

III B.Tech. I Semester Regular Examinations, November -2005
HEAT TREATMENT TECHNOLOGY
(Metallurgy & Material Technology)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain the effect of carbon content and alloying elements on properties and transformation temperatures of Martensite. [6]
(b) Explain the Martensitic transformation by Bain distortion model. [6]
(c) What are Athermal Martensite and Isothermal martensites. [4]
2. (a) Critically discuss the microstructural changes during various tempering stages. [9]
(b) What is secondary hardening? What is the effect of alloying elements on tempering. [7]
3. Discuss the process, advantages and disadvantages of liquid carburising process. [16]
4. (a) What do you mean by structural steels? [2]
(b) Discuss the microstructure, heat treatment, properties and applications of any one structural steel. [14]
5. (a) What is the effect of cooling rate on cast irons? [4]
(b) How the white cast irons are obtained? Explain. [6]
(c) En list properties, applications of white cast irons. [6]
6. (a) What are ferritic - pearlitic malleable cast irons? Explain. [6]
(b) What are black heart malleable cast irons? Explain [5]
(c) What are white heart malleable cast irons? Explain [5]
7. (a) What are the main industrial applications of Al-Mg and Al-Zn alloys. [6]
(b) Write short notes on the following.
i. Aluminum-silicon alloys [5]
ii. Duralumin. [5]
8. (a) Write a short notes on self-lubricating bearings? [5]
(b) What are dry and anti corrosive bearings? Explain. [6]
(c) What are solders? Give the various types of solders. Give their applications. [5]

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1. Draw Fe-Fe₃C phase diagram and label the phase fields. Discuss the different reactions that take place in this system? [16]
2. (a) Discuss the determination of hardenability by Jominy end quench test. [7]
(b) Discuss how hardenability is affected by [3x3=9]
 - i. Austenitic grain size
 - ii. Carbon content
 - iii. Presence of alloying elements?
3. With the help of a suitable diagram, explain the principle, process and applications of marstraining and cryo forming? [16]
4. (a) Discuss the heat treatment of Austenitic stainless steels with suitable heat treatment cycle? [8]
(b) What is sensitisation? Mention the various remedial measures to avoid sensitisation? [8]
5. How are cast Irons classified on the basis of their manufacture, composition microstructure and appearance of fracture? Explain them. [16]
6. (a) What are ferritic - pearlitic malleable cast irons? Explain. [6]
(b) What are black heart malleable cast irons? Explain [5]
(c) What are white heart malleable cast irons? Explain [5]
7. (a) Bring out the various metallurgical properties of copper and its alloys. [6]
(b) Draw copper-zinc equilibrium diagram. Label various phases in it. Explain the diagram. [10]
8. (a) Draw lead-tin equilibrium phase diagram and label all phases in it. [6]
(b) Explain the various physical and mechanical properties of lead? [4]
(c) What are the important lead alloys. Explain any Two of them in detail. [6]

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1. Draw Fe-Fe₃C phase diagram and label the phase fields. Discuss the different reactions that take place in this system? [16]
2. What is annealing? Describe the following annealing processes [1+5+5+5]
 - (a) Subcritical Annealing
 - (b) Partial Annealing
 - (c) Full Annealing
3. (a) Discuss the effects of various post-carburising heat treatment on the characteristics of case and core of the material. [6]
(b) Explain the following case hardening methods
 - i. Liquid carburising [5]
 - ii. Gas carburising [5]
4. (a) Discuss the heat treatment of Austenitic stainless steels with suitable heat treatment cycle? [8]
(b) What is sensitisation? Mention the various remedial measures to avoid sensitisation? [8]
5. Explain the effects of 'P', 'S' and Mn on the properties, Microstructures and applications of cast irons. [16]
6. (a) Explain the manufacture of Nodular cast iron? [8]
(b) What are the Mechanical Properties of Nodular Cast Irons? [4]
(c) What are the main applications of S.G. Cast Irons? [4]
7. (a) Bring out the various metallurgical properties of copper and its alloys. [6]
(b) Draw copper-zinc equilibrium diagram. Label various phases in it. Explain the diagram. [10]
8. (a) Draw lead-tin equilibrium phase diagram and label all phases in it. [6]
(b) Explain the various physical and mechanical properties of lead? [4]
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1. (a) Explain the Transformation of Pearlite into Austenite? [7]
(b) Discuss the effect of time and temperature on Transformation of pearlite to austenite? [9]
2. (a) Discuss the determination of hardenability by Jominy end quench test. [7]
(b) Discuss how hardenability is affected by [3x3=9]
 - i. Austenitic grain size
 - ii. Carbon content
 - iii. Presence of alloying elements?
3. (a) Any combination of heat treatment and plastic deformation by cold working cannot be referred to as thermomechanical treatments. Discuss. [7]
(b) Explain the process, microstructure, and properties of Ausforming of steels with neat diagram. [9]
4. Discuss the function of
 - (a) Nickel in maraging steel and austenitic stainless steel. [4x4=16]
 - (b) Chromium in stainless steel and high speed steel.
 - (c) Manganese in Hadfield steel and austenitic stainless steel.
 - (d) Silicon in transformer steel and spring steel.
5. (a) What are cast irons? Give its importance in the Metallurgical Curriculum? [8]
(b) Compare and contrast steels and cast Irons. [8]
6. (a) What are ferritic - pearlitic malleable cast irons? Explain. [6]
(b) What are black heart malleable cast irons? Explain [5]
(c) What are white heart malleable cast irons? Explain [5]
7. (a) Explain in detail the precipitation hardening process? [6]
(b) Explain the coherent lattice theory to explain the age hardening phenomenon. [10]
8. (a) Draw lead-tin equilibrium phase diagram and label all phases in it. [6]

- (b) Explain the various physical and mechanical properties of lead? [4]
- (c) What are the important lead alloys. Explain any Two of them in detail. [6]

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