

[3862]-112

S.E. (Mech. & Mech. Sand) (First Semester) EXAMINATION, 2010

METALLURGY

(2008 COURSE)

Time : Three Hours

Maximum Marks : 100

N.B. :— (i) Answer any *three* questions from each Section.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(vi) Assume suitable data, if necessary.

SECTION I

1. Answer the following :

- (a) Define cold working. Draw microstructure of mild steel before and after cold working. Why cold worked materials are annealed ?

[6]

P.T.O.

(b) Give reasons (any *three*) : [9]

(i) Aluminium shows higher ductility than steel.

(ii) Fine grained steels are stronger than coarse grained steels.

(iii) Substitutional and interstitial crystal defects improve the strength and hardness.

(iv) Dislocations play an important role during plastic deformation of metals.

(c) Define slip plane and slip direction. [3]

Or

2. Answer the following :

(a) Give the classification of crystal imperfections. Explain with neat sketches screw dislocation and volume defects. [8]

(b) Define the recrystallization temperature and work hardening. Why are alloys worked hardened during plastic deformation ? [5]

(c) Obtain effective number of atoms per unit cell for cubic unit cells and state its significance. [5]

3. Answer the following :

(a) Define engineering and true stress. Obtain the relationship between engineering stress, strain and true stress, strain. [6]

- (b) Draw a neat sketch of creep testing m/c and explain the test procedure. Draw the standard creep curve. [7]
- (c) Explain the significance of Endurance limit. [3]

Or

4. Answer the following :

- (a) With a neat sketch explain the procedure for Rockwell hardness test. State *two* main differences between Brinell and Rockwell hardness tests. [7]
- (b) Give the reason (any *three*) : [9]
- (i) Specimens are notched in impact test.
 - (ii) Ultrasonic flaw inspection is not suitable to detect the defects in thin materials.
 - (iii) Magnaflux test is used to detect surface and subsurface defects.
 - (iv) Radiography is used to detect the defects in welded joints of boilers.
 - (v) Eddy current test can be used for sorting the steels.

5. Answer the following :

- (a) Draw Fe-Fe₃C phase equilibrium diagram and label completely. Explain the phases, critical temperatures and phase transformation reactions. [10]

- (b) State the requirements of steels used for various tools. Explain the significance of chromium and vanadium in tool steel. [6]

Or

6. Answer the following :

- (a) Draw the microstructures and state the properties and applications of the following : [6]

(i) S.G. iron

(ii) Grey cast iron.

- (b) Give the significance of the following (any *two*) : [6]

(i) En353

(ii) AISI1040

(iii) C45

- (c) Explain free cutting steels w.r.t. composition and machinability. [4]

SECTION II

7. Answer the following :

- (a) Define annealing and normalising. Explain any *three* annealing treatments with the use of proper portion of Fe-Fe₃C phase equilibrium diagram. [9]

- (b) Define hardenability. Draw standard Jominey hardenability test set-up. Draw hardenability curves for 0.4% carbon and 0.8% carbon steels. Explain the significance of hardenability curves. [7]
- (c) Give *four* differences between flame and induction hardening. [2]

Or

8. Answer the following :

- (a) Draw TTT curve for 0.8% carbon steel. How are TTT curves used for the annealing, normalising and hardening treatments. [8]
- (b) Explain the principle of carburising and nitriding. [4]
- (c) State the characteristics of martensite and tempered martensite. Why are tool steels multitempered ? [6]

9. Answer the following :

- (a) Explain the following characteristics of metal powder : [6]
- (i) Particle size and shape distribution
 - (ii) Flow rate
 - (iii) Apparent density.
- (b) Explain the effect of the following variables on metal powder characteristics in atomisation method : [6]
- (i) Atomising pressure

- (ii) Nozzle geometry
- (iii) Pouring temperature.
- (c) Draw Al-Si phase transformation diagram and give eutectic phase transformation reaction. [4]

Or

10. Answer the following :

- (a) Define sintering. Why Briquettes need sintering treatment ? Explain the sintering process used for cemented carbide tools. [6]
- (b) Explain the blending and compacting processes. [4]
- (c) Explain anodising used for aluminium alloys. [3]
- (d) Distinguish between brass and bronze. [3]

11. Answer the following :

- (a) Explain the basic characteristics required to produce good composites. [4]
- (b) Explain the properties and applications of the following fibers : [8]
 - (i) Aramid
 - (ii) Glass

(iii) Graphite

(iv) Alumina

(v) Silicon.

- (c) State and explain usual problem that occur at cryogenic temperature. [4]

Or

12. Answer the following :

- (a) Explain the characteristics of high temperature materials. [3]
- (b) State any *one* material used for the turbine and give the reason. [4]
- (c) Give classification of refractories. State properties and applications of each type of refractories. [7]
- (d) Give classification of silicate glass. [2]