

Code No: 07A50604

R07**Set No. 2**

III B.Tech I Semester Examinations, November 2010
HEAT TREATMENT TECHNOLOGY
Metallurgy And Material Technology

Time: 3 hours**Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. Compare Hadfield steel and Austenitic stainless steel on following lines:
 - (a) Chemical composition
 - (b) Heat treatment
 - (c) Work hardening characteristics
 - (d) Corrosion resistance Formability [16]
2. What are continuous furnaces? Explain different types of continuous furnaces used in heat treatment industry with neat sketches. [16]
3. (a) Explain the effect of various alloying elements on eutectoid temperature and composition
- (b) Explain how is it possible to obtain a structure composed of fine Pearlite, Bainite & Martensite [7+9]
4. (a) What is normalising? How is it different from annealing? What are the various objectives of normalising. Explain why is normalising a preliminary heat treatment prior to hardening process.
- (b) Explain why there is a thermal expansion when Austenite changes to Martensite. Show it with relevant figures. [10+6]
5. (a) Discuss the effect of silicon in transformer steel and spring steels.
- (b) Explain why in maraging steels, there is insignificant amount of distortion, and no danger of decarburization. [7+9]
6. (a) What are the required properties of heavy duty gears & cams? How these properties may be achieved by case hardening or surface hardening process? Discuss.
- (b) What factors control the gas carburising process? Discuss them. [8+8]
7. (a) What is equivalent zinc of a brass? Explain its significance and usefulness.
- (b) A brass contains 28%Zn, 1%Sn, 1%Al and balance copper. What is its equivalent zinc? [8+8]
8. a) Which factors affect the properties of a gray cast iron? How are they controlled to obtain optimum properties?
- b) Why gray cast irons have better damping capacity than nodular cast irons? [10+6]

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R07**Set No. 4**

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Answer any FIVE Questions
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1. (a) Review critically the thermomechanical treatment of non-ferrous alloys.
 (b) Explain about various gases used in flame hardening process. Discuss their relative merits & demerits. [10+6]
2. (a) What could be the defects that may form due to the heat treatment of HSS? Explain about these defects and suggest suitable remedial measures.
 (b) Which are the commonly used alloying elements in tool steels? Why are they used? What properties are achieved by the tool steels? Discuss. [9+7]
3. (a) Distinguish between stable and meta stable phases with suitable examples.
 (b) What do the horizontal lines indicate and what do the vertical lines indicate in any phase diagram? Explain with suitable examples. [8+8]
4. Discuss the reaction that take place between the following in furnace under controlled atmospheres and explain their role in the furnaces.
 (a) Metal and oxygen
 (b) Metal and carbon
 (c) Different gases [16]
5. (a) Which factors affect the properties of a gray cast iron? How are they controlled to obtain optimum properties?
 (b) Find the weight percentages of ferrite, graphite and cementite in a pearlitic-ferritic gray cast iron containing 4.0% total carbon and 0.4% combined carbon. [8+8]
6. (a) Why the ferritic stainless steels are not heat treatable? Discuss.
 (b) Draw the microstructures of 0.4%C steels in
 i. annealed,
 ii. normalized and
 iii. hardened condition and explain in detail [5+11]
7. (a) What are magnetic steels? Explain their important properties.
 (b) How do the magnetic steels classified? Explain the heat treatment given to steels to get magnetic texture. [8+8]
8. Briefly discuss heat treatment of following alloys:

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- (a) Al-Cu alloys
- (b) Al-Mg alloys
- (c) Heat resistant alloys

[16]

FIRSTRANKER

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R07**Set No. 1**

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Time: 3 hours**Max Marks: 80**

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1. State True or False and justify:

- (a) 90/10 aluminium bronze can be hardened by quenching in water from 900⁰C.
- (b) Tin bronzes show pronounced coring.
- (c) Phosphor bronzes are the alloys of copper and phosphorous.
- (d) 3 to 5% copper is generally added to tin base white metal alloys. [16]

2. (a) Explain the various factors which control the cooling rate to be used after soaking the steel for various types of heat treatments.

(b) Explain about the importance of heating, soaking and cooling stages in any heat treatment process. [8+8]

3. (a) What are high speed steels and super high speed steels. What are their composition, properties & applications.

(b) What are precipitation hardened stainless steels? Why they have limited application? What is the mechanism of hardening in those steels? [8+8]

4. Describe "Low Alloy High Strength" steels. Are they different from "High Strength Low Alloy Steels"? Explain. [16]

5. (a) Compare and contrast between vacuum furnaces and other heat treatment furnaces.

(b) Explain salient features of "Lift-off Cover" furnace. What are its various industrial applications? [8+8]

6. (a) Why post carburizing heat treatment is necessary for case carburized parts? Discuss

(b) What is vacuum carburizing process? Discuss in detail. List the advantages and limitations of this process. [7+9]

7. (a) Explain the limitations on the use of Fe-Fe₃C diagram.

(b) What do you mean by austenitic stabilizers? What are those elements? Explain about austenitic stabilisers.

(c) Explain about A_{c4} & A_{c1m} [5+8+3]

8. (a) What are inoculated cast irons? Explain about their composition.

(b) What are antifriction cast irons? Explain their important properties. [8+8]

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Time: 3 hours**Max Marks: 80**

Answer any FIVE Questions
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1. (a) Explain why TTT diagram is called S-curve .What are the other names? Explain.
 (b) Define and explain
 i. Alloy
 ii. Alloy steels
 (c) Explain the influence of various alloying elements on grain growth in steels. [6+5+5]
2. Write short notes on the following:
 (a) Conveyor furnace
 (b) Pit furnace
 (c) Muffle furnace. [5+5+6]
3. (a) If the primary consideration is hardenability, which alloy steel should be selected? Why?
 (b) Explain how alloying elements that dissolve in ferrite increase its strength. [8+8]
4. (a) Explain the various stages in the tempering process.What is the driving force for the tempering process?Also discuss how the temper embrittlement can be avoided.
 (b) Explain the reasons for the reduction in hardness during the various stages of tempering of steels. [11+5]
5. (a) Why do many aluminium alloys respond to age hardening? Give some examples.
 (b) Why do alluminium alloy 2017 rivets have to be refrigerated until used?
 (c) What are the important properties of aluminium? [5+5+6]
6. Explain about Hadfield manganese steel. What is its general composition? What are the important properties and applications? Give the microstructure of the steels at room temperature. Also explain about Hadfield manganese steel. [16]
7. (a) Write a short note on 'carbon potential' with reference to carburizing process
 (b) Describe how the Ficks law can be helpful in evaluating the depth of carburizing as a function of time.

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- (c) Why isoforming decreases ductile to brittle transition temperature? [6+5+5]
8. (a) Why are graphite flakes in gray iron very often surrounded by ferrite areas?
- (b) Why should the iron-iron carbide diagram not used to determine the structures in gray iron?
- (c) Why is malleable iron made only from hypoeutectic white iron? [5+6+5]

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