Indian Institute of Technology Guwahati
Department of Biosciences and Bioengineering
Mid-Semester Examination (Febuary 28, 2022)
Transport Phenomenon in Bioprocesses (BT 208)

Answer ALL the questions

All the assumptions made should be explicitly defined with suitable justification

ALL the Question no(s) with respective answers should be written LEGIBLY

Duration: 1.5 hrs.   **Total Marks: 40**

1. A liquid mixture of 150 mol containing 40 mole% n-hexane and 60 mole% n-heptane is to be batch-distilled at 1 atm total pressure.
   a) If 50 mol is distilled, what is the average composition of the distillate and the composition of the liquid left in the still?
   b) If the accumulated vapor is 90% n-heptane, calculate the amount of distillate. The relative volatility of the n-hexane in the mixture is 2.56. **(10 marks)**

2. A mixture of 45 mole % n-hexane and 55 mole % n-heptane is subjected to continuous fraction in a tray column at 1 atm total pressure. The distillate contains 90% n-hexane and the residue contains 10% n-hexane. The feed is saturated vapour. The relative volatility of n-hexane in mixture is 2.56. Determine the minimum reflux ratio for this separation.   **(20 marks)**

3. An Ethanol(A) – water (B) solution in the form of stagnant film 2.0mm thick at 293k is in contact at one surface with an organic solvent in which ethanol soluble and water is insoluble. Hence NB =0. At point 1 the concentration of ethanol is 17.8% and the solution is $\rho_1 = 972.8$ kg/m^3. At point 2 the concentration of ethanol is 7.8% and the solution is $\rho_2 = 988.1$ kg/m^3. The diffusivity of ethanol is 0.74 x 10-9 m^2/sec. Calculate the steady state flux N_A? **(10 marks)**