

**B.TECH. SEM -VII (CHEMICAL 2014 COURSE (CBCS) :****SUMMER - 2018****SUBJECT : CHEMICAL PROCESS EQUIPMENT DESIGN – II**Day : **Tuesday**  
Date : **22/05/2018****S-2018-2466**Time : **02.30 PM TO 05.30 PM**  
Max. Marks : 60**N. B. :**

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Use of non programmable **CALCULATOR** is allowed.
- 4) Assume suitable data if necessary.

- Q.1** a) Explain selection criteria of evaporators [05]  
b) Explain design procedure of batch crystallizer [05]

**OR**

5kg/s of an aqueous solution containing 12% solute is to be concentrated to 40% by weight. The feed solution at 21<sup>0</sup>C enters the last effect of a backward feed arrangement triple effect evaporator. [10]

- a) Pressure of the heating steam is 4kg/cm<sup>2</sup> and corresponding temperature is 143<sup>0</sup>C.
- b) Vacuum in the last effect is 0.2 kg/cm<sup>2</sup> which corresponds to a boiling temperature of 60<sup>0</sup> C.
- c) Overall heat transfer coefficients in individual units:  
 $U_1 = 1800 \text{ w/m}^2\text{k}; U_2 = 1000 \text{ w/m}^2\text{k}; U_3 = 600 \text{ w/m}^2 \text{ k}.$
- d) Heat capacity of the liquor may be assumed as constant = 3700 J/kg K:
- e) Latent heat of steam = 2241 kJ/kg.
- f) Latent heat of vapour = 2357 kJ/kg.

- Q.2** How the performance of continuous dryer is measured? [10]

**OR**

- a) How the performance of continuous dryers is measured? [05]
- b) Explain Rotary drum filters with neat diagram. [05]

- Q.3** a) Explain plate design procedure. [05]

- b) Explain various design variables in distillation. [05]

**OR**

Acetone is to be recovered from an aqueous waste stream by continuous distillation. The feed contains 10 mol% acetone. Acetone of at least 95% purity is wanted and the aqueous. Effluent must not contain more than 1mol% acetone. The fed will be a saturated liquid. [10]

x	0.0	0.05	0.10	0.15	0.2	0.25	0.3	0.35	0.4	0.45
y	0.0	0.6381	0.7301	0.7716	0.7916	0.8034	0.8124	0.8201	0.8269	0.8376
<sup>0</sup> C	100.0	74.80	68.53	65.26	63.59	62.6	61.87	61.26	60.75	60.35

x	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95
y	0.8387	0.8455	0.8532	0.8615	0.8712	0.8817	0.8950	0.9118	0.9335	0.9627
<sup>0</sup> C	59.95	59.54	59.12	58.71	58.29	57.90	57.49	57.08	56.68	56.30

Design the plates for the column specified. Take the minimum feed rate as 70% of the maximum. Maximum feed rate = 10000 kg/h use sieve plate.

**P.T.O.**

- Q.4** SO<sub>2</sub> is produced by the combustion of sulphur in air is absorbed in water. [10]  
 Pure SO<sub>2</sub> is then recovered from the solution by steam stripping. Make a preliminary design for the absorption column. The feed will be 5000 kg/h of gas containing 8% v/v SO<sub>2</sub>. The gas will be cooled to 20<sup>0</sup>C. A 95% recovery of SO<sub>2</sub> is required.

%w/w solution	0.05	0.1	0.15	0.2	0.3	0.5	0.7	1.0	1.5
Partial pressure gas mmHg	1.2	3.2	5.8	8.5	14.1	26	39	59	92

Assume number of stages required is 20.

**OR**

Write short note on: [10]

- a) Choice of packing
- b) Types of packing

- Q.5** a) Write short note on: [05]  
 i) Piping and instrumental diagram  
 ii) Pressure drop in pipelines

b) Explain in detail piping support. [05]

**Q.6** a) Explain significance of color codes in piping system. [05]

b) Explain significance of piping layout in process industry. [05]

**OR**

A pipeline connecting two tanks contains four standard elbows, a globe valve that is fully open and a gate valve that is half open. The line is commercial steel pipe, 25 mm internal diameter length 120m. The properties of fluid are: [10]

Viscosity 0.99 mNm<sup>-2</sup>.s density = 998 kg/m<sup>3</sup>.

Calculate pressure drop due to friction when the flow rate is 3500 kg/h.

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