2005 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

B.TECH CHEMICAL ENGINEERING

TRANSPORT PHENOMENA (CHEMICAL ENGINEERING) QUESTION PAPER

---

1. (a) Explain the physical interpretation of tyx.
(b) Define shear stress and momentum flux. Prove that shear stress and moment um flux have the same units.

2. An incompressible fluid is flowing in steady state in the annular region between two coaxial circular cylinders of radii KR and R. Obtain expressions to find out momentum flux distribution and velocity distribution.

3. Show that the Nusselt number = 2, for heat conduction from a solid sphere to surrounding stagnant fluid. Use shell energy balance.

4. A liquid flows on a vertical wall of length 'L' coated with material A. Material 'A' is slightly soluble in liquid B. Assuming plug flow and short contact time (L/V max.), obtain a solution for average mass flux NA as function of length 'L'.

5. An infinite horizontal slab uniform width 'h' has its upper and lower surface maint ained at concentration Cao and Zero respectively. Determine the steady-state concentration profile in the slab. Calculate the flux for both surfaces at steady state conditions.

6. Explain the following:
(a) The partial time derivative
(b) Total time derivative
(c) Substantial time derivative
(d) Navier-stokes equation.

7. Determine the velocity and shear stress distribution for the tangential laminar flow of an incompressible fluid between two vertical coaxial cylinders, the outer one of which is rotating with angular velocity
. End effects may be neglected

8. Find thetimesmoothed velocitydistributionforturbulent flowinalong tubeusing the Prandtl mixing-length relation. Take the radius and length of the tube as R and L.
????.