53 (FPT 403) TPEN

2017

TRANSFER PROCESS ENGINEERING

Paper : FPT 403

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions from **seven**.*

1. *(i)* Write Newton's law of viscosity and define all terms. Discuss with diagram.

   (ii) Write Fourier's law of heat conduction.

   (iii) Calculate heat loss per m^2 of surface area for an insulating wall composed of 25·4*mm* thick fiber insulating board, where the inside temperature is 352·7*K* and the outside temperature is 297·1*K*. Thermal conductivity of insulating board is 0·048*W/mK*.

   10+5+5=20

2. *(i)* What is diffusive and convective mass transfer ?

(ii) Write Fick's 1st and 2nd law and define all terms.

(iii) Write unit of diffusion coefficient, mass transfer coefficient, mass flux, volumetric oxygen transfer coefficient.

8+8+4=20

3. Discuss briefly about "Interphase mass transfer" with diagram, mentioning required assumptions. 20

4. *(i)* How momentum flux and fluid linear velocity varies with radial distance ? Write the relation only, need not to derive.

(ii) A solute is diffused through a fluid at steady state. At point 1, solute concentration is $1{\cdot}37\times10^{-2}g/m^3$ and at point 2, solute concentration is $0{\cdot}72\times10^{-2}g/m^3$. The distance between the points is $0{\cdot}4m$. Diffusivity is $0{\cdot}013m^2/s$ and cross sectional area is constant. Calculate flux and concentration at the middle point of the distance.

8+12=20

5. *(i)* Write convective mass transfer equation and discuss.

(ii) Discuss any mass transfer model.

8+12=20

6. Discuss briefly mass transfer aspects in the following unit operations : 20

(i) Absorption

(ii) Adsorption

(iii) Distillation

(iv) Liquid-liquid extraction.

7. The equilibrium distribution of a solute in gas and liquid phase at constant temperature is given below :
$y = 1{\cdot}2x$. Solute in bulk gas phase is 0·04 mole fraction and that in bulk liquid phase is 0·025. The individual mass transfer coefficient are $Ky = 7{\cdot}2 Kmol/m^2h(\Delta y)$ and $Kx = 4{\cdot}6 Kmol/m^2h(\Delta y)$
Calculate :

(i) In which direction solute will transport ?

(ii) Calculate Flux.

(iii) Which phase resistance controls the mass transfer process here ?

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