QP Code:RD21BTECH285 | Reg. No | | | | | | | | | | | AY 21

GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Fifth Semester Regular) Examinations, December – 2023

21BCHPC35003– Transport Phenomenon

(Chemical)

Time: 3 hrs | Maximum: 70 Marks

Answer all questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions		CO #	Blooms Level
a.	Define Newton's Law of viscosity.	CO1	K2
b.	How viscosity depends on temperature in case of fluids?	CO2	K3
c.	What are the boundary conditions used for solving shell heat balance equation?	CO1	K3
d.	Write Fick's Law of diffusion.	CO1	K2
e.	Differentiate between laminar and turbulent flow in pipe.	CO2	K3

PART – B **(15 x 4 = 60 Marks)**

Answer ***ALL*** questions		Marks	CO #	Blooms Level
2. a.	Explain types of fluids by showing them on shear stress and shear strain plot with mathematical expressions.	15	CO2	K3
	(OR)			
b.	One method for determining the radius of a capillary tube is by measuring the rate of flow of a Newtonian liquid through the tube. Find the radius of a capillary from the following flow Data: Length of capillary tube: 50.02 cm Kinematic viscosity of liquid: 4.03×10^{-5} m^2/s Density of liquid: 955.2 kg/m^3 Pressure drop in the horizontal tube: 4.829×10^5 Pa Mass rate of flow through tube: 2.997×10^{-3} kg/s	15	CO2	K3
3.a.	A heated sphere of radius R suspended in a large motionless body of fluid, Show that, $Nu = \frac{hD}{K} = 2$. Where h is heat transfer coefficient, D is the diameter of sphere and K is the thermal conductivity.	15	CO2	K3
	(OR)			
b.	The heat generate per unit volume in a parallel plate is given by $S_V = \mu\left(\frac{v}{b}\right)^2, \frac{w}{m^3}$ where v is the upper plate velocity; b is the distance between two plates. Taking origin at the lower plate with boundary condition x = 0, T =T_0, and x = b, q_x= 0, Derive: $T - T_0 = \frac{\mu v^2}{k}\left[\frac{x}{b} - \frac{1}{2}\left(\frac{x}{b}\right)^2\right]$	15	CO2	K3
4.a.	In studying the rate of leaching of a substance A from solid particles by a solvent B, the rate controlling step is diffusion of A from the particle surface through a stagnant liquid film thickness δ out into the main stream.	15	CO2	K3

The molar solubility of A in B is C_{A0} and the main stream is $C_{A\delta}$.

Show that Rate of leaching is $N_{AZ} = D_{AB}(C_{AO} - C_{A\delta})/\delta$

(OR)

b.	A droplet of liquid A of radius r_1, is suspended in a stagnant film of gas of radius r_2. Boundary conditions are $r = r_1$, $x_A = x_{A1}$ and $r = r_2$, $x_A = x_{A2}$. Taking the value of constant as $r_1^2 N_{Ar1}$ Show that, $$N_{Ar1} = \frac{CD_{AB}}{r_2 - r_1}\left(\frac{r_2}{r_1}\right)\ln\left(\frac{x_{B2}}{x_{B1}}\right),$$ When $r_2 \to \infty$, what will be the expression for N_{Ar1}.	15	CO2	K3
5.a.	Derive Reynold's Stress components from equation of motion.	15	CO2	K2

(OR)

b.	Derive the dimensionless shell energy balance differential equation in turbulent pipe flow and mention the boundary conditions.	15	CO2	K2

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