(Following Paper ID and Roll No. to be filled in your Answer Books)

Paper ID : 151801   **Roll No.** ☐☐☐☐☐☐☐☐☐☐☐

B. TECH.

Theory Examination (Semester-VIII) 2015-16

TRANSPORT PHENOMENA

Time : 3 Hours   *Max. Marks : 100*

Note : Attempt all question carrying equal marks :

1. Attempt any four of the following :   (5×4=20)

    (a) What are the driving forces for mass, heat and momentum transfer ?

    (b) What is shear stress for a fluid ? How many components are there ? Explain.

    (c) In what way Newtons' second law is useful in analysing fluid-flow problems ?

    (d) What is meant by continuum ? In what way is it useful ?

    (e) State th Law of conservation of momentism. how to write momentum balance ?

(f)   What is the difference between viscosity, apparent viscosity and kinematic viscosity ?

2.   Attempt any four of the following: (5×4=20)

(a)   Drive equation of continuity.

(b)   Differentiate between newtonian and non-newtonian fluid. What are time dependent Fluid?

(c)   Write the substantial derivatives in the momentism balance equation. What is its physical significance ? Express the momentum balance equation in vector form.

(d)   Estimate the diffusion coefficient of acetone, CH_3 CO CH_3, in water at 25°C using wilke-change euqation. Data :

Association Prameter ϕ for solvent = 2.6

Atomic valume for.

C = 14.8 cm³/g mole

H = 3.7 cm³/g mole

O = 7.4 cm³/g mole

Viscosity of solvent, μ = 0.8937 CP.

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(e)   What are various mechanism of heat transfer ?

(f)   What is the driving potential for mass transfer ? What are analoge to this potential and to mass transfer itself for the transport of electric charge ?

3.   Attempt any two of the following : $10 \times 2 = 20$

(a)   How is Frictton factor defined ? Show that for fully developed flow the Friction factors is a fuction of reynold's number only.

(b)   What is Prandtl's mixing length ? indicate in which it is useful in solving turbulent fluid flow problems.

(c)   A catalytic reactor is used for a reaction $2A \rightarrow A_2$ using shell balance method write mass balance equation and solve it to obtain concentration profile.

4.   Attempt any two of the following: $10 \times 2 = 20$

(a)   Which dimenssionless numbers are used to correlate heat transfer coeffcent for natural convection ?

(b)   A Viscous Fluid Flows upward through a samll circular tube and the flows downwards on the other side. show that the velocity distribution in the falling film is given by :

$$U_z = \frac{qgR^2}{4\mu}\left[1-\left(\frac{r}{R}\right)^2+2a^2\,\text{In}\left(\frac{r}{R}\right)^2\right]$$

(c) What is 'turbulence ? What are the concepts of turblence energy and the size of eddy ?

5. Attempt any two of the following : $\qquad 10 \times 2 = 20$

(a) One of the wall of thin rectangular plate is at temperature T_1. The other three walls are at temp T_2. Determine steady state temperature profile in the plate.

(b) A droplet (radius $= r_1$) of substance A is suspended in a stream of gas B. The gas film has the radius r_2. show that r^2 NAr is constant. Obtain its value.

(c) Discuss the dependence of diffusivity in gases on temperature as predicted by chapman-Enskog theory. It fuller's relationship a better equation ?