

GUJARAT TECHNOLOGICAL UNIVERSITY
BE – SEMESTER - VIII (NEW) EXAMINATION - WINTER 2018

Subject Code: 2180505
Date: 19/11/2018
Subject Name: Multicomponent Distillation
Time: 2:30pm to 5:00pm
Total Marks: 70
Instructions:

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

MARKS

- Q.1** (a) Write an expression to calculate the number of possible sequences. Calculate the number of possible sequences for 6 components. **03**
- (b) Define. (1) Adjacent key component (2) Split key components and (3) non distributed components. (4) Azeotropic mixture. **04**
- (c) A distillation column for the separation between propane and n-butane is to have the following feeds. Data: $R / R_{\min} = 1.39$. **07**

	Upper flow	Lower flow
Temperature	170	230
Pressure	245	245

Component flow rate (lb mol/hr)		
Ethane	2.5	0.5
Propane	14	6
n-Butane	10	18
n-Pentane	5	30
n-Hexane	0.5	4.5

Use Fenske equation to estimate the number of stages that should be placed between two feeds. (Refer Chart provided)

- Q.2** (a) Write a Kirk Bridge equation with detail specifications for finding the feed stage location in multicomponent distillation column. **03**
- (b) List out various methods used for calculating the number of theoretical stages for multicomponent distillation. **04**
- (c) What do you mean by sequencing of multicomponent distillation? How it is important? Discuss marginal vapour method to determine the best possible sequence for multicomponent distillation? **07**

OR

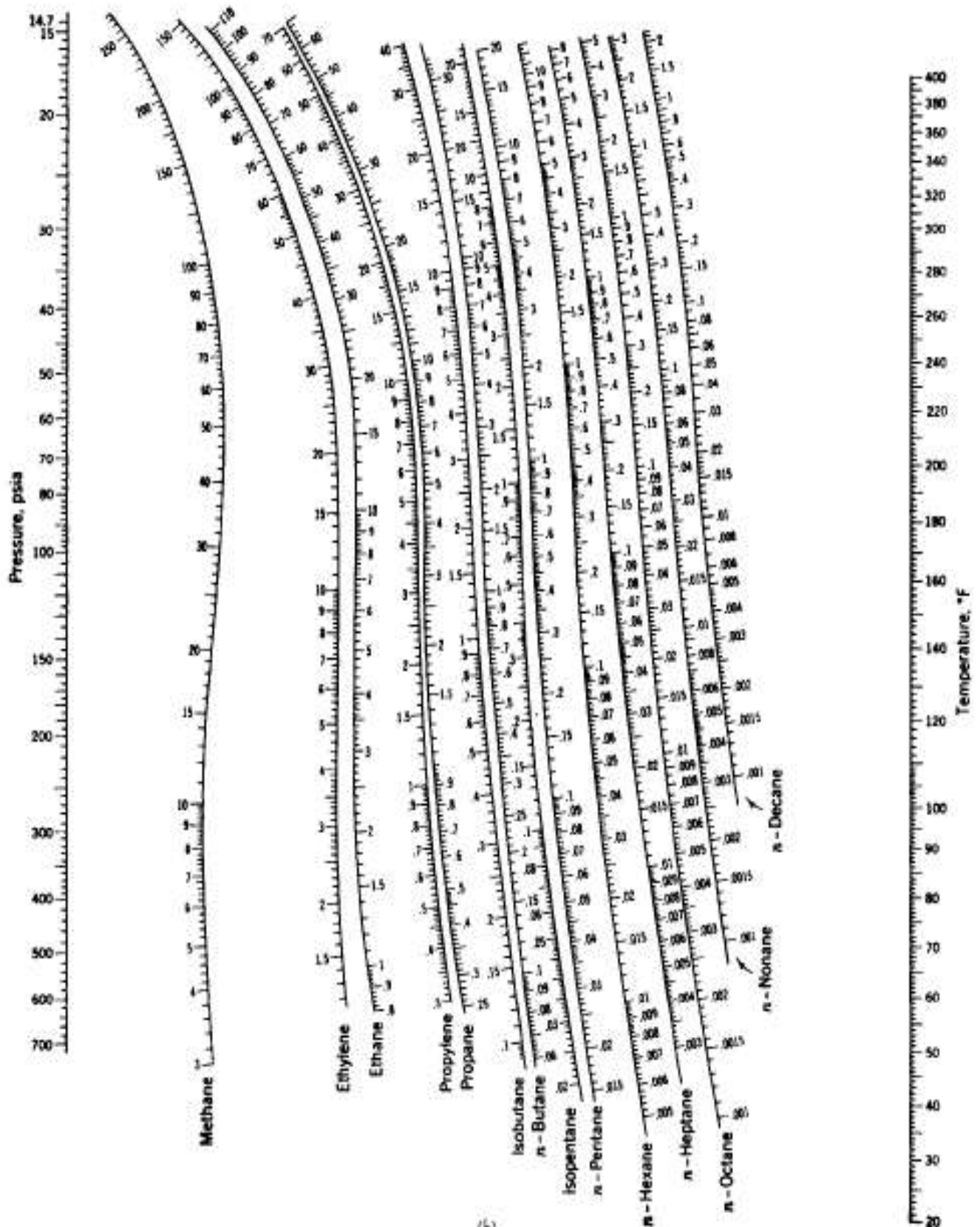
- (c) Write a short note. "Selection criteria for the operating pressure in multicomponent distillation column." **07**
- Q.3** (a) Explain in brief. "Jet flooding: **03**
- (b) What do you mean by optimum reflux ratio. **04**
- (c) A saturated liquid consisting of phenol and cresols with some xylenols is fractionated to give a top product of 95.3 mol% phenol. Meta cresol is heavy key component and phenol is light key component. Total condenser is used. The composition of the top product and of the phenol is in the bottom are given. **07**
- (a) Complete the material balance over the still for a feed rate of 100 kmol / hr.
- (b) Calculate the minimum reflux ratio by Underwood's method.

Components	α_{avg}	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	1.0	30	0.15	?
Xylenols	0.59	20	-	?
Total		100	100	

OR

- Q.3 (a) Explain in brief. "Downcomer flooding" **03**
 (b) What do you mean by tray efficiency. List out the methods to determine the tray efficiency. **04**
 (c) How to determine vapour liquid equilibrium data? **07**
- Q.4 (a) Write an equation to determine the minimum reflux ratio for multicomponent distillation. **03**
 (b) Explain the selection criteria among various types of trays. **04**
 (c) Explain in detail. "Steps for Theile- Geddes method for finding theoretical stages of multicomponent distillation column. **07**
- OR**
- Q.4 (a) List out disadvantages of Vacuum distillation? **03**
 (b) Explain the selection criteria among various types of packings. **04**
 (c) State the algorithm or steps for Lewis Matheson method to calculate theoretical stages in rectification section & also state feed tray identification. **07**
- Q.5 (a) Discuss the batch distillation with rectification. **03**
 (b) Discuss the applications of heat pumps in distillation column. **04**
 (c) Differentiate between Azeotropic distillation and extractive distillation. **07**
- OR**
- Q.5 (a) Write an expression Bogart equation with all terms. **03**
 (b) How will you identify feed tray location in Lewis Matheson method in Multicomponent distillation? **04**
 (c) Discuss energy saving in distillation column by thermally coupled distillation.. **07**

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K - Value chart