

**III B.Tech I Semester Regular Examinations, November 2006**

**HEAT TREATMENT TECHNOLOGY**

(Metallurgy & Material Technology)

**Time: 3 hours**

**Max Marks: 80**

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

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1. (a) What is Bainite? Mention various types of bainitic structures. [8]  
(b) Explain the mechanism of Bainitic transformation? [8]
2. Describe the following processes with respect to microstructure and mechanical properties. [8+8]  
(a) stress-relief annealing  
(b) Patenting
3. (a) Explain objectives and uses of surface hardening. Give the classification of surface hardening methods? [8]  
(b) Discuss any one case hardening method? [8]
4. Discuss the composition, heat treatment, microstructure and applications of grain-oriented silicon steels? [16]
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) 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) Draw copper-tin phase diagram and label the phases in it. [8]  
(b) Write short notes on [4+4]  
    i. Phosphor bronze  
    ii. Gun metal
8. (a) Explain the importance of Titanium in the modern industrial scenario? [6]  
(b) Explain the various properties of Titanium and its alloys? [5]  
(c) Explain the various applications of Titanium and its alloys? [5]

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1. Draw Fe-Fe<sub>3</sub>C 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 following
  - i. Plasma nitriding [5]
  - ii. Salt bath nitrocarburising [5](b) Discuss the recent advances in surface hardening process. [6]
4. (a) Give the composition of HSS. [3]  
(b) Discuss composition, typical heat treatment cycle and microstructure of high-speed steels. [13]
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 ferrite - 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. (a) What is the effect of carbon content on tetragonality and hardness of martensite. [8]  
(b) Discuss the mechanism of Martensitic transformation. [8]
2. What is meant by temper brittleness? Why does it occur? Are there any remedies for it? Discuss? [16]
3. With the help of a suitable diagram, explain the principle, process and applications of marstraining and cryo forming? [16]
4. (a) Give the microstructures, properties and applications of plain carbon steels. [10]  
(b) What are the limitations of plain carbon steels. [6]
5. How are cast Irons classified on the basis of their manufacture, composition microstructure and appearance of fracture? Explain them. [16]
6. (a) Explain the microstructure of malleable cast iron and explain its importance? [8]  
(b) What are the properties of malleable cast irons? [4]  
(c) What are the applications of malleable cast irons? [4]
7. (a) Draw copper-tin phase diagram and label the phases in it. [8]  
(b) Write short notes on [4+4]
  - i. Phosphor bronze
  - ii. Gun metal
8. (a) Write short notes on [4+4]
  - i. Babbits
  - ii. Pb-Sn alloys.  
(b) How tin base alloys are classified. Give the composition; properties and applications of any two types of tin base alloys. [8]

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1. (a) Explain the term Heat Treatment. How does heat treatment alter the mechanical properties of an alloy? [8]  
(b) Discuss the heat treatment process variables? [8]
2. (a) Explain ideal critical diameter and Severity of Quench. [8]  
(b) Explain why hardenability is improved by coarsening of austenitic grains size. [8]
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. Explain the effects of 'P', 'S' and Mn on the properties, Microstructures and applications of cast irons. [16]
6. (a) Explain the microstructure of malleable cast iron and explain its importance? [8]  
(b) What are the properties of malleable cast irons? [4]  
(c) What are the applications of malleable cast irons? [4]
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 short notes on [4+4]  
i. Babbits  
ii. Pb-Sn alloys.  
(b) How tin base alloys are classified. Give the composition; properties and applications of any two types of tin base alloys. [8]

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