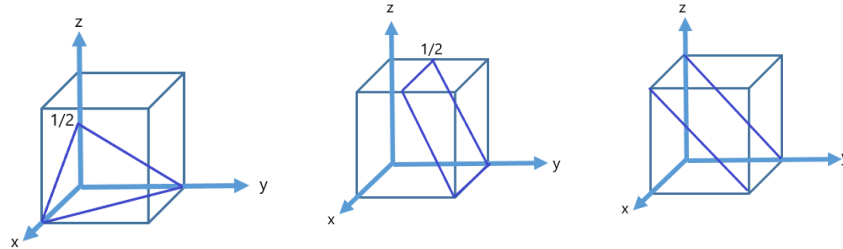


Engineering Materials

BE (Chemical) 4th Sem

Max. Marks: 25

1. Draw the following in a cubic unit cell (each in a separate unit cell): [101], (112), (003) 3
2. Determine the Miller Indices of a plane that makes an intercept of 2 Å, 3 Å and 4 Å on the coordinate axis of an orthorhombic crystal with a:b:c = 4:3:2. 3
3. It is reported that impurity atoms can fit into center of each edge of an FCC unit cell. Compute the radius of impurity atom that will just fit into one of these sites in terms of atomic radius R of host atom. 3
4. Determine the Miller Indices for the planes shown in the unit cell: 3



5. Ba (barium) is known to have BCC structure with a lattice parameter of 5.08 Å. Determine the linear density of atoms along $\langle 110 \rangle$ directions. 3
6. 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 1.4 wt%. How long will it take to achieve a carbon content of 1 wt% at a position 0.2 mm below the surface? The diffusion coefficient for C in Fe at this temperature is $7.14 \times 10^{-12} \text{ m}^2/\text{s}$; assume that the steel piece is semi-infinite. Given, error function values: 4

z	0.25	0.30	0.35	0.40	0.45	0.50
erf (z)	0.2763	0.3268	0.3794	0.4284	0.4755	0.5205

7.
 - i. Draw the Pb-Sn phase diagram. 6
 - ii. Explain the invariant reaction. What is the number of degrees of freedom?
 - iii. For an alloy of 80% Sn at 184°C (1°C above the eutectic temperature), determine the fraction of the β phase.