## NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR.

## DEPARTMENT OF CHEMICAL ENGINEERING.

## SEMESTER 6TH. ASSIGNMENT NO :1.

Qno:1 .Estimate the diffusivities of the following gas mixtures:

(a) Nitrogen –carbon dioxide, 1 standard atm, $25^0$ C.
(b) Hydrogen chloride – air, 200 kN/$m^2$, $25^0$C.

Qno: 2. Estimate the diffusivity of isoamyl alcohol ($C_2H_{12}O$) at infinite dilution in water at 288 K.

Qno:3. The diffusivity of carbon tetrachloride, $CCl_4$ through oxygen $O_2$, was determined in a steady state Arnold evaporating cell, having a cross sectional area of 0.82 $cm^2$, was operated at 273 k and 755 mmHg pressure. The average length of the diffusion path was 17.1 cm.if 0.0208 cc of $CCl_4$ was evaporated in 10 hours of steady state operation, what should be the value of the diffusivity of $CCl_4$ through oxygen?

Qno:4. A crystal of copper sulphate $CuSO_4.5H_2O$ falls through a large tank of pure water at $20^0$C. Estimate the rate at which the crystal dissolves by calculating the flux of $CuSO_4$ from the crystal surface to the bulk solution. Molecular diffusion occurs through a film of water uniformly 0.0305 mm thick surrounding the crystal. At the inner side of the film, adjacent to the crystal surface, the concentration of $CuSO_4$ is 0.0229 mole fraction $CuSO_4$ (solution density = 1193 kg/$m^3$).the outer surface of the film is pure water. The diffusivities of $CuSO_4$ is 7.29 X $10^{-10}$ $m^2$/s. temperature = 293 K. molecular weight of $CuSO_4$ = 160.

Qno:5. Alcohol vapor is diffusing through a layer of water vapor under equimolar counter diffusion at $35^0$C and 1 atm. Pressure. The molal concentration of alcohol on the two sides of the gas film (water vapor) 0.3 mm thick are 80% and 10% respectively. Assuming the diffusivity of alcohol – water vapor to be 0.18 $cm^2$/sec,

(i) Calculate the rate of diffusion of alcohol and water vapor in kg/hr through an area of 100 $cm^2$ .
(ii)If the water vapor layer is stagnant, estimate the rate of diffusion of alcohol vapor.