone to room temperature and calculate the proportions of different phases and also draw the room temperature microstructures? [4+11]
5. (a) What is a cermet? Give the structure, properties and applications of any one cermet.
 (b) Discuss briefly on abrasive materials. [7+8]
6. Discuss the following alloys:
 - (a) Cupronickels
 - (b) Beryllium Bronzes. [7+8]
7. (a) Briefly classify composites and give examples.
 (b) Critically discuss various methods of component manufacture of composites. [4+11]
8. (a) Why ferritic stainless steels are non Heat treatable? Then how can you increase the strength?
 (b) Give the composition of Austenitic stainless steels and explain the role of 'Ni'?
 (c) Give the characteristics of Austenitic stainless steels? [7+4+4]

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1. (a) Zirconia is one of the most important oxide ceramic. Why?
 (b) Describe briefly classes of magnetic ceramics. [8+7]
2. (a) What are two kinds of solid materials? Glass is not considered as true solid. Why?
 (b) How is metallic bond similar to both ionic and covalent bond?
 (c) Ionic solids are bad conductors of electricity but an aqueous or fused solution of them conducts electricity. Why? [4+6+5]
3. Discuss the following:
 - (a) Modification of Al-Si alloys
 - (b) Alclad alloys
 - (c) High strength - low density Aluminium alloys. [6+4+5]
4. (a) Write a short note on Cementite in Fe-Fe₃C.
 (b) Describe the slow cooling history of 1.2% C in Fe-Fe₃C diagram and calculate the proportions of different phases at 1200⁰C, 750⁰C, at eutectoid temperature and just below eutectoid temperature and also draw the room temperature microstructures? [4+11]
5. (a) Distinguish between quench hardening and precipitation hardening.
 (b) List the various annealing methods. Explain the changes in structure and properties before and after various methods with typical applications. [5+10]
6. Define solid solution? Discuss in detail with examples of the following:
 - (a) Sub situational Solid solution
 - (b) Interstitial solid solution. [15]
7. (a) Draw schaeffler Diagram?
 (b) With the help of schaeffler diagram, explain the different types of stainless steels? [7+8]
8. (a) Why fiber reinforcement is so important? Briefly explain classification of fibers and describe any two fabrication methods.

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- (b) A unidirectional composite is composed of 70% by volume of a fibre with $E=230$ GPa, in a resin matrix of $E = 5$ GPa. Calculate the longitudinal modulus of the composite. [10+5]

FIRSTRANKER

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R09**Set No. 1**

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1. Distinguish between malleable Iron and ductile iron in terms of
 - (a) Manufacturing Process
 - (b) Structure
 - (c) Properties
 - (d) Applications. [4+4+4+3]
2.
 - (a) Differentiate between a single crystal and polycrystalline material?
 - (b) Explain why fine grained materials have superior properties than coarse grained materials?
 - (c) Explain the purpose of etching in metallographic examination? [6+5+4]
3.
 - (a) What are ceramics? Indicate their main characteristics.
 - (b) Discuss briefly classification of ceramic materials. [5+10]
4.
 - (a) Why amorphous materials solidify over a range, but crystalline materials exhibits sharp freezing points.
 - (b) As the Coordination number in a crystal structure decreases the interatomic distance decreases. Why?
 - (c) Explain why brass has less conductivity but copper has good conductivity? [4+6+5]
5.
 - (a) Distinguish between age hardening and dispersion hardening.
 - (b) Discuss the kinetics of precipitation on ageing in duralumin. [5+10]
6.
 - (a) Give reasons why carburizing temperatures are around 900°C.
 - (b) Discuss the age hardening phenomena with respect to Al-Cu alloy. [4+11]
7.
 - (a) Show by calculation how many unit cells of iron share one carbon atom when it is dissolved to the maximum extent to the gamma iron.
 - (b) FCC-iron has more dissolution of carbon at eutectoid temperature than BCC-Iron even though FCC-iron has more atomic packing factor than BCC-Iron. Explain why?
 - (c) Close packed crystal structure is invariably stable at lower temperature if a metal shows allotropy. But the case of iron is exception. Why? [6+5+4]

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8. (a) What is the degree of matrix microcracking? And how is it obtained?
(b) Ceramic matrix composites performance would be controlled by several factors. What are they? Explain them. [4+11]

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R09**Set No. 3**

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1. (a) Why stainless steels are stainless?
 (b) Is it possible to harden 18%Cr-8%Ni steels by heat treatment?
 (c) Why Austenitic stainless steels prone to weld decay? How can you avoid weld decay? [2+6+7]
2. Write a short note on
 - (a) Metallic bonding
 - (b) Space lattice and unit cell
 - (c) Co-ordination number and atomic packing factor
 - (d) Crystal structure. [4+4+4+3]
3. Discuss the structure, properties and applications of the following:
 - (a) Calcium oxide
 - (b) Beryllium oxide. [7+8]
4. Write short notes on:
 - (a) Miscibility gap
 - (b) Degrees of freedom
 - (c) Invariant reactions
 - (d) Segregation. [4+4+4+3]
5. (a) Mention the important properties of graphite and its applications.
 (b) Discuss briefly multidirectional weaving techniques to produce composites. [7+8]
6. Justify the following statements:
 - (a) In beta brass (50 at % Cu, 50 at % Zn), all corner sites are occupied by Zn atoms but body-centered sites by Cu atoms.
 - (b) In Cu₃ Au Super lattice, Copper atoms are at face centers while gold atoms are at corners.
 - (c) An ordered solid solution is different than a chemical compound? [6+5+4]

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7. (a) What alloying elements are commonly used in the commercial aluminium alloys? And explain their effect on structure and properties of alloys.
(b) In what way the mechanical properties of aluminium and its alloys be increased? Discuss. [7+8]
8. (a) Suggest giving reasons suitable heat treatment methods to improve machinability of 0.1%C, 0.3%C, 0.7%C & 1.2%C.
(b) What is annealing? What is its purpose? Write a brief note on homogenization annealing applied to steel castings. [7+8]

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