Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–II EXAMINATION – SUMMER 2017

Subject Code: 2723001 **Date:29/05/2017**

Subject Name: Advanced Mass Transfer

Time:02:30 PM to 05:00 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)** Explain stepwise procedure for multicomponent batch distillation with constant overhead composition. **07**

(b) Discuss the advantages and disadvantages of vacuum distillation in detail. **07**

Q.2 **(a)** State and discuss various types of membrane modules in detail. **07**

(b) Describe the Phenomena of Reverse Osmosis (RO) with neat sketch. **07**

OR

(b) Explain concept and working principle of Ultrafiltration in detail with neat diagram. **07**

Q.3 **(a)** Define: i) Light key component ii) Heavy key component iii) Adjacent key iv) Split key v) Distributed component vi) Non distributed component vii) Relative volatility **07**

(b) State the concept of super-heated drying and discuss its working principle. **07**

OR

Q.3 **(a)** Find the mole fraction of n-butane in distillate and also in residue by Thiele Geddes method based on following data: **14**

Feed Composition

Component	mole%
n-butane	37
i-pentane	32
n-pentane	21
n-hexane	10

n- butane is light key component and i- pentane is heavy key component, feed flow rate F = 4750 mol/h, feed is saturated liquid at its bubble point, reflux ratio R = 3, distillate flow rate D = 1250 mol/ h, residue flowrate W = 3500 mol/h, operating pressure = 2 atm(ab.). Assume constant molar overflow and total condenser is used. Equilibrium constant values of n-butane are as follows:

Tray Number	Temperature (^{0}C)	K_{C4}
1	22	1.086
2	24	1.156
3	28	1.308
4 (Feed)	32	1.474
5	41	1.904
Reboiler	48	2.300

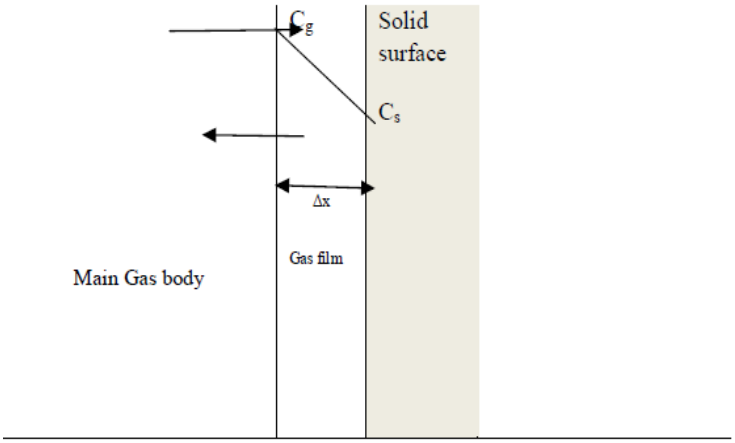
Q.4 **(a)** Explain Fick's law of diffusion through solids. **07**

(b) Differentiate between super-heated steam drying and conventional hot air drying. **07**

OR

Q.4 **(a)** Derive the rate equation for straight mass transfer (Physical Absorption of A) based on two film theory with neat sketch. **07**

(b) The irreversible reaction $A_{(g)} + B_{(s)} \rightarrow R_{(g)}$, first order reaction with respect to A takes place on flat solid surface as shown in Figure. Develop the overall rate expression for this gas-solid reaction where dilute A diffuses through a stagnant gas film on to a plain solid surface B. On the surface, A reacts with B to give gaseous R, which diffuses back into main gas stream. **07**



Q.5 **(a)** Discuss the criteria for selection of Spray tower, Venturi scrubber and Tray tower as absorbers. **07**

(b) Discuss the Process design steps of Falling film absorber. **07**

OR

Q.5 Explain with neat sketch and suitable example the degree of freedom and variable specifications for typical design cases based on key components and the required equilibrium stages. **14**

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