ADVANCED SEPARATION PROCESSES

Introduction: Classification of reparation processes; Equilibrium – Based reparations General properties operation and complexities of reparations that involve mass rap rating agents and energy repeating agents. Review of vapor liquid and energy separating agents. Review of vapor liquid equilibrium and other equilibrium. Thermodynamic consistency test for VLE date phase rule and degrees of freedom estimations. Eqmilirinor ratio concept and its estimation from Defroster's charts; Bubble and Dew-Point calculations, Flash calculation estimation of state of the mixture

Unit-II

Binary separation process: Common approach for process design estimation of feed location, product qualities and theoretical stages of equilibrium based reparations: single stage-single component and Multistage single component reparation processes involving absorption stripping liquid -liquid immiscible extraction adsorption and distillation Kermes-brown equation and its limitation process designee (estimation of feed location, product qualities and theoretical stages) of multistage multiple feeds and side stream process.

Unit III

Multi component separation process: Multi component Distillation Introduction. Key components; Estimation of minimum theoretical stages (Fizzles equation0 Distribution as non-key components in airhead and bottom products at total refuse; Determination of minimum refuse ratio (under wood's method), Approximate calculation for multi component, multistage distillation estimation of actual refuse ratio and theoretical stages) kirks-Bridge equation) distribution of no-key components at actual refuse.

Unit-IV

Capacity and efficiency of contacting devices energy requirements of reparation process case studies in the reelection of separation process

Unit –V

Membrane separation process principled, characteristics and clarification of membrane reparation process, membrane materials, structure preparation of techniques, membrane modules, Membrane characterization pose size, pore distribution. Factors affecting retentively, Concentration polarization, gel polarization, fouling, eleaqing and refrigeration of membranes. Mechanisms of separation processes membrane, deme membranes and liquid membranes science and Technology of micro filtration reverse osmosis ultra filtration,

Nan filtration dialysis and electro dialysis perspiration, liquid membrane permeation, gas permeation membrane reactor: polymeric, ceramic metal and Bio membranes

TEXT / REFERENCE BOOKS:

1. R.E. Treybal, Mass Transfer operation, 3rd edition MC Graw – Hill 1980
2. G.J. Geankoplis, Transport Process and separation process Principles, 4th equation, pretice Hall of India, 2007
3. P.H. Mankat, Equilibrum Stays Separation, Elsewies publication, 1988.

ANDHRA UNIVERSITY
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Max.Marks: 100 Time: 3Hours

Answer any **FIVE** of the following
All questions carry equal marks

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1) Explain and derive the Mass transfer flux equation for molecular diffusion in gases for the case of (i) Equimolar counter diffusion and (ii) A is diffusing through stagnant non diffusing B.
2) a) Explain the diffusion through a varying cross sectional area and derive the equation for mass transfer flux.

b) A sphere of naphthalene having a radius of 2.00 mm is suspended in a large volume of still air at 318 K and 1.01325 x 10^5 Pa. The surface temperature of the naphthalene can be assumed to be at 318 K and its vapor pressure at that temperature is 0.555 mm Hg. The D_{AB} of naphthalene in air at 318 K is 6.92 x 10^{-6} m^2/s. Calculate the rate of evaporation of naphthalene from the surface.

3) A semi-infinite slab is initially at a concentration of a C_0 and at y=0 suddenly raised to the concentration C_1 and maintained constant. Derive the expression for the concentration distribution in the solid as a function of time and distance.
4) (a) Explain briefly about the diffusivities in gases

(b) Explain briefly about the diffusivities in liquids

5) a) Explain the Prandtl Analogy

   b) Explain the mass transfer between a gas phase and a falling liquid film
6) Explain (a) The two film theory and (b) The penetration theory.
7) Explain the mass transfer in the laminar boundary layer when the fluid is in laminar flow over a flat plate.
8) Explain the following briefly.
   a) Individual and overall mass transfer coefficients.
   b) Reynolds analogy.