INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

Spring Semester 2023-2024 Class Test

***Subject*: Mass Transfer Laboratory (CH39006)**

***Date*: 02.04.2024 (AN)** ***Time*: 30 Min.** ***Full Marks*: 30**

Name:

Roll No.:

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1. Tick (√) mark the right one from the alternatives given in the following statements: **15**

(a) Gas phase diffusivity varies with temperature as $D_{AB} \alpha T^n$. The value of n is: (i) $0<n<1$ (ii) $1<n<2$ (iii) $2<n<3$.

(b) During diffusivity determination in Stefan tube, (i) diffusion of CCl_4 vapor through stagnant air takes place (ii) both CCl_4 vapor and air diffuse in opposite direction (iii) both CCl_4 vapor and air diffuse upward from top of the CCl_4 layer.

(c) Cooling tower is used to (i) cool air (ii) cool water (iii) humidify air.

(d) Cooling tower is a (i) type of packed tower (ii) spray tower (iii) combination of packed tower and spray tower.

(e) The solid hold-up in a counter-current rotary dryer (i) increases (ii) decreases (iii) does not vary with gas flow rate.

(f) The residence time in a counter-current rotary dryer (i) increases (ii) decreases (iii) does not vary with angle of inclination.

(g) Critical moisture content of a solid depends on (i) the nature of the solid (ii) initial moisture content of the solid (iii) the drying rate during constant-rate period.

(h) In packed towers, (i) flooding occurs before loading (ii) flooding occurs after loading, (iii) flooding and loading occur simultaneously.

(i) A packed absorption column should be operated (i) above the flooding point (ii) at the flooding point (iii) below the flooding point.

(j) The height of a packed extraction column (i) increases (ii) decreases (iii) does not vary with driving force.

(k) The height of a packed extraction column (i) increases (ii) decreases (iii) does not vary with solvent flow rate.

(l) For easy separation by distillation, the relative volatility should be (i) <1 (ii) 1 (iii) >1.

(m) Batch distillation is same as (i) differential distillation (ii) flash distillation (ii) equilibrium flash vaporization.

(n) For distillation under total reflux condition, the reflux ratio is (i) 0 (ii) 1 (iii) ∞

(o) Adsorption of CO_2 onto molecular sieve (i) increases with temperature (ii) decreases with temperature (iii) decreases with pressure.

2. In a cooling tower experiment in the laboratory, the following data are obtained: Water rate: 25 kg/h; Air rate: 38.34 kg/h; Inlet air humidity: 0.012 kg water vapor/kg dry air; Exit air humidity: 0.045 kg water vapor/kg dry air. Determine the loss of water by evaporation as percentage of water fed to the tower. **[5]**

3. 1000 kg/h of an aqueous alcohol solution containing 35% alcohol (by weight) is distilled in a sieve plate distillation column. The distillate product contains 85% alcohol by weight and the bottoms product contains 5% alcohol by weight. Determine the distillate and bottom products rates in kg/h. **[5]**

4. 500 g of wet sand containing 30% moisture is dried under constant drying conditions to 15% moisture in 30 min. The sand is kept on a petridish of 10 cm diameter. The critical moisture content of the wet sand is 10%. What is the rate of drying in kg/m^2 s? **[5]**

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