M.Tech. First Semester (Chemical Engg.) (CBS)

13001 : Transport Phenomena : 1 CE 1

P. Pages : 2

Time : Three Hours

* 0 3 4 5 *

AW - 3714

Max. Marks : 80

Notes :
1. Answer **six** question.
2. Question No. **two** is compulsory.
3. Assume suitable data wherever necessary.
4. Diagrams and chemical equations should be given wherever necessary.
5. Illustrate your answer necessary with the help of neat sketches.
6. Use of pen Blue/Black ink/refill only for writing the answer book.

1. A turbine produces 745kW net output at its shaft at 90% efficiency using 3600 tonnes/hr of water $\left(\rho = 1000 \text{ kg/m}^3\right)$. Water is drawn from a tank at 95m above the turbine where the pressure is $2\times10^5 \text{ N/m}^2$. The turbine discharges water to a tank 5m below where the pressure is 1atm. The incoming and outgoing conducts to and from the turbine are of uniform cross section. Calculate the frictional losses through the turbine, through the conducts and hence the total losses. If no heat loss to the surroundings calculate the rise in temperature obtained by water. **13**

2. Prove that the converging nozzle body is always under tension and the body force acting on it, when fluid flows through it is given by **15**

$$F_{xA} = -\frac{\mu_{b_1}^2 \rho A_1}{2}\left[1-\frac{A_1}{A_2}\right]^2$$

3. Obtain the expression for average velocity in terms of maximum velocity for the following velocity profiles; **13**

i) $u = U\max\left\{1-\left(\frac{r}{R}\right)^2\right\}$

ii) $u = U\max\left\{1-\frac{r}{R}\right\}^{1/7}$

4. Find the relation between velocity and radian position for the laminar flow of a non-Newtonian fluid through a circular pipe at steady state. The stress rate of shear is given by **13**

$$\tau = K\left\{-\frac{du}{dr}\right\}^n$$

5. Discuss conservation of mass or continuity equation for an unsteady state 3dimensional flow in differential terms. Simplify the equation applicable for a steady state incompressible flow. **13**

6. Differentiate between Eulerian and Lagrangian methods for representing fluid flow. Obtain expression for local and convective acceleration. **13**

7. Calculate the displacement thickness, momentum thickness and energy thickness for a boundary layer having a velocity profile, **13**

$$\frac{\mu_x}{U_0} = 2\left(\frac{Y}{\delta}\right) - \left(\frac{Y}{\delta}\right)^2$$

8. Show that mass transfer from a spherical body to an infinite medium is given by Sherwood no. (Sh) = 2. **13**

9. Coal containing 100% carbon having the diameter 2×10^{-4}m is barning in air at 1373K. If the diffusion coefficient of oxygen in air is $1.5\times10^{-4}m^2$/ second the density of carbon is $12.84 kg/m^3$, Calculate the time required for complete combustion. **13**

10. Discuss briefly the salient features of different analogies proposed by Reynold, Prandtl-Taylor and Chilton-Colburn. **13**

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