GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2018
Subject Code:2160503   **Date:01/05/2018**
Subject Name:Process Equipment Design -I
Time:10:30 AM to 01:30 PM   **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)**	How variation in length and height of the weir can affects performance of distillation column.	**03**
	(b)	Discuss the five standard locations of pressure taps in orifice meter.	**04**
	(c)	Hexane at 37.8 °C is pumped through the system at a rate of 9.09 m^3/hr. The tank is at atmospheric pressure. Pressure at the end of discharge line is 345 kPa g. The discharge head is 3.05 m and the suction lift is 1.22 m above the level of liquid in the tank. The friction loss in suction line is 3.45 kPa and that in the discharge line is 37.9 kPa. The mechanical efficiency of the pump is 0.6. The density of hexane is 659 kg/m^3 and its vapor pressure at 37.8 °C is 33.71 kPa. Calculate (i) (NPSH)$_A$ and (ii) Power required by the centrifugal pump.	**07**
Q.2	**(a)**	Discuss equivalent length, schedule Number and pipe thickness.	**03**
	(b)	Discuss the factors affecting the fluid allocation in Heat exchanger.	**04**
	(c)	Discuss about the Liquid distributors, Liquid redistributors, Packing support and Hold-down plate for packed tower type absorber.	**07**

OR

	(c)	Discuss the criteria of selection among the different types of the equipment used as absorbers or scrubbers.	**07**
Q.3	**(a)**	What is the meaning of % of baffle cut? Discuss various types of baffles and its applications.	**03**
	(b)	Explain types of packings useful in the packed column.	**04**
	(c)	In vertical thermosyphon reboiler recirculation ratio is fixed by trial and error method. Discuss in detail that, how to find or fix the recirculation ratio in the following conditions: (i) $\Delta Pav >> \Delta Pt$ (ii) $\Delta Pav < \Delta Pt$ (iii)$\Delta Pav \approx \Delta Pt$	**07**

OR

Q.3	**(a)**	Draw falling film type absorber and explain its advantages and disadvantages over the adiabatic type packed tower.	**03**
	(b)	Discuss (NPSH)$_A$ and (NPSH)$_R$.	**04**
	(c)	Write general design procedure for shell & tube heat exchanger.	**07**
Q.4	**(a)**	Draw a neat sketch of air cooled heat exchanger and discuss its merits and demerits.	**03**
	(b)	Explain the properties of the solvent need to be consider while selecting suitable solvent for extraction operation.	**04**
	(c)	Discuss the steps for process design of counter current multistage extractor.	**07**

OR

Q.4	(a)	Why expansion joint is provided in fixed tube sheet heat exchanger? Draw different types of expansion joints.	03
	(b)	List important industrial applications of liquid-liquid extraction.	04
	(c)	Discuss the design steps for the process design of horizontal and vertical gravity settler.	07
Q.5	(a)	Explain light key and heavy key components for distillation column.	03
	(b)	Discuss jet and downcomer flooding with figure.	04
	(c)	A saturated liquid, consisting of phenol and cresol with some xylenols, is 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 composition of the top product and of the phenol in the bottom is given. (i) Complete the material balance over the still for a feed rate of 100 kmol/h and (ii) Calculate the minimum reflux ratio by Underwood's method.	07

Component	α_{av}	Feed, mole %	Top product, mole %	Bottom product, mole %
Phenol	1.98	35	95.30	5.24
o-Cresol	1.59	15	4.55	?
m-Cresol	1.00	30	0.15	?
Xylenols	0.59	20	--	?

OR

Q.5	(a)	What is the function of downcomer? Discuss the different types of downcomers used in distillation column.	03
	(b)	Write a short note on determination of optimum reflux ratio.	04
	(c)	Discuss factors affecting the selection of types of tray in the distillation column.	07

****