

HEAT TREATMENT TECHNOLOGY (MT-605)

Time: 3 hours

Full Marks :70

Answer question No. 1 and any FIVE from the rest

Marks in the margin indicate full marks

All parts of a question must be written at one place

Give neat sketches wherever necessary

1. Answer the following (No marks awarded for incomplete / partly correct answer) (any Ten): [2x10]
- (i) Name one austenite and one ferrite stabilizing element.
 - (ii) With the help of Iron-Cementite phase diagram identify the minimum temperature at which complete liquid phase can be formed in plain-C steel and write the corresponding wt.% C.
 - (iii) Calculate the wt.% of ferrite in a steel containing 0.8 wt.% C at room temperature and at eutectoid temperature.
 - (iv) How do Cr and Co affect the nose of the TTT diagram?
 - (v) What is critical cooling rate?
 - (vi) Define severity of quench.
 - (vii) A heat treatment furnace is overloaded with many large components kept in stack and components are quench hardened from austenizing temperature. What is the most likely defect to be observed?
 - (viii) What is the microstructure of grey cast iron?
 - (ix) Which carburising process shows better control over carburised layer thickness in steels?
 - (x) What is the maximum solid solubility of Copper in Aluminium?
 - (xi) Identify a hardening process which does not require a separate quenching medium.
 - (xii) Write the chemical composition of 18:4:1 grade of high speed steels.
 - (xiii) How the eutectoid temperature and composition of steels are affected by Ni and Cr?
 - (xiv) Write the composition of Hadfield Manganese steel and its phases at room temperature.
2. (a) What are the experimental parameters to be maintained during Jominy end quench test? How do you quantitatively determine the hardenability value of a particular steel sample by this method?
- (b) A 0.35% plain-C steel and a 0.35%C – 1.0% Mn steel are water quenched from austenizing temperature. Which steel will show higher hardenability? Briefly discuss the reasons. [(3+4)+3]
3. (a) Briefly explain the various stages of heat removal during quenching.
- (b) Name the factors which control the quenching characteristics.
- (c) What are the advantages of synthetic quenchants over other quenching media? [3+3+4]
4. (a) What is the importance of carburization treatment of steels?
- (b) What is the necessity of post carburization heat treatment?
- (c) What is the necessity of inspection of heat-treated products? [2+3+5]
5. Briefly describe the black heart process of malleabilization of white cast iron. [10]

6. (a) Which series of Al-base alloys are heat treatable in nature?
(b) Explain the precipitation hardening characteristics of Al – 4.5wt.% Cu alloy.
(c) Identify the applications and corresponding heat treatment schedule of Ti-6Al-4V alloy. [1+5+4]
7. Write technical notes on (any Two): [5 x 2]
(a) Patenting
(b) Austempered ductile iron
(c) Secondary hardening of steel
8. Write a typical composition of the followings, corresponding heat treatment schedule and expected properties (any Three): [3½ x3]
(i) Ferritic stainless steel
(ii) Standard Ni-hard cast iron
(iii) Maraging steel
(iv) Transformer steel
(v) Ball bearing steel