Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B. Tech (AUE) /SEM-5/AUE 503/2011-12

2011
METERIAL SCIENCE AND 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 the following :

$10 \times 1 = 10$

i) Strain hardening in material increases the value of

   a) Shear strength   b) Compressive strength

   c) Tensile strength   d) None of these.

ii) Main objective for addition of tungsten in steel is to get

   a) good machinability

   b) high temperature strength

   c) corrosion resistance

   d) grain refinement.

iii) Which of the following elements have Face Centred Cubic (FCC) structure ?

   a) γ-iron, Cu, Ag, Au, Al, Ni

   b) Mg, Zn, Ti, Zr, Cd

   c) α-iron, W

   d) All of these.

5216   [Turn over

iv) Austenite is a combination of

    a) ferrite and cementite   b) cementite and γ-iron

    c) pearlite and ferrite   d) ferrite and austenite.

v) Delta iron occurs at temperature of

    a) room temperature

    b) above melting temperature

    c) $1400\,°C$ to $1539\,°C$

    d) $910\,°C$ to $1400\,°C$.

vi) Precipitation or age hardening strengthening mechanism mainly applies in

    a) Al-Cu alloys

    b) Steel

    c) Cast iron

    d) Polymer

    e) Ceramic materials

vii) XRD (X-ray diffraction) is used to find out

    a) Chemical composition and crystal structure of material

    b) Fatigue detection

    c) Fracture detection

    d) Creep

    e) Corrosion.

viii) The temperature at which new grains are formed in a metal is called

    a) Recrystallisation temperature

    b) Critical temperature

    c) Eutectic temperature

    d) None of these.

ix) Dislocation of materials refer to which of the following types of defects ?

    a)   Point defect   b)   Line defect

    c)   Surface defect   d)   Volume defect.

x) An elastic or viscoelastic deformation mainly occurs in the material

    a)   Polymer   b)   Ceramic

    c)   Composite   d)   Nanomaterial.

GROUP – B

(Short Answer Type Questions)

Write short notes on any *three* of the following.

$3 \times 5 = 15$

2. Defects of solid material.

3. Strengthening mechanisms of engineering materials.

4. Annealing and Normalising.

5. Cash and surface hardening.

6. T-T-T and C-C-T diagram for eutectoid steel.

GROUP – C

(Long Answer Type Questions)

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

7. a) Draw the Iron-Carbon equilibrium phase diagram and label all phases.

    b) Differentiate between Iron-carbon equilibrium diagram and TTT-diagram.

    c) What are true stress and true strain ? Give the relation between engineering Stress-strain and true stress-strain with curve.   5 + 5 + 5
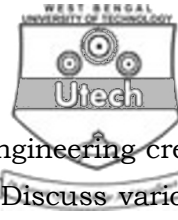
8. a) Give the definition of creep. Draw the engineering creep curve and give all the creep equations. Discuss various steps about creep in the engineering material.

   b) Discuss about the fracture mechanism and draw all the samples or specimen figures in the impact fracture toughness test.

   c) Discuss about the S-N curve. 5 + 5 + 5

9. What are the materials used for manufacturing following automobile components and why ? 5 × 3

   a) Transmission gears

   b) Main shaft

   c) Cylinder head

   d) Crankshaft

   e) Piston

10. a) Give definition of composite material. Give classification of composite material.

    b) Define the term "corrosion" of metals.

    Write down the surface treatments done to prevent corrosion of steel.

    c) What is solid solution ? How does it differ from an alloy ? Distinguish between an interstitial and a substitutional solid solution. 5 + 5 + 5

11. a) What is heat treatment process ? What is the objective of annealing ?

    b) Describe the phenomenon of solidification of alloys.

    c) Give classification and draw stress-strain diagram of various engineering materials. 5 + 5 + 5