17648

15162

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) Mobile Phone Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. a) **Attempt any <u>THREE</u> of the following:** **12**

(i) State Fick's law of diffusion. Give its mathematical expressions and explain the term involved.

(ii) Derive an expression $Y = \frac{\alpha x}{1(\alpha - 1)x}$

(iii) What is selectivity? What does it indicates?

(iv) Define the terms:

(1) Critical moisture content

(2) Equillibrium moisture content

(3) Bound moisture content

(4) Unbound moisture content

and show it on equillibrium moisture curve.

Marks

b) **Attempt any ONE of the following:** **6**

(i) State any two situations where liquid liquid extraction is preferred over distillation. Define selectivity ratio and state its significance.

(ii) Explain with neat sketch construction and working of OSIO cooling type crystalliser.

2. Attempt any FOUR of the following: **16**

a) Define the following terms:

(i) Solubility

(ii) Nucleation

(iii) Super saturation

(iv) Crystal growth

b) State the factors on which rate of drying is depends.

c) What are the principle methods of distillation? Which method is better? Explain

d) What is reflux ratio? Write in brief on optimum reflux ratio.

e) Differentiate between extraction and distillation.

3. Attempt any TWO of the following: **16**

a) Derive an expression for Rayleigh equation for simple distillation.

b) A liquid mixture containing 40 mole% benzene and 60 mole% toluene is subjected to flash distillation at a separator pressure of 101.325 KPa to vapourise 50 mole% offered what will be the equillibrium composition of vapours and liquid? Find the temperature in separator for an equillibrium stage.

x	0.897	0.773	0.66	0.55	0.46	0.37	0.29	0.21	0.14	0.075
y	0.958	0.897	0.83	0.757	0.657	0.591	0.496	0.393	0.281	0.161
Temp.°C	82.9	85	87	90.5	93.3	96.1	99	101.6	104.5	107.2

Marks

c) A mixture of benzene and toulene containing 40 mole% benzene and 60 mole% toulene is to be separated in a fractionating column to give a product containing 96 mole% Benzene and bottom product containing 95 mole% toulene feed is a mixture of two third vapours and one third liquid. Find the number of theoretical plates required if reflux ratio is 3.14

x	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
y	0.22	0.385	0.52	0.625	0.714	0.79	0.85	0.91	0.96	1

4. a) **Attempt any <u>THREE</u> of the following:** **12**

(i) Explain extraction process briefly and give application field of extraction.

(ii) Derive an expression for steady state equimolar counter diffusion.

(iii) What do you mean by azeotrope? Explain in brief with temperature composition diagrams.

(iv) What is selection criteria for a solvent in gas absorption process?

(v) State salient features of two film theory.

b) **Attempt any <u>ONE</u> of the following:** **6**

(i) What types of packing materials are used in packed column? Write characteristics of packing materials.

(ii) Explain construction and working of spray dryer with neat sketch.

Marks

5. Attempt any FOUR of the following: **16**

a) Derive an expression for operating line of flash distillation.

b) Which types of plates are used in plate column? Draw its figure. Which type of plate gives better performance?

c) Explain minimum liquid - Gas ratio in absorption process.

d) A methanol-water solution containing 50% by weight methanol at 300 K is to be continuously rectified at 101.325 KPa at a rate of 5000 kg/hr to provide distillate containing 95% methanol and residue containing 1% methanol by weight calculate the flow rates of distillate and resideue.

e) What is HETP? Write in brief about channelling in packed column.

f) State the factors on which rate of drying depends.

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

a) Derive an expression for time of drying under constant drying condition.

b) Solids are to be dried under constant drying condition from 67% to 25% moisture. The value of equillibrium moisture for material is 1% if the critical moisture content is 40% and rate of drying in constant rate period is 1.5 kg/m^2hr.

Calculate the drying time

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

c) What will be the percent yield of Glabar salt (Na_2SO_4 $10H_2O$) if pure 32% solution is cooled to 293 K without any loss due to evaporation:

Data:

Solubility of Na_2SO_4 in water at 293 K is 19.4 gms per 100 gms water.

At. Wt. Na = 23 S = 32 O = 16 H = 1