17648

**21718**

**3 Hours / 100 Marks** Seat No. | | | | | | | | |

***Instructions :*** (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

**Marks**

**1. (A) Attempt any THREE :** **12**

(a) Explain the different terms involved in two film theory.

(b) State Raoult's law and Dalton's law. Write its Mathematical expression.

(c) Define the following terms :

(i) Solubility

(ii) Distribution coefficient

(iii) Critical moisture

(iv) Selectivity

(d) Explain the four methods of bringing supersaturation.

**(B) Attempt any ONE :** **06**

(a) What is channelling ? How it can be prevented ? How does it leads to flooding and loading of packed column ?

(b) Explain construction and working of OSLO evaporative crystalizer with neat sketch.

**2. Attempt any FOUR :** **16**

(a) Explain the factors on which rate of drying depends.

(b) Describe the working of fluidised bed drier.

(c) What is reflux ratio ? How does it improves the purity of product ? Justify.

(d) Derive an expression for the operating line of rectifying section of distillation column.

(e) Draw a triangular diagram and describe its use in extraction.

**3. Attempt any TWO :** **16**

(a) Derive expression for q-line and show various types of 'q' lines for various feed conditions.

(b) A mixture of benzene and toluene containing 40 percent benzene and 60 percent toluene is to be separated in a fractionating column to give a product (distillate) containing 96 percent benzene and a bottom product containing 95 percent toluene. The feed is a mixture of two third vapour and one third liquid. Find the number of theoretical stages required if reflux ratio of 1.5 times the minimum is used and if relative volatility is 2.5.

(c) Explain in detail lewis-sorel method used to obtain theoretical plates required for a given degree of separation.

**4. (A) Attempt any THREE :** **12**

(a) Differentiate between distillation and extraction on following points :

(i) Thermal energy

(ii) Operating cost

(iii) Equipment

(iv) Quality of product

(b) Write an expression for steady state equimolar counter current diffusion with meaning of each term.

(c) Give important application of steam distillation and batch distillation. Describe steam distillation in detail.

(d) Give the names and important characteristics of packing used in packed tower.

**(B) Attempt any ONE :** **06**

(a) Explain the construction and working of Mixer settler equipment.

(b) Describe the Drying Rate Curve with a neat diagram.

**5. Attempt any FOUR :** **16**

(a) Generate *x*-y data, when $\alpha = 2.3$

*x* – liquid phase composition

y – vapour phase composition

(b) What is an azeotrope ? Why an azeotropic mixture cannot be separated by conventional methods ? How an azeotrope can be distilled ?

(c) Write the factors should be considered for selecting solvent in gas absorption (any 4).

(d) 100 kmol/h of a feed containing 35 mole % methanol is to be continuously distilled in a fractionating column to get 96.5 mole % methanol as a distillate and 10 mole % methanol as a bottom product. Find the molal flow rates of the distillate and the bottoms.

(e) Write down the relative merits of plate and packed column.

**6. Attempt any TWO :** **16**

(a) Solids are to be dried under constant drying conditions from 67% to 25% moisture. The value of equilibrium for the material is 1%. If the critical moisture content is 40% and rate of drying in the constant rate period is 1.5 kg/($m^2$ h), calculate the drying time.

Drying surface = 0.5 $m^2$/kg dry solid.

(b) Explain construction and working of spray drier with neat labelled diagram.

(c) Calculate the yield of $MgSO_4.7H_2O$ crystals when 1000 kg saturated solution of $MgSO_4$ at 353 K is cooled to 303 K assuming 10% of the water is lost by evaporation during cooling.

Data :

Solubility of $MgSO_4$ at 353 K = 64.2 kg/100 kg water.

Solubility of $MgSO_4$ at 303 K = 40.8 kg/100 kg water.

Atomic weight

Mg = 24, S = 32, H = 1 and O = 16

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