

Total No. of Questions :6]

SEAT No. :

P266

[Total No. of Pages :2

Oct./ BE/ Insem. - 584

B.E. (Chemical Engineering)

CHEMICAL ENGINEERING DESIGN - II

(2015 Course) (Semester - I) (409343)

Time : 1 Hour]

[Max. Marks :30

Instructions to the candidates:

- 1) *Answers Q.1 or Q.2, Q.3 or Q.4 and Q.5 or Q.6.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) State design variables in Distillation. [4]
b) Explain Van Winkle's Correlation to predict plate efficiencies for binary systems. [6]

OR

- Q2)** a) Draw a neat diagram of sieve plate performance. [4]
b) Design the down comer (back-up) for the Distillation column for the data given below: [6]
Liquid density = 1000 kg/m^3 Liquid viscosity = $0.35 \times 10^{-3} \text{ Ns/m}^2$
Height of overflow weir = 25 mm Downcomer area = 0.067 m^2
Height of the weir = 50 mm Flow rate of liquid in the downcomer = 2.50 kg/s
Length of the Weir = 0.690 m
Total pressure drop = 120 mm of liquid.

- Q3)** a) What is the difference between Random Packing and structured packing. [4]
b) Describe in brief : Cornell's method for prediction of HTU in design of a packed Absorption column. [6]

OR

- Q4)** Using onda's method estimate height of gas film transfer unit, liquid film transfer unit and (HoG) to absorb SO_2 in water at 20°C produced by the combustion of 5 in Air as per the data given below:- [10]

P.T.O.

$R = 0.08314 \text{ bar m}^3/\text{kmol.k}$; Surface tension of liquid = $69 \times 10^{-3} \text{ N/m}$

Packing Used = Intalox saddles

Material = Ceramic

Size of packing = 38 mm ; Actual area of packing per unit volume = $194 \text{ m}^2/\text{m}^3$

Surface tension of packing material = $61 \times 10^{-3} \text{ N/m}$

Density of water = 1000 kg/m^3 ; $L_w^* = 18 \text{ kg/sm}^2$

Viscosity of Water = $1 \times 10^{-3} \text{ Ns/m}^2$; $g = 9.81 \text{ m/s}^2$

Flow rate of gas = 1.40 kg/s ; Actual diameter of Column = 1.50 m

$K_5 = 5.23$; $V_w^* = 0.79 \text{ kg/m}^2\text{s}$

Gas viscosity = $0.018 \times 10^{-3} \text{ Ns/m}^2$; Diffusivity of gas = $1.40 \times 10^{-5} \text{ m}^2/\text{s}$

Gas density = 1.29 kg/m^3 ; Diffusivity of liquid = $1.70 \times 10^{-9} \text{ m}^2/\text{s}$

Molar gas flow rate per rate per unit column C.S.A. = $0.026 \text{ Kmol/m}^2\text{s}$

Molar liquid flow rate per rate per unit C.S.A. of column = $0.92 \text{ Kmol/m}^2\text{s}$

Take $m \frac{Gm}{Lm} = 0.8$ for $\text{NoG} = 8$.

Q5) a) Explain in brief : Schedule Number of pipe and economic velocity and pipe diameter. [7]

b) Estimate the optimum pipe diameter for water flow rate of 10 kg/s , at 20°C . Carbon steel pipe is to be used. Density of water = 1000 kg/m^3 . [3]

OR

Q6) a) Water is flowing through a pipeline at a rate of 2 kg/s to a distance of 2.0 Km . The impressed head of water is 10 m of H_2O . Calculate diameter of the pipeline for data given below:- [8]

Density of Water = 1000 kg/m^3 .

Viscosity of Water = $1 \times 10^{-3} \text{ Ns/m}^2$.

b) What is the purpose of using pipe hangers and support in pipelines? [2]

