

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VIII • EXAMINATION – SUMMER • 2015****Subject code: 180505****Date :05/05/2015****Subject Name: Multi Component Distillation****Time: 10.30AM-01.00PM****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) What is Vacuum distillation? Discuss the advantages and disadvantages of Vacuum Distillation. **07**
- (b) Explain the Azeotropic distillation with the suitable example. **07**

- Q.2** (a) Discuss criteria of selection between tray tower and packed tower. **07**
- (b) Discuss FUG method to determine theoretical stages for multi component distillation. **07**

OR

- (b) Define and Explain in brief following: **07**
- 1) Light key component
 - 2) Heavy key component
 - 3) Adjacent key

- Q.3** (a) Discuss the criteria for selection of solvent for extractive distillation **07**
- (b) Explain the stepwise procedure of Thiele Geddes method for Multi component distillation **07**

OR

- Q.3** A distillation column is to separate 4750 mol/h of feed composed of 37% n-butane, 32% iso-pentane, 21% n-pentane and 10% n-hexane. The column operates at an average pressure of 2 atm 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. Use Underwood's method to determine the minimum reflux for the required separation. Feed is 25% (by mole) vapor. Assume ideal vapor-liquid equilibrium. All compositions are mole%. **14**

Component	α_{avg}
n-butane (LK)	2.567
Iso-pentane (HK)	1
n-pentane	0.762
n-hexane	0.236

- Q.4** 200 kmol/h of feed, containing 50% benzene, 25% toluene and 25% o-xylene, is to be 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. **14**

OR

- Q.4** A saturated liquid, consisting of phenol and cresols with some xylenols, is fractionated 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. **14**

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.
- (3) For $R=3R_m$, calculate the composition of vapor entering to the top most tray by Lewis-Matheson method.

- Q.5** Discuss the use of heat pump with refrigerant in distillation column for energy saving. **14**

OR

- Q.5** Explain in detail the equation tearing procedure for multi component distillation. **14**
