

22609

22223

3 Hours / 70 Marks

Seat No.

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- 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.
 - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

- 1. Attempt any FIVE of the following: **10****
- a) Define mass transfer coefficient. Give its SI unit.
 - b) Define gas absorption.
 - c) State Fick's law of diffusion.
 - d) Define HETP.
 - e) Define equilibrium moisture content.
 - f) Define selectivity.
 - g) Define the term crystallisation.

P.T.O.

- 2. Attempt any THREE of the following:** **12**
- a) Describe azeotropic distillation.
 - b) Derive Rayleigh's equation of differential distillation.
 - c) Describe with neat sketch spray column used for liquid liquid extraction.
 - d) Describe hydrodynamics of packed column.
- 3. Attempt any THREE of the following:** **12**
- a) Describe neat sketch of tray dryer with its advantages and disadvantages. (any two)
 - b) Describe with neat sketch Swensos-Walker crystallizer.
 - c) Describe briefly the selection criteria for a solvent to be used for liquid-liquid extraction.
 - d) Describe the concept of optimum reflux ratio.
- 4. Attempt any THREE of the following:** **12**
- a) Differentiate between distillation and extraction. (four points)
 - b) Draw feed line for different feed conditions in distillation.
 - c) Suggest suitable dryer for drying
 - i) Pharmaceutical products.
 - ii) Free flowing materials
 - iii) Slurries
 - iv) Milk powder
 - d) Describe steam distillation.
 - e) A solution of sodium nitrate in water contains 48% NaNO_3 by wt. at 313 K temperature. Calculate percent yield of NaNO_3 crystals that may be obtained when temperature is reduced to 283 K. Solubility of NaNO_3 at 283 K is 80.18 kg/100kg H_2O .

5. Attempt any TWO of the following:

12

- a) A feed containing 60 mole % hexane and 40 mole % octane is fed to a pipe still through a pressure reducing valve into a flash separator. The vapor and liquid leaving separator are assumed to be in equilibrium. If 50 mole % of feed is vaporised, find composition of top and bottom products. The equilibrium data is given below :

Mole fraction of hexane in liquid (x)	1	0.69	0.4	0.192	0.045	0
Mole fraction of hexane in vapor (y)	1	0.932	0.78	0.538	0.1775	0

- b) Draw neat labelled diagram of spray dryer and explain its working.
- c) Find the percent yield of Glauber salt ($\text{Na}_2\text{SO}_4 \cdot 10 \text{H}_2\text{O}$) if a pure 32% solution is cooled to 293 K (20°C) without any loss due to evaporation.

Date : Solubility of Na_2SO_4 in water at 293 K is 19.4 gm per 100 gm water At wt- Na = 23, S = 32, O = 16, H = 1.

6. Attempt any TWO of the following:

12

- a) 100 K mol of a mixture containing 50 mole % n-heptane (more volatile) and 50 mole % n-octane is subjected to a differential distillation at atmospheric pressure with 60 mole % of liquid distilled. Find composition of the composited distillate and the residue using Reyleigh equation.

X	0.5	0.46	0.42	0.38	0.34	0.32
Y	0.689	0.648	0.608	0.567	0.523	0.497

- b) Differentiate between absorption and distillation. (any six points)
- c) A 100 kg bath of granular solids containing 30% moisture is to be dried in a tray dryer to 16% moisture by passing a current of air at 350 K tangentially across its surface at a velocity of 1.8 m/s. If the constant rate of drying under these conditions is $0.7 \times 10^{-3} \text{ kg/m}^2\text{s}$ and critical moisture content is 15%. Calculate the time required for drying solids. Drying surface = $0.03 \text{ m}^2/\text{kg}$ dry weight.