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Roll No

CM 7001-CBGS

B.E. VII Semester

Examination, June 2020

Choice Based Grading System (CBGS)

Process Equipment Design -II

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. 6330 lb/hr of toluene is cooled from 160 to 100°F by heating amyl acetate from 90 to 100°F using 15-ft hairpins. The exchangers are 2-by 1 $\frac{1}{4}$ in. IPS. Allowing 10 psi pressure drops and providing a minimum dirt factor of 0.004
 - a) How many hairpins are required
 - b) How shall they be arranged
 - c) What is final dirt factor
2.
 - a) Explain random tower packing-type fractionators design applied to any rectifier stripping-type fractionators.
 - b) Discuss the factors required for sieve tray pressure drop calculation. Explain entrainment.
3. It is desired to design a double-effect evaporator for concentrating a certain caustic soda solution from 12.5% to 40%, the feed at 50° C enters the evaporator at a rate of 25000 kg/hr. steam at atmospheric pressure is being used for the said purpose. The second effect is operated under 600 mmHg vacuum. Water is available at 30° C. If the overall heat transfer coefficients of the two stages are 1952 and 1220 kcal/hr m²°C respectively. Determine the heat transfer area of each effect. Neglect Superheat.

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4. 1,45,000 lb/hr. of distilled water enters an exchanger at 93°F and leaves at 85°F. The heat will be transferred to 260,000 lb/hr. of raw water coming from supply at 75°F and leaving the exchanger at 80°F. A 10 PSI pressure drop may be expended on both streams while providing a fouling factor of 0.0005 for distilled water and 0.0015 for raw water when the tube velocity exceeds 6 fps.
5. Explain the following term:
 - a) Entrainment
 - b) Types of packing
 - c) HETP
 - d) Weeping and flooding in column
6. Design a shell-and-tube exchanger using Bell's method for the following duty. 100,000 kg/h of Methanol leaves the base column at 95°C and is to be cooled to 40°C by exchange with brackish water coming from storage at 25°C and leaves at 40°C. Available for service is number of tubes 918, shell ID 894 mm, Bundle diameter 826 mm, Tube OD 20 mm, Pitch 1.25 A 25 mm, Tube length 4830 mm, Baffle pitch 356 mm.
7. A rotary dryer using counter current flow it to be used to dry 12000 kg/hr of wet salt containing 5% water (wet basis) to 0.10% water (wet basis). Heated air at 147°C with 50°C wet-bulb temperature is available. The specific heat of the salt is 0.21. The outlet temperatures of air and salt are 72°C and 93°C respectively. Calculate the length and diameter at the dryer required.
8. Write short notes on.
 - a) Different types of shell and tube heat exchanger with figure
 - b) Single effect and multiple effect evaporator with figure
 - c) Plate and packed column

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