SHAHEED BHAGAT SINGH STATE TECHNICAL CAMPUS, FEROZEPUR

ROLL No: | | | | | | | | | | | | **Total number of pages:[2]**

B.Tech. || CHE || 6th Sem
TRANSPORT PHENOMENON
Subject Code:BTCH-605

Time allowed: 3 Hrs **Max Marks: 60**

Important Instructions:

- **All questions are compulsory**
- **Assume any missing data**

PART A (10x 2marks)

Q. 1. Short-Answer Questions:

a) Compare Fick's law of diffusion with Newton's law of viscosity.
b) What is the effect of temperature and pressure change on diffusivity?
c) What is friction factor? What is its utility?
d) What is Chilton Colburn analogy?
e) Explain the terms free convection and forced convection?
f) Show that the 'Grashof number' is dimensionless.
g) What is Maxwell Stefan equation? When is it used?
h) Compare the temperature dependence of the thermal conductivities of gases, liquids, and solids.
i) Write down the Brinkman number? Give its significance.
j) Find the diffusivity of TNT in Benzene at 15oC, given $\mu_{benzene}$= 0.705 cP, V_A = 140cc/gmol and $\psi_{benzene}$ = 1.

PART B (5×8marks)

Q. 2. a. Derive the Hagen-Poiseuillie equation by the application of Navier-Stokes equation.. CO_1

b. The Bernoulli equation for steady flow of inviscid fluids is one of the most famous equations in classical fluid dynamics. Show how it is obtained from the Euler equation of motion.

OR

a.Derive an equation of change for temperature ,in terms of the heat flux vector **q** and the viscous momentum flux tensor **τ.** CO_1

b. What are the various means of mass transfer and their analogues in energy transfer?

Q. 3. Prove that the flow of a liquid in laminar flow between two infinite parallel flat plates is given by $Po - P_L = 12\ \mu\ V_{avg} L / a^2$ where L is length of plate in the direction of flow, **a** is the distance between plates. CO_2

OR

A fluid with constant viscosity and density flow along an inclined flat surface under the influence of gravity with no ripplings. Derive the equations for momentum flux and velocity distribution. The film thickness is measured away from the wall (that is, $x = 0$ at the wall, $x = d$ at the edge of the film). Write all your assumptions. CO_2

Q. 4. Differentiate between forced convection and free convection.Also derive an expression for velocity distribution when heat is transported in fluids through free convection .Give two examples where this phenomena can be observed. CO_3

OR

(a) Develop an equation for heat conduction through composite cylindrical walls. CO_3

5. Derive the equation for the rate of mass transfers in 'diffusion through a stagnant gas film'. CO_4

OR

a Derive the concentration profile in the gas film for diffusion with heterogeneous chemical reaction. CO4

b. Estimate D_{AB} for the system CO-$C0_2$ at 296.1K and 1 atm total pressure.

Given

Species	M	T(K)	p_c(atm)
CO	28	133	34.5
CO2	44	304	72.9

Dimensionally analyse the equations of change for non-reacting binary mixtures. CO_5

OR

Define Nusselt number and Sherwood number. How are they analogous? CO_5
Summarize the multicomponent equations of change in terms of the fluxes of mass ,momemtum and energy.