

22609

24225

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) State Ficks law of diffusion.
  - b) Define relative volatility.
  - c) Define Gas absorption and give an example.
  - d) Define equilibrium moisture content.
  - e) Define HETP.
  - f) State limitations of McCabe-Thiele method.
  - g) Define distribution coefficient of extraction.

P.T.O.

- 2. Attempt any THREE of the following :** **12**
- a) Explain various methods of generating supersaturation.
  - b) Derive Rayleigh's equation for differential distillation.
  - c) Differentiate between distillation and extraction.  
(Any four points)
  - d) Explain briefly the selection criteria for solvent in gas absorption.
- 3. Attempt any THREE of the following :** **12**
- a) Derive an equation for q-line.
  - b) Explain Mixer settler with neat diagram.
  - c) Describe the concept of optimum reflux ratio.
  - d) Write down the characteristics of packings.
- 4. Attempt any THREE of the following :** **12**
- a) Derive flux equation for steady state equimolar counter diffusion.
  - b) Explain rate of drying curve under constant drying conditions.
  - c) A mixture of benzene and toluene boils at 368 K under a pressure of 101.325 KPa. Determine the composition of the boiling liquid assuming that mixture obey's Raoult's law. At 368 K the vapour pressure of benzene is 155.56 kPa and that of toluene is 63.98 kPa.
  - d) Explain Mier's supersaturation theory.
  - e) Explain briefly the selection criteria for solvent to be used for liquid extraction.

**5. Attempt any TWO of the following :****12**

- a) A liquid mixture containing 40 mole % methanol and 60 mole % water is fed to a differential distillation at atmospheric pressure, with 60 mole % of the liquid is distilled. Find the composition of the composite distillate and the residue.

Equilibrium Data

$x$	0.05	0.1	0.2	0.3	0.4	0.5
$y$	0.27	0.42	0.57	0.66	0.73	0.78

- b) A mixture of benzene and toluene containing 60 mole % benzene is to be separated to give a product of 95 mole % benzene and a bottom product containing 10 mole % benzene. The feed enters the column at its bubble point. It is proposed to operate the column with reflux ratio of 2.5. Find the number of theoretical plates needed and the position of feed plate.

Equilibrium Data

$x$	0	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
$y$	0	0.13	0.21	0.375	0.5	0.6	0.7	0.77	0.83	0.9	0.95	1.0

- c) Find the yield of  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$  crystals when 100 kg of 48%  $\text{Na}_2\text{S}_2\text{O}_3$  solution is cooled to 293 K (20°C). Also calculate the percentage yield of the hydrated crystals. (At. Wt: Na = 23, S = 32, O = 16, H = 1)

Data : Solubility of  $\text{Na}_2\text{S}_2\text{O}_3$  is 70 parts per 100 parts water at 293 K (20°C)

**6. Attempt any TWO of the following :****12**

- a) Explain Oslo evaporative crystallizer with neat sketch.
- b) A batch of wet solids is to be dried from 35% to 10% moisture under constant drying conditions in five hours. If the equilibrium moisture content is 4% and the critical moisture content is 14%. Estimate the time required to dry the solids to 6% moisture under the same drying conditions. All moisture content are on the wet basis.
- c) Explain construction and working of drum dryer with neat sketch.