



Material Science & Metallurgy
(123104 / 213104)

P. Pages : 3

Time : Three Hours

Max. Marks : 80

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
 2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
 3. Students should note, no supplement will be provided.
 4. From each question, attempt **any two** sub questions out of a, b and c.
 5. Neat figure should be drawn wherever necessary.
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1. a) Define cold working and hot working. When compared to hot working state the advantages of cold working. **8**

 - b) i) Draw the unit cell of α iron, Aluminium and Z_n metal. **3**

 - ii) State the different types of crystal defects present in metals. What is the effect of these defects on mechanical properties of metal ? **5**

 - c) What do you mean by strengthening mechanisms of metal ? **8**
Describe any two strengthening mechanisms from the following.
 - i) Solid solution strengthening.
 - ii) Strain hardening.
 - iii) Precipitation hardening.
 - iv) Grain size control.
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2. a) i) Define the following terms : **4**
 - a) Ductility
 - b) Yield stress
 - c) Brittleness
 - d) Toughness.

 - ii) Draw typical stress-strain diagrams for **4**
 - a) ductile material showing distinct yield point.
 - b) Brittle material label them properly.

- b) i) State the principal of hardness testing in Rockwell hardness and Brinell hardness test. 4
- ii) Draw the neat figures for the following and label them 4
- a) S. N. Curve for ferrous and Non-Ferrous metal.
- b) A typical creep curve.
- c) Effect of temperature on energy required to failure in impact test (any two of the above (i) (ii) and (iii)).
- c) i) What exactly is nondestructive testing and what are some advantages of the approach ? 4
- ii) Explain any one of the following. 4
- a) Liquid penetrant inspection
- b) Magnetic partical testing.
3. a) i) What are the four single phases in the iron – carbon equilibrium diagram ? Define them properly. 5
- ii) Define the following terms : 3
- i) allotropy ii) critical temperature ii) pearlite
- b) i) What is hypoeutectoid and hypereutectoid steel ? What structure it will assume upon slow cooling. 4
- ii) Draw the simplified iron-carbon diagram for steel, indicating on it, different phases and temperatures. 4
- c) i) What are the two possible high-carbon phases that form during eutectic reaction in cast iron ? What features tend to favour the formation of each ? 4
- ii) What are the some of the attractive engineering properties of grey cast iron? 4
4. a) i) Draw graphical summery of processing heat treatments for steel on an simplified equilibrium diagram and state their desired objectives. 8
- b) i) Draw T.T.T. curve for eutectoid steel and lable it properly. 4

- ii) Define : 4
- a) Martensite b) Banite
c) Hardenability d) Heat treatment
- c) State true and false with justification.
- i) Induction hardening is done on medium and high carbon steel.
- ii) Plain carbon steels can not be nitrided effectively. 8
5. a) Explain the limitations of plain carbon steel and state the functions of alloying elements added to plain carbon steel. 8
- b) What are the stainless steels ? State the various types of stainless steels and their applications. Why the steels are stainless ? 8
- c) Name the various types of tool steels. State their properties and applications. 8
