Printed Pages: 4 **EEV-063**

(Following Paper ID and Roll No. to be filled in your Answer Books)	
Paper ID : 197611	**Roll No.**

B.TECH.

Theory Examination (Semester-VIII) 2015-16

TRANSPORT PHENOMENA

Time : 3 Hours ***Max. Marks : 100***

Section-A

Q1. Attempt all parts. All parts carry equal marks. Write answer of each part in short. (2×10=20)

(a) What is the importance of transport phenomena?

(b) State fick's law of diffusion.

(c) When does the transition to turbulent flow occurs?

(d) Write the boundary conditions used in solving mass balance problems.

(e) Mention the three distinct regions exhibited by pseudoplastic material.

(f) How average velocity is related to maximum velocity for flow of Newtonian fluids through circular ducts under laminar flow conditions?

(g) State if the momentum boundary layer thickness is lower than the thermal boundary layer thickness.

(h) List some models to characterize non-newtonian fluids.

(i) Express the relationship between friction factor and reynolds number.

(j) Define the effectiveness factor for porous catalysts.

Section-B

Q2. Attempt any 5 questions from this section. (10×5=50)

(a) Discuss and compare equimolar counter diffusion and diffusion through a stationary gas.

(b) Water flows over a flat plate at a velocity U_∞ of $3ms^{-1}$. Calculate the total drag on a section of the plate that is 1m wide and 2m long, the beginning of the section co-inciding with the leading edge of the plate. Assume the transition occurs at a Reynolds number of 5×16. Also, calculate the shear stress at the wall (in units of Nm^{-2}) at a distance of 1m from the leading edge of the plate.

(c) A furnace wall is constructed with fire brick (k = l.l W m^{-1} K^{-1}) of thickness 0.3 m. To reduce heat loss and to prevent burns, the outside of the wall is cov ered with 0.05 m of an insulating material (k=0.086 W m^{-1} K^{-1}). If the inner wall temperature is 1200 K and the heat flux

q/A is 930 W m^{-2}. determine the outside temperature of the insulation. Is the operation safe? If not, what corrections would you make?

(d) A non-newtonian lluid. described by bingham model.

$\tau = \tau_0 + \mu_0[dv_z/dr]$ if $r > r_0$ and $\tau = 0$ if $\tau \leq \tau_0$

is flowing through a vertical tube as a result of a pressure gradient. The radius and length of the tube are R and L respectively. Obtain a relationship between the volumetric flow rate Q and the pressure gradient by shell balance technique. Also show for $\tau_0 = 0$, the relationship reduces to Haegan-Poiseulle equation.

(e) Discuss the unsteady state one directional heat transfer in a finite slab.

(f) Compare the temperature dependency of viscosity, thermal conductivity and diffusion coefficient for both gases and liquids.

(g) Elaborate the rheological characteristics of non-newtonian fluids.

(h) Derive the concentration profile in the gas film for diffusion with heterogeneous chemical reaction.

Section-C

Note: Attempt any two questions from this section.

(15×2=30)

Q3. (a) Compare the analogies heat, mass and momentum transfers.

(b) Derive the expression for velocity profiles and momentum flux for two immiscible liquids A and B flowing in laminar flow between two parallel plates separated by a distanee 2x.

Q4. (a) Describe in brief about the significance of boundary layer development in circular ducts.

(b) Use Navier Stokes equation for constant density to obtain the differential equations, for velocity distribution for flow of an isothermal film.

Q5. Experiments with a small-scale agitated tank are to be used to design a geometrically similar installation with linear dimensions 10 times as large. The fluid in the large tank will be a heavy oil with μ = 13.5 cp and ρ = 0.9 g/cm^3. The large tank is to have an impeller speed of 120 rpm?

(a) Determine the impeller speed for the small scale model.

(b) Determine the operating temperature for the model if water is to be used as the stirred fluid.