Register Number……

B.TECH., DEGREE EXAMINATIONS: NOV/DEC 2012

Fifth Semester

BIO TECHNOLOGY

BTY115: Mass Transfer Operations

Time: Three Hours **Maximum Marks: 100**

Answer All Questions:-

PART A (10 x 1 = 10 Marks)

1. In a turbulent fluid, the mass transfer is effected as a result of
   A. transfer by currents B. random motion of molecules
   C. parallel motion of molecules D. combination of both a and b
2. Diffusivity of vapour with variation of pressure is described by the relation,
   A. $D_{AB} \alpha P_T$ B. $D_{AB} \alpha 1/P_T$ C. $D_{AB} \alpha P_T^2$ D. $D_{AB} = P_T$
3. Which type of column is used for hydrogen fluoride gas by separation absorption?
   A. plate column B. spray column C. packed column D. bubble cap
4. For absorption of carbon dioxide in water, main resistance to mass transfer lies in the
   A. liquid film B. gas film C. gas-liquid interface D. equilibrium
5. Separation becomes uneconomical when relative volatility is
   A. >1.05 B. < 1.05 C. 1.05 D. 0.05
6. An example of a maximum boiling azeotrope is
   A. *n*-heptane – *n*-octane system B. hydrochloric acid-water system
   C. ethanol-water system D. chloroform-water system
7. Recovery of oil from vegetable seeds with organic solvent is an example of
   A. elution B. dissolution C. leaching D. adsorption
8. Which type of extractor would be useful for handling antibiotics.
   A. Treybal extractor B. Podbielniak extractor C. Schiebel extractor D.Pulsed column
9. Vander waals adsorption is also called
   A. activated adsorption B. physical adsorption C. chemisorption D. selective adsorption
10. Coarse solids can be leached in
    A. Dorr classifier B. Rotocel C. Rotary extractor D. Pachuca tank

PART B (10 x 2 = 20 Marks)

11. State Fick's law of diffusion.
12. On what factors does the mass transfer rate between two fluid phases depend?
13. Give common problems of packed columns.
14. For vacuum operation why packed towers are desirable?
15. When steam distillation is recommended?
16. Write short notes on total reflux in distillation.
17. How do you define selectivity?
18. Why horizontal compartmenting plates or baffles provided in mechanically agitated liquid-liquid extractors?
19. What happens to the rate of leaching with increase in temperature ?
20. Mention some of the essential characteristics of a good adsorbent.

PART C (5 x 14 = 70 Marks)

21. a) The air pressure in a tyre reduces from 221.99 bar in 5 days. The volume of air in the tube is 0.025 m^3. The surface area and the wall thickness of tube are 0.5 m^2 and 1 cm respectively. The solubility of air in rubber is 0.07 m^3/ m^3 rubber. Estimate the diffusivity of air rubber system.

(OR)

b) (i) Explain the theories of mass transfer in detail (7)

(ii) Define overall and individual mass transfer coefficient. Deduce the relationship between them. (2+5)

22. a) An Air-Ammonia mixture containing 2% by volume ammonia is to be scrubbed with water at 25 °C in a tower packed with 2.54 cm stone ware Raschig rings. The water and gas rate are 1200 kg/hr m^2 each based on empty tower cross section. Estimate the height of tower required if 98% of ammonia is to be absorbed in the entering gas. The equilibrium relationship is $ye = 0.924\ X$ where y is mole fraction of ammonia in air and x is mole of ammonia in solution with water. The height of transfer unit may taken as equal to 1 m.

(OR)

b) Derive an expression to calculate number of stages in one component multistage absorption.

23. a) A binary mixture of 35 mole % A is to be fractionated to contain 93 mole % A in distillate and 2.2 mole % A in residue. The feed is half liquid and the reflux ratio is 4. The relative volatile of mixture is 2. Calculate the number of theoretical plates in the column.

(OR)

b) 100 moles of A and B mixture containing 50 mole of A is subjected to a differential distillation at atmospheric pressure till the composition of A in the residue is 33%. Calculate the total moles of the mixture distilled. Average relative volatility its of this mixture is 2.16.

24. a) Explain the factors to be considered in the selection of solvents for

(i) Extraction (7)

(ii) Absorption (7)

(OR)

b) Which type of extractor uses centrifugal forces to separate liquid mixture? Discuss its Principle, Construction, Working, Applications, Merits and Demerits briefly. (2+12)

25. a) Describe in detail about a leaching equipment that is used for leaching vegetable seeds with merits and demerits.

(OR)

b) Derive Langmuir isotherm stating suitable assumptions. Give its limitations. (12+2)

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