Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH/CHE(OLD)/SEM-4/CHE-403/2013

2013

MATERIAL SCIENCE & TECHNOLOGY

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) Dislocations are sometime called

a) point imperfection b) line imperfection

c) surface imperfection d) volume imperfection.

ii) The method improving the fatigue resistance of a material is

a) fine grain sizing

b) shot peering

c) polishing the surface

d) decarburizing the sheet.

iii) APF of regular HCP crystal structure as

a) 0·68 b) 0·74

c) 0·22 d) zero.

iv) Crystalline structure of copper is
   a) FCC
   b) BCC
   c) HCP.

v) In a TV picture tube the types of luminescence occurs is
   a) fluorescence
   b) phosphorescence
   c) photoluminescence
   d) cathodoluminescence.

vi) Which of the following element is added to iron to improve its corrosion resistance ?
   a) Zn b) Cr
   c) Mg d) Al.

vii) At the equilibrium separation distance for an ion pair inter-ionic force will be
   a) zero b) minimum
   c) maximum d) any value.

viii) If one solid phase split into two solid phases on heating, the reaction is
   a) eutectic b) eutectoid
   c) peritectoid d) none of these.

ix) For rhombohydral crystal structure the relation between the lattice constants *a, b, c* and angle α, β, γ is
   a) $a = b = c$ and $\alpha = \beta = \gamma \neq 90°$
   b) $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90°$
   c) $a = b \neq c$ and $\alpha = \beta = 90°, \gamma = 120°$
   d) $a = b = c$ and $\alpha = \beta = \gamma = 90°$.

x) The degrees of freedom when ice water and water vapour coexist in equilibrium is/are
   a) two b) one
   c) zero d) three.

xi) The chemical formula of Zirconia is
   a) SiC b) ThO_2
   c) ZrO_2 d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Write short notes on slip and twinning mechanism.

3. Define calcinations and roasting. Name the classification of roasting.

4. Define atomic packing factor. Prove that atomic packing factor for the FCC crystal structure is greater than the BCC crystal structure.

5. With the help of a representative sketch explain briefly the salient points of the metastable iron carbon equilibrium diagram.

6. Write short note on TTT diagram.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Define anelastic and viscoelastic behaviour. 2 + 2

   b) State the Braggs law and explain how the structure of an unknown crystal can be determined with the help of this law. 1 + 3

   c) A sample of BCC Fe was placed in a *X*-ray diffractometer using *X*-ray of 0·154 nm wavelength. First order diffraction from the (110) plane was obtained at $2\theta = 44{\cdot}704°$. Calculate the value of the lattice constant of Fe. 3

   d) What is the superconducting state for a material ? What is optical fibre ? What types of impurities are particularly detrimental to light loss in optical fibres ? 2 + 1 + 1

8. a) What is creep ? Describe the mechanism of creep with a suitable graph. 1 + 3

   b) Define Frenkel and Schottky defects. 2 + 2

   c) In homogenous nucleation calculate the ratio of surface energy and volume energy in the nucleation energy equation at the critical condition. 3

   d) Discuss different stages of tempering of martensite. 3

   e) Write the eutectoid reaction occurs in Fe-Fe_3C alloy at 727°C. 1

9. a) Draw a TTT diagram of eutectoid and explain its salient features. 5

   b) What is intergranular and fretting corrosion ? 2 + 2

   c) With a suitable example describe sacrificial coating ? Discuss different types of non-metallic coating ? 3 + 3

10. With a suitable block diagram describe the different hydrometallurgical process.

11. With a suitable diagram describe the different parts of LD converter used for steel making.

12. a) What are different types of polyethylene ? Discuss their applications ? 3

   b) Write short notes on borosilicate glass and silicone rubber ? 6

   c) What is ceramic ? What are the raw materials required for ceramic production ? Discuss the various application of ceramics ? 1 + 2 + 3

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