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10ME/AU42A

Fourth Semester B.E. Degree Examination, Dec.2015/Jan.2016
Material Science and Metallurgy

Time: 3 hrs.

Max. Marks:100

Note: *Answer any FIVE full questions, selecting atleast TWO questions from each part.*

PART – A

1   a.   Define "Bravais" space lattice. Describe with neat sketches, all the 14 possible arrangements of lattice points in the space by giving the following parameters in tabular form.
     (i)   The lattice points (Atoms)
     (ii) The lattice constants
     (iii) The lattice angles.   **(08 Marks)**
    b.   Define co-ordination number. Calculate the APF (Atomic Packing Factor) of SCC (Simple Cubic Structure).   **(04 Marks)**
    c.   Find out APF of HCP with neat sketch by calculating the c/a value. Where 'c' is the height of HCP structure and 'a' is the side of the base.   **(08 Marks)**

2   a.   Differentiate between elastic and plastic deformation. With neat graph explain about linear and non-linear elastic behavior of a material.   **(04 Marks)**
    b.   With neat graph explain stiffness and resilience.   **(04 Marks)**
    c.   A tensile test bar of 12.5 mm diameter and gauge length of 60 mm. failed at 7800 kgs. The load exerted at upper yield point is 4800 kgs and lower yield point is 4500 kgs. It fractures at 5000 kgs. The gauge length after fracture was measured 75 mm and diameter at fracture 8 mm. Hence find out the following.
     (i)   Lower yield stress   (ii) Upper yield stress   (iii) UTS (Ultimate Tensile Strength)
     (iv) Fracture stress   (v) Percentage (%) of elongation.   **(12 Marks)**

3   a.   Define fatigue. Explain with neat sketch and graphs all the three types of fatigue.   **(04 Marks)**
    b.   What do you understand by "Mechanism of Fatigue"? Explain it with neat figure. Explain with neat figure three stages of fatigue failure.   **(04 Marks)**
    c.   With neat sketch, explain the RR Moore reversed bending fatigue test. Draw S-N curve of mild steel and alloy, and explain it in detail.   **(12 Marks)**

4   a.   Define solidification. What is the mechanism of solidification? Explain both the stages.
                                                                                               (04 Marks)
    b.   Explain by drawing a neat graph of free energy change v/s radius of the nucleus. Explain heterogeneous nucleation by drawing a neat figure.   **(04 Marks)**
    c.   Explain in detail the phase diagram-I interstitial solid solution and Gibb's phase rule.
                                                                                               (12 Marks)

PART – B

5   a.   Draw the iron-carbon equilibrium diagram. Show all the phases. Write in detail about all the different phases.   **(15 Marks)**
    b.   Write the different invariant reactions containing different % of carbon.   **(05 Marks)**

6 a. Define TTT diagram, with examples. **(05 Marks)**
   b. With neat figure draw TTT diagram for 0.8% carbon eutectoid steel with different phases. **(15 Marks)**

7 a. Write notes on grey cast iron, white cast iron, malleable cast iron and spheroidal graphite iron. **(10 Marks)**
   b. Explain in detail about copper and its alloys. **(10 Marks)**

8 a. Define composite material. Write its different classifications. **(10 Marks)**
   b. With a neat sketch, explain the vacuum bag moulding process of fabrication of composite material. **(10 Marks)**

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