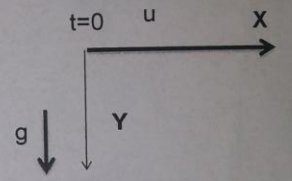
CHL-331 : Minor-2 Examination: Fluid Particle Mechanics

Time:1 hour; Full Marks:20. Answer All the Questions . Use necessary assumptions if required and state clearly in answer booklet. Do not ask questions to invigilators.

1. A mixture of two sizes of glass spheres of diameters 0.75 and 1.5 mm is fluidised by a liquid and complete segregation of the two species of particles occurs, with the smaller particles constituting the upper portion of the bed and the larger particles in the lower portion. When the voidage of the lower bed is 0.6, what will be the voidage of the upper bed? It may be assumed that the terminal falling velocities of both particles may be calculated from Stokes' law . 4

2. Two particles of diameters d_1 and d_2 ($d_1>d_2$) are thrown in x direction at the same initial velocity as shown in figure. Assuming the movement of the particles in stokes regime, find out the ratio of distance travelled by the two particles before it comes to rest along x direction. Hints: Neglect the effect of y directional movement along x.



4

3 (a)Compare the characteristics of motion of bubbles (air), liquid droplets(density 2gm/cc, viscosity around 1cp) and solid particles (density 2gm/cc) through water in detail in the table form.

(b)Compare the major differences among various particles in Geldart chart with examples in detail in the table form.

(c)Write down expression of viscosity of slurry for solid concentration is less than 1% in terms of viscosity of medium μ and porosity of bed ε.

Marks : 3+2+1

4. A **tapered** vertical gas absorption tower (bottom diameter 2m and top diameter 4m) containing ceramic Raschig rings randomly packed to height of 5m. Air containing a small proportion of SO_2 passes upwards through the absorption tower at a flow rate of $6 m^3/s$ at the bottom. The viscosity and density of the gas may be taken as 1.8×10^{-5} Pa s and 1.2 kg/m^3, respectively. Details of the packing are given below: Ceramic Raschig rings: Surface area per unit volume of packed bed, Sv=190 m^2/m^3, voidage of the bed=0.71. Calculate the pressure drop across the packing in the tower.

Marks : 6