GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VIII • EXAMINATION – WINTER • 2014

Subject Code: 180505   **Date: 25-11-2014**
Subject Name: Multi Component Distillation
Time: 02:30 pm - 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)** Discuss the advantages and disadvantages of vacuum distillation.   **07**
  (b) Discuss the criteria for selection of solvent for extractive distillation.   **07**

Q.2 **(a)** Discuss FUG method to determine theoretical stages for multicomponent distillation.   **07**
  (b) Discuss the selection criteria for different types of trays used in tray tower.   **07**
OR
  (b) Explain the working principle of Azeotropic Distillation with flow sheet of one industrial application.   **07**

Q.3   By using Lewis-Matheson method, calculate the composition of liquid   **14**
        leaving the second tray from the top of the column for following case.
        (a) Distillation column details

Component	Feed, mole%	Distillate, mole %	Residue, mole %
n- Butane	37	95.0	16.3
i-Pentane	32	5.0	41.6
n-Pentane	21	--	28.5
n-Hexane	10	--	13.6

(b) F = 4750 mol/hr, D = 1250 mol/hr and q =1
(c) Operating pressure, P_t = 2 atm a
(d) Reflux ratio = 3
(e) Vapour pressure of Component
$\ln P_v = A - B / (T + C)$, P_v in mm Hg and T in K

Component	A	B	C
n- Butane	15.6782	2154.9	-34.42
i-Pentane	15.6338	2348.67	-40.05
n-Pentane	15.8333	2477.07	-39.34
n-Hexane	15.8366	2697.55	-48.78

OR

Q.3   A saturated liquid, consisting of phenol and cresols with some xylenols, is **14** fractioned to give a top product of 95.3 mole % phenol. Metacresol is heavy key and phenol is light key component. Total condenser is used. The compositions of the top product and of the phenols in the bottoms are given.

Component	Average Relative Volatility	Feed, mole %	Top product, mole %	Bottom product, mole %
Phenol	1.98	35	95.3	5.24
o-Cresol	1.59	15	4.55	?
m-Cresol	1.00	30	0.15	?
Xylenols	0.59	20	-	?

(1) Compute the material balance over the still for a feed rate of 100 kmol/h.
(2) Calculate the minimum reflux ratio by Underwood's method.

Q.4 **(a)** Explain the stepwise procedure of Thiele Geddes method for Multicomponent **07** distillation.
   (b) Explain Light key component, heavy key component, and adjacent key and split key **07** components.

OR

Q.4   200 kmol/h of feed, containing 50% benzene, 25% toluene and 25% o-xylene, is to be **14** separated in batch distillation with a rectification column. Top product must contain 99% benzene. All compositions are mole%. Composition of distillate should remain constant throughout the batch distillation. Distillation is to be continued until the moles of benzene are reduced to 10 kmol in residue. Average relative volatility for benzene, toluene and o-xylene is 2.497,1 and 0.3459 respectively. Determine the Reflux ratio Vs. Time data.

Q.5   Discuss the equation tearing procedure for multi component distillation. **14**

OR

Q.5   A distillation column is to separate 4750 mol/h of feed composed of 37% n- **14** butane, 32% iso-pentane, 21% n-pentane and 10% n-hexane. The column

operates at an average pressure of 2 atm a and will produce a distillate product containing 95% n-butane and 5% iso- pentane. The bottom product is allowed to contain no more than 570 mol/h of n-butane. If minimum reflux ratio is 1.45, then determine number of theoretical stages required for separation.

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