GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– V (New) EXAMINATION – WINTER 2019

Subject Code: 2150404   **Date: 21/11/2019**

Subject Name: Principles of Process Engineering-II

Time: 10:30 AM TO 01:00 PM   **Total Marks: 70**

Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Discuss local and overall mass transfer coefficients.	**03**
	(b)	Differentiate between packed tower v/s tray tower.	**04**
	(c)	Oxygen (A) is diffusing through carbon monoxide (B) under steady state condition with the carbon monoxide non diffusing. The total pressure is 1 x 10^5 N/m^2, and the temperature 0 ^{o}C. The partial pressure of oxygen at two planes 2 mm apart is, respectively 13000 and 6500 N/m^2. The diffusivity for the mixture is 1.87×10^{-5} m^2/s. Calculate the rate of diffusion of oxygen in kmol/s through each square meter of the two planes.	**07**
Q.2	**(a)**	Define: (i) Tie-line (ii) Operating line (iii) Raffinate	**03**
	(b)	What are different types of packing.	**04**
	(c)	Derive Fick's law of diffusion and explain N_A and J_A. Also prove that For unidirectional binary diffusion $J_A = -J_B$.	**07**

OR

	(c)	Differentiate between direct and indirect mass transfer operations with examples.	**07**
Q.3	**(a)**	Discuss construction and working of sparged vessel.	**03**
	(b)	Explain the following terms with respect to tray towers: (i) Flooding (ii) Theoretical tray (iii) Coning (iv) Tray spacing	**04**
	(c)	Explain counter current multiple contact, Shanks system for leaching with neat figure.	**07**

OR

Q.3	**(a)**	Explain steps to determine minimum liquid to gas ratio for absorbers.	**03**
	(b)	Explain criteria of solvent selection for extraction.	**04**
	(c)	A packed tower is designed to recover 98% CO_2 from a gas mixture containing 10% CO_2 and 90% air using water. A relation $y=14x$ can be used for equilibrium conditions where, $y=$kgCO_2/kg dry air and $x=$kg CO_2/kg water. The water to gas rate is kept 30% more than the minimum value. Calculate the height of the tower if $(HTU)_{OG}$ is 1 meter.	**07**
Q.4	**(a)**	Explain preparation of solids for leaching.	**03**
	(b)	Write short note on Bollman extractor.	**04**
	(c)	Discuss in detail about Film theory for mass transfer coefficient.	**07**

OR

Q.4	**(a)**	Explain the following terms with respect to tray towers: (i) weeping (ii) dumping (iii) tray spacing	**03**
	(b)	Write short note on gas absorption with chemical reaction.	**04**

(c) Derive equation for material balance for single stage countercurrent leaching. **07**

Q.5	(a)	Explain fick's law of diffusion.	**03**
	(b)	Explain criteria of solvent selection for gas absorption.	**04**
	(c)	Write short note on Rotocell extractor with neat sketch.	**07**

OR

Q.5	(a)	Enlist industrial applications of gas absorption and leaching.	**03**
	(b)	Explain different components of tray tower.	**04**
	(c)	Explain with a neat sketch the material balance for multi-stage liquid-liquid extraction.	**07**

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