Sessional 21 Oct., 2021 10-11 AM

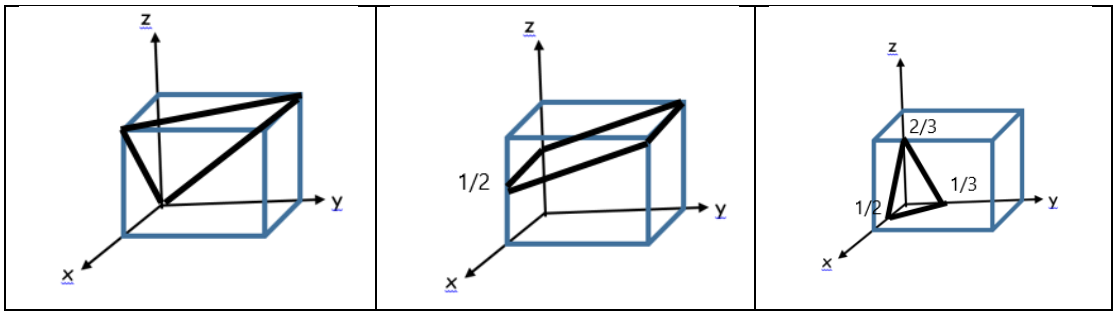
Engineering Materials

BE (Chemical with MBA) 3rd Sem Max. Marks: 25

1. (a) A metal crystallizes in FCC structure. Compute the lattice constant, given that the atomic weight and density for the metal are 6.91 g/mol and 580 kg/m^3 respectively. (3)

   (b) Compute the highest planar density of atoms for vanadium which has BCC crystal structure. Given: ρ=5.96 g/cm^3, atomic weight=50.9 g/mol. (4)

   (c) Specify the Miller Indices for the following planes shown in the unit cell:



(3)

2. The atomic weight, density, and atomic radius for three hypothetical alloys are listed in the following table. For each, determine whether its crystal structure is FCC, BCC, or simple cubic and then justify your determination.

Alloy	**Atomic weight (g/mol)**	**Density (g/cm^3)**	**Atomic radius (nm)**
A	77.4	8.22	0.125
B	107.6	13.42	0.133
C	127.3	9.23	0.142

(5)

3. An Fe-C alloy with carbon concentration of 0.2 wt% is to be treated at 950°C. The carburizing medium imposes a surface concentration of carbon of 1.2 wt%. How long will it take to achieve a carbon content of 1 wt% at a position 0.3 mm below the surface? The diffusion coefficient for C in Fe at this temperature is 7.14x10^{-12} m^2/s; assume that the steel piece is semi-infinite. Given, error function values:

z	0.15	0.20	0.25	0.30	0.35	0.40	0.45
erf (z)	0.1680	0.2227	0.2763	0.3268	0.3794	0.4284	0.4755

(5)

4. Draw and distinguish between edge dislocation and screw dislocation (with reference to Burger's vector). (5)