B.Tech. MECHANICAL ENGINEERING (BTMEVI)

00974

Term-End Examination

June, 2014

BIME-005 : MATERIAL SCIENCE

Time : 3 hours   *Maximum Marks : 70*

*Note :   Attempt **any seven** questions. All questions carry **equal** marks. Use of scientific calculator is **permitted**.*

1. (a)   State the difference between steel and cast   5+5
          iron, with respect to their compositions.
    (b)   Define the following as related to
          engineering materials and explain the
          principles of their measurement.
          (i)   Hardness   (ii)   Ductility

2. (a)   Name two alloying elements other than   5+5
          carbon, commonly employed in steel and
          state how they influence the properties of
          steel.
    (b)   List any two commonly used non ferrous
          alloys stating their composition and
          application.

3. (a)   Distinguish between the following   5+5
          (any two) :
          (i)   Quenching and tempering
          (ii) Normalising and annealing
          (iii) Cementite and martensite

(b) Draw a stress-strain diagram for a low carbon steel specimen indicating the proportional limit, elastic limit, yield point, the point of maximum loading and rupture.

4. (a) Distinguish between intrinsic and extrinsic semiconductors. 5+5

   (b) What are the types of defects in solids ? Explain point imperfection and line imperfection.

5. (a) Draw a Bergers circuit that encloses a positive and a negative edge dislocation each with one incomplete plane in a simple cubic crystal. 5+5

   (b) What is a phase ? What is the difference between α-iron and ferrite ? Define an invariant reaction with an example.

6. (a) Define fatigue and creep. Describe a creep testing experiment and draw a typical creep curve. 5+5

   (b) An aluminium bar of 24 mm × 30 mm cross section is under a load of 7000 kg and a steel bar of diameter 10 mm is under a load of 5000 kg. Which part has the greater stress ?

7. (a) Define hardenability. Explain the effect of grain size and chemical composition on hardenability. 5+5

   (b) What are the austempering and martempering ? Why are these treatments given only to carbon alloys ?

8. (a) What are the ceramic materials ? Give a 5+5
        classification of ceramic materials with their
        common characteristic features.

    (b) Explain the term polymorphism with
        reference to ceramic materials. Explain the
        factors that affect the dimensional stability
        of refractory materials.

9. (a) What are refractory materials ? Describe 5+5
        the use of such materials as insulating
        materials.

    (b) What do you understand by
        polymerization ? What is the difference
        between additional polymerization and
        condensation polymerization ?

10. (a) Define the following : (any five)   5+5
        (i)   Ferromagnetism
        (ii)   Paramagnetism
        (iii) Diamagnetism
        (iv)   Magnetisation
        (v)   Relative permeability
        (vi)   Miller idices
        (vii) Cast iron
        (viii) P-N junction
        (ix)   Corrosion

    (b) With energy band gap diagrams differentiate
        between insulators, conductors and
        semi-conductors.

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