

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-VIII (NEW) - EXAMINATION – SUMMER 2017****Subject Code: 2180505****Date: 06/05/2017****Subject Name: Multi Component Distillation(Department Elective - III)****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 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. Feed rate is 100 kmol/hr. Total condenser is used. For reflux ratio 5, determine number of theoretical stages for desired separation. 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	-	?

- Q.2 (a)** What is Vacuum distillation? Discuss the advantages and disadvantages of Vacuum Distillation. **07**
- (b)** What is azeotrope? Explain azeotropic distillation with suitable example. **07**

**OR**

- (b)** Explain thermally coupled distillation with the suitable example. **07**
- Q.3 (a)** Explain following with suitable example: (1) Light Key (2) Heavy Key (3) Split Key (4) Distributed Component **08**
- (b)** Discuss criteria for selection between tray tower and packed tower with industrial examples. **06**

**OR**

- Q.3** A distillation column is to separate 5000 mol/h of feed composed of 40% n-butane, 30% iso-pentane, 20% 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 600 mol/h of n-butane. Feed is 25% (by mole) vapor. Assume ideal vapor-liquid equilibrium. All compositions are mole%. Average relative volatility for n-butane, iso-pentane, n-pentane and n-hexane is 2.567, 1, 0.762 and 0.236 respectively. Determine: the number of theoretical stages required for desired separation for reflux ratio  $R=2R_m$ . **14**

- Q.4 (a)** Discuss batch distillation with rectification. **07**
- (b)** State the steps for Thiele Geddes method for calculation of theoretical stages in rectifying section. **07**

**OR**

- Q.4 (a)** Discuss the criteria of selection among various types of plates. **07**
- Q.4 (b)** Discuss the criteria of selection among various types of packings. **07**
- Q.5 (a)** Discuss the use of heat pump with refrigerant in distillation column for energy saving **10**
- (b)** Explain optimum reflux ratio. **04**
- OR**
- Q.5 (a)** Discuss stepwise procedure of Lewis-Matheson method for finding number of theoretical stages required for desired separation. **14**

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