Code No: NR410801 **NR**

IV B.Tech I Semester Supplementary Examinations, November 2005
TRANSPORT PHENOMENA
(Chemical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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NOTE: Use of equations of change are permittted.

1. (a) Write the equations for mass and molar uxes in binary systems with their corres ponding units.

   (b) Estimate the liquid diffusion coefficient of ethanol in a dilute solution of water at 10^0C. The molecular volume of ethanol is 59.2 cm^3/gmol. Ψ_B for water is 2.6 and M_B for water is 18. [8+8]

2. Derive a formula for the thickness of a film of a Bingham fluid falling down a vertical flat surface at a rate Γ (g sec^{-1} per unit width of wall). [16]

3. A circular fin of thickness B is fitted on a circular pipe of radius R_0. The wall temperature of the pipe is T_0 and that of ambient is T_a. The radius of the circular fin is R_1. Neglecting the heat loss from the edge, obtain a differential equation to predict temperature profile T (r) in the fin. Use shell energy balance. [16]

4. A current at 300amps is passed through a stainless steel wire of 2.5mm in diameter. The resisitivity of the wire is 100milli ohm-m and length of wire is 1.5m. It the outer surface temperature of wire is at 200^0C, calculate the center temperature of the wire. The thermal conductivity of the wire is 40W/m^0C. [16]

5. Consider the problem of drying of droplets. Derive the equation for diffusion through a spherical shell of raidus r1. The shell is surrounded by a spherical film of radius r2. Obtain the molar flux for the evaporating component A. [16]

6. (a) Derive an expression for temperature distribution in case of an incompressible Newtonian fluid between two coaxial cylinders in which the outer one is rotating and the inner one is stationary.

   (b) Explain the physical significance of Brinkman number. [12+4]

7. Consider an electrical wire suspended in a flowing fluid. The ends are mounted on solids maintained at temp. Ts and gas at constant temp Tg. The fluid flows past the wire. Although the wire is cylindrical it is thin enough so there are no radial temperature gradients. Heat is generated in the wire(due to current) at a rate Se. Using the Navier -Stokes equation

   (a) write the differential equation.

   (b) For this solution write the necessary boundary conditions

(c) Solve the equation for temperature profile in the wire. [6+2+8]

8. (a) Explain the qualitative comparison of laminar flow and turbulent velocity distribution

(b) Explain Reynolds stresses. [10+6]

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