BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSC **SEMESTER : VI**
BRANCH: FOOD TECHNOLOGY **SESSION : SP/2023**

SUBJECT: FT309 MASS TRANSFER IN FOOD PROCESSING

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Graph paper to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	A sphere of naphthalene having a radius of 2.0mm is suspended in a large volume of still air at 318k and $1.01325X10^5$Pa(1atm). The surface temperature of the naphthalene can be assumed to be at 318K and its vapour pressure at 318K is 0.555mm of Hg. The D_{AB} of naphthalene in air at 318K is $6.92X10^{-6}$ m^2/Sec. Calculate the rate of evaporation of naphthalene from surface.	[5]	CO-1	3
Q.1(b)	Calculate the rate of diffusion of hydrogen (A) through nondiffusing methane (B) at 25^0Cand 101 kN/m^2 pressure (D_{AB} = 6.6 x 10^{-5} m^2/s). The diffusion path is 5 mm long and the concentration of hydrogen at the two ends of the path in terms of partial pressure is 12 kN/m^2 and 8.4 kN/m^2 respectively.)	[5]	CO-1	3
Q.2(a)	A continuous fractionating column operating at atmospheric pressure is to separate a feed containing 30% CS_2 and 70% $CC1_4$ into an overhead product of 95 % CS_2 and a bottom product of 95 mole % $CC1_4$. The feed enters as a saturated liquid at its boiling point. Assuming an overall plate efficiency of 70% and a reflux ratio is1.5. Estimate the number of plates needed. All the compositions are in mole %.	[5]	CO-2	3

Equilibrium data:

x	0.0296	0.0615	0.258	0.39	0.532	0.663	0.758	0.86
y	0.0823	0.1555	0.494	0.634	0.747	0.830	0.880	0.932

Q.2(b)	Discuss application of azeotropic and steam distillation. Give Flow sheet to explain the processes.	[5]	CO-2	2
Q.3(a)	Discuss the factors which govern the selection of solvents to be used for liquid-liquid extractions. What is Extract and Raffinate.	[5]	CO-3	2
Q.3(b)	The temperature of air in a room is 26.7°C and the total pressure is 101.3 kPa abs. The air contains water vapor with a partial pressure P_A = 2.76 kPa. [vaper pressure of water, P_{AS}=3.5 kPa] Calculate (i) the humidity (ii) the saturation humidity and percentage humidity (iii) the percentage relative humidity	[5]	CO-5	3
Q.4(a)	Derive expression Langmuir adsorption isotherm with assumption.	[5]	CO-4	3
Q.4(b)	A solute of $K_2Cr_2O_7$ in water contains 15% by wt $K_2Cr_2O_7$. Determine the amount of $K_2Cr_2O_7$ that can be produced from 1500 Kg of solution if 700 Kg of water is evaporated and remaining solution is cooled to 20°C. The solubility of $K_2Cr_2O_7$ at 20°C is 115 Kg/1000 Kg of water.	[5]	CO-4	3
Q.5(a)	Define: (i) Bound moisture (ii) Equilibrium moisture (iii) Typical drying rate curve and bring out its salient features.	[5]	CO-5	2
Q.5(b)	A time of 5 hr was taken to dry a material from an initial moisture of 30% to a final moisture of 7%. Critical and equilibrium moisture are found to be 15% and 2% respectively. How much further time would be required to dry the material to final moisture of 4%. All moisture contents are on wet basis.	[5]	CO-5	3

::::::24/04/2023::::::M