Name:

Enrolment No:

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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

Course: Mass Transfer-I **Semester: V**
Program: B.Tech (CE+RP) **Time 03 hrs.**
Course Code: CHEG3003 **Max. Marks: 100**
Instructions: In case of data missing make necessary assumptions

S. No.	**SECTION A (4X5=20) (**Attempt **all** questions**)**	**Marks**	**CO**
Q 1	For the decomposition of N_2O_5 (A) as per the reaction $N_2O_5 \longrightarrow 2NO_2 + \frac{1}{2}O_2$. If O_2 (B) diffuses back then calculate the value of $N_A/(N_A+N_B)$	**5 M**	**CO1**
Q 2	Define and give significance of i) Schmidt number and ii) Stanton number.	**5 M**	**CO2**
Q 3	Derive operating line for Stripping section of distillation column with neat figure.	**5 M**	**CO5**
Q 4	Define Flooding and weeping	**5 M**	**CO4**
	SECTION B (4X10=40) (Answer **all** the questions**)**		
Q 5	Explain the concept of Film theory, Penetration theory and Surface renewal theory and state its assumptions.	**10 M**	**CO2**
Q 6	In a mass transfer apparatus operating at 1 atmosphere the individual mass transfer coefficient have the following values k_x=22 kg mol/m^2.h, k_y=1.07 kg mol/m^2.h. The equilibrium compositions of the gaseous and liquid phases are characterizes by Henry's law p*= $0.08x10^6X$ mm Hg. Determine i) the overall mass transfer coefficients, ii) how many times the diffusion resistance of liquid phase differs from that of gas phase?	**10 M**	**CO3**
Q 7	With neat schematic diagram, explain the working principle of bubble cap column for gas-liquid contacting.	**10 M**	**CO4**
Q 8	Discuss differential distillation in detail. Also, derive Raleigh's equation for binary mixture.	**10 M**	**CO5**
	SECTION C (2X20=40M) Question **No. 10** compulsory. Answer **any one** in question **No. 9**		
Q 9	Develop an expression for the flux of species 'A' with respective to a stationary observer for the case of multi component diffusion. OR	**20 M**	**CO1**

	Ammonia is diffusing through an inert air film 2 mm thick at a temperature of 20 ^{o}C and a pressure of 1 atm. The concentration of ammonia is 10 mole% on one side of the film and zero on the other side. D_{AB} at 0 ^{o}C and 1 atm is 0.198 cm^2/s. Estimate the % change of flux if the temperature is 20 ^{o}C and pressure is raised to 5 atm.		
Q 10	A mixture of benzene and toluene containing 38 mole% of benzene is to be separated to give a product of 90 mole% benzene at the top, and the bottom product with 4 mole% benzene. The feed enters the column at its boiling point and vapor leaving the column is simply condensed and provide product and reflux. It is proposed to operate the unit with a reflux ratio of 3.0. Locate the feed plate and number of plates. The vapor pressures of pure benzene and toluene are 1460 and 584 mm Hg respectively. Total pressure is 750 mm Hg.	**20 M**	**CO5**