BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR

B.E. Met Part-II 3rd Semester Examination, Dec'2012

Introduction to Materials (MT-301)

Time: 3 Hours | Full Marks: 70

*Answer any **seven** questions. All questions carry equal marks*

1 (a) Draw schematics to show different types of Bravais lattices in crystalline materials.
(b) Calculate the atomic packing factor (APF) for Body centred cubic (BCC) crystal.
(c) Draw the (i) (110) and (236) planes, (ii) [110] and [101]directions in cubic system.
(d) What is the angle between (010) and (632) planes in cubic crystal?

[4+2+2+2]

2 (a) Name the common methods of manufacture of engineering components and indicate in one sentence, the principle used in each method to obtain the desired shape.
(b) Select i) A method that can produce a brass top weighing 300 gm as well as a steel roll, weighing two tones, (ii) a method to produce aluminium channels of different cross section
(c) Explain why metals in general are ductile, where as materials like porcelain and Teflon are not. Outline the nature of atomic bonding of the above three materials.

[4+2+4]

3 (a) Define Hardness of a metal. Mention the different types of hardness test. In Vicker's hardness test, if the average length of diagonals is reported as 2.1mm, calculate the VHN of a 50kgf load.
(b) Draw the engineering stress-engineering strain curve and mention all related terms of this curve.
(c) A cylindrical specimen of steel having an original diameter of 12.8 mm is tensile tested to fracture and found to have an engineering fracture Strength of 460 MPa. If its cross-sectional diameter at fracture is 10.7 mm, determine: (i) The ductility in terms of percent reduction in area. (ii) The true stress at fracture.

[4+3+3]

4 (a) Give example of two materials each for (i) aerospace and (ii) bio-medical applications. Discuss clearly why these materials are selected for their respective applications.
(b) Name the applications of the following materials (i) Mn steel, (ii) High strength low alloy steel (HSLA), (iii) Gray cast Iron, (iv) Stainless steel, (v) Duralumin.

[5+5]

5 Differentiate between
(a) Hot rolling and cold rolling
(b) Direct extrusion and indirect extrusion
(c) Schottky and Frenkel defect

[3+3+4]

6 Write shorts Notes (any three)
(a) Stacking faults
(b) Polymorphism
(c) Open die forging and closed die forging
(d) Grain Boundary

7 (a) State phase rule and explain the different terms. Calculate the degree of freedom at the eutectoid point.

(b) Define isomorphous system with an example.

(c) Differentiate between Eutectic and peritectic reactions using appropriate example.

[4+3+3]

8 (a) Draw net sketch of $Fe\text{-}Fe_3C$ phase diagram with appropriate identification of temperatures, compositions and phases fields.

(b) Discuss the importance and limitation of phase diagrams.

[6+4]

9 (a) Calculate the fraction of proeutectoid ferrite, eutectoid ferrite and total ferrite in a 0.4 wt% C steel.

(b) Draw a Pb-Sn phase diagram and cite all the temperatures and compositions.

(c) Explain terms macrostructure, microstructure and nanostructure.

[4+3+3]

10 (a) Define composite materials. Classify different types of composites. Discuss the importance of composites.

(b) Mention different types of ceramics

(c) Compare the properties of metals with those of ceramics.

[4+2+4