

# 17648

**11920**

**3 Hours / 100 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. a) Answer any THREE of the following: **12****
- (i) State Fick's law of diffusion. Give its mathematical expression.
  - (ii) Define the terms :
    - (1) Volatility
    - (2) Relative volatility
  - (iii) Draw a neat labelled diagram of mixer settler used for liquid - liquid extraction.
  - (iv) Draw rate of drying curve and mark the following:
    - (1) Critical moisture content
    - (2) Equilibrium moisture content

P.T.O.

b) Answer any ONE of the following: 6

- (i) Explain vapour-liquid equilibrium diagram.
- (ii) What will be the yield of  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$  crystals when 100kg of 48%  $\text{Na}_2\text{S}_2\text{O}_3$  solution is cooled to 293 K. Solubility of  $\text{Na}_2\text{S}_2\text{O}_3$  is to parts per 100 parts water at 293 K.

2. Answer any FOUR of the following: 16

- a) Which are the different methods for attaining super saturation?
- b) Draw a neat labelled diagram of fluidised bed dryer.
- c) State different mass transfer theories.
- d) Draw a neat labelled diagram of spray column.
- e) Define the following:
- (i) Distribution coefficient
- (ii) Selectivity
- (iii) Extract phase
- (iv) Raffinate phase

3. Answer any TWO of the following: 16

- a) Derive Rayleigh's equation for differential distillation.
- b) A liquid mixture containing 40mol % benzene and 60mol % toluene is subjected to flash distillation at a pressure of 101.325 KPa to vaporise 50mol % of feed. What will be the equilibrium composition of vapour and liquid?

|     |   |      |      |     |     |      |     |     |
|-----|---|------|------|-----|-----|------|-----|-----|
| $x$ | 0 | 0.1  | 0.2  | 0.3 | 0.4 | 0.6  | 0.8 | 1.0 |
| $y$ | 0 | 0.21 | 0.38 | 0.5 | 0.6 | 0.77 | 0.9 | 1.0 |

- c) A mixture of benzene and toluene containing 40mol % benzene is to be separated to give a product of 90mol % benzene at the top and 10mol % benzene at bottom  $\alpha = 2.4$ . Calculate number of plater under total reflux.

4. a) **Answer any THREE of the following:** **12**
- (i) Differentiate between distillation and extraction on the following points :
    - (1) Purity of product
    - (2) Operating cost
    - (3) Phases involved
    - (4) Temperature conditions
  - (ii) Explain analogy between mass and heat transfer.
  - (iii) Derive an expression between Y and X from definition of relative volatility.
  - (iv) Explain factors to be considered while selecting solvent for gas absorption (Any four points).
- b) **Answer any ONE of the following:** **6**
- (i) Explain hydrodynamics of packed column.
  - (ii) With a neat diagram explain the working of drum dryer.
5. **Answer any FOUR of the following:** **16**
- a) 100 Kmoles/hr of a feed containing 36 mol %  $\text{CH}_3\text{OH}$  is to be continuously distilled in fractionating column to get 96.5 mol %  $\text{CH}_3\text{OH}$  as distillate and 10 mol %  $\text{CH}_3\text{OH}$  as bottom product. Find molal flowrate of distillate and bottom product.
  - b) Draw a neat labelled diagram of bubble cap tray.
  - c) State two types of gas absorption. Explain with examples.
  - d) Give the values of q for different feed conditions. Also draw q-lines for different values of q.
  - e) Explain the following terms
    - (i) Channeling in packed column
    - (ii) HETP.

**6. Answer any TWO of the following:****16**

- a) A wet solid is to be dried from 35% to 10% by moisture under constant drying conditions in 5 hr. If equilibrium moisture content is 4% and critical moisture content is 14%, how long will it take to dry solids 6% moisture under same conditions?
  - b) Derive the expression for time required to dry the solid from moisture content  $x_1$  ( $>x_c$ ) to moisture content  $x_2$  ( $<x_c$ ).
  - c) With a neat labelled diagram explain the construction and working of Oslo cooler crystalliser.
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