**Mass Transfer-1 Class Test**

**Time Duration: 30 minutes Date: 13th Feb 2023**

**Instructions:**

1.Assume atmospheric temperature and pressure, and required constants if not mentioned.

2. If constants are not provided then solve in terms of the missing constant.

Q.1. There is a 2 mm thick layer of water on the floor of a room. The water vaporizes and diffuses through a stagnant film of air of estimated thickness of 2.5 mm on the water surface. Under the condition of evaporation, the water temperature is essentially equal to its wet-bulb temperature. If the ambient temperature is 28°C, calculate the time required for the water layer to disappear completely for the following cases:

(a) the ambient air has a relative humidity of 60%; and

(b) the floor has micro pores and water penetrates the floor at a constant rate of 0.1 Kg/m2.h, the ambient air having a humidity as in part (a).

Given that the wet bulb temperature is 22.5°C at 60% relative humidity and 28°C. The diffusivity of water vapour in air is 0.853 ft2/h at 1 atm and 0°C. Vapour pressure, Pv (in bar), of water is given by: ln Pv = 13.8573 – 5160.2 /T , where T is temperature in k.

Q.2. In a laboratory experiment, the solute A is being absorbed from a mixture with an insoluble gas in a falling film of water of 30° C and a total pressure of 1.45 bar. The gas- phase mass transfer coefficient at the given gas velocity is estimated to be Kc = 90.3 kmol/(h)(m2)(Kmol/m3). It is known that 13.6% of total mas transfer resistance lies in the gas-phase. At a particular section of the apparatus, the mole fraction of the solute in the bulk gas is and the interfacial concentration of the solute in the liquid is known to be xi =0.00201. The equilibrium solubility of the gas in water at the given temperature is

Where p is the partial pressure of A in the gas in mm Hg and is the solubility of A in water in mole fraction.

Calculate (a) the absorption flux of the gas at the given section of the apparatus,

(b) the bulk liquid concentration at that section of the apparatus,

(c) the overall liquid-phase mass transfer coefficient, and

(d) the individual and overall gas-phase driving forces in terms of ∆p and ∆y.