Instructions:  (1) All Questions are compulsory.
(2) Answer each next main Question on a new page.
(3) Illustrate your answers with neat sketches wherever necessary.
(4) Figures to the right indicate full marks.
(5) Assume suitable data, if necessary.

Marks

1. Attempt any TEN of the following :  20

(a) Define : (i) Unit Cell; (ii) Space Lattice.
(b) Why different properties of materials should be studied?
(c) Define : (i) Phase, (ii) Solid solution.
(d) What is heat treatment? State its two advantages.
(e) How steels are classified based on carbon content?
(f) State the various quenching medias used for heat treatment.
(g) What is alloy steel? Give two examples.
(h) State different types of cast irons.
(i) State two properties and any two applications of copper.
(j) List any four properties of Aluminium.
(k) What are the polymers? Name any two polymeric materials.
(l) Name any four non-metallic materials with their applications.
(m) State any four applications of powder metallurgy.
(n) What are the advantages of Non-destructive testing?
2. Attempt any FOUR of the following:

(a) What is packing efficiency of a unit cell? Calculate the packing efficiency of BCC structure.

(b) Define the following:
   (i) Ductility
   (ii) Plasticity
   (iii) Density
   (iv) Strength

(c) Explain substitutional and interstitial solid solution with neat sketch.

(d) With neat sketch explain Cu – Ni binary isomorphous system.

(e) What are the objectives of heat treatment?

(f) Explain TTT diagram of plain carbon steel with neat sketch.

3. Attempt any FOUR of the following:

(a) Give the detail classification of engineering materials.

(b) Explain Lead and Tin binary eutectic system with neat sketch.

(c) What are the various phases exists on Fe – Fe₃C diagram?

(d) Define Annealing. State the effects of Annealing on properties of steel.

(e) State the effect of following alloying elements on steel:
   (i) Nickel
   (ii) Molybdenum
   (iii) Chromium
   (iv) Tungsten

(f) What is 18-4-1 tool steel? State its applications.
4. Attempt any FOUR of the following: 16

(a) Draw a neat sketch of Iron-Iron carbide equilibrium phase diagram.

(b) What is Normalising? State its purpose & also explain how normalising is carried out.

(c) Define Hardening. Explain how hardening is carried out.

(d) What is stainless steel? State the important properties and applications of stainless steel.

(e) What is Muntz metal? State its properties and applications.

(f) What is Brass? State its properties and applications.

5. Attempt any FOUR of the following: 16

(a) What is carburizing? List the methods of carburizing. Also state any two applications of carburizing.

(b) What is surface hardening? State the needs of surface hardening.

(c) Differentiate between white cast iron and gray cast iron.

(d) White down the composition of

(i) 40CrMo2
(ii) FeE400
(iii) 45C10S18
(iv) 40C8

(e) What are the desired properties of bearing materials?

(f) Compare thermoplastics and thermosetting plastics.

P.T.O.
6. Attempt any FOUR of the following:  

(a) Compare Austempering and Martempering.  

(b) Suggest the suitable steel for the applications of  
   (i) Crankshaft of I.C. Engine  
   (ii) Propeller shaft of a truck  
   (iii) Car bodies  
   (iv) Household utensils  

(c) State the properties and applications of glass wool.  

(d) What is Acrylic? Give its properties and applications.  

(e) Draw a block diagram showing various steps involved in powder metallurgy.  

(f) What is non-destructive testing? List the various methods of NDT.