QPC: RD20BTECH337 AR 20 Reg. No

GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Fifth Semester – Regular) Examination, December – 2022

BPCCH5030 – Transport Phenomena

(Chemical Engineering)

Time: 3 hrs Maximum: 70 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) **(1 x 10 =10 Marks)**

Q.1. Answer ***ALL*** questions [CO#] [PO#]

a. 1cP is CO1 PO1

(i) 0.1 Pa-s (ii) 0.01 Pa-s

(iii) 0.001 Pa-s (iv) None of these

b. In falling film the shear stress distribution is _____ in nature for steady laminar flow CO1 PO1

(i) Linear (ii) Parabolic

(iii) Logarithmic (iv) None of these

c. The shear stress distribution is _____ in nature for steady laminar flow of Newtonian fluid in a pipe. CO1 PO1

(v) Linear (vi) Parabolic

(vii) Logarithmic (viii) None of these

d. Energy source are CO2 PO1

(i) Electrical (ii) Viscous

(iii) Both (i) & (ii) (iv) None of these

e. The ratio of thermal diffusivity to momentum diffusivity CO2 PO2

(i) Prandtle number (ii) Inverse of Prandtl number

(iii) Both (i) & (ii) (iv) None of these

f. Reynolds number is used in CO1 PO1

(i) Momentum transfer (ii) Energy transfer

(iii) Both (i) & (ii) (iv) None of these

g. Time average of the fluctuating component is CO4 PO1

(i) 1 (ii) 0

(iii) Time dependant (iv) None of these

h. In creeping flow around sphere, the friction factor is CO1 PO1

(i) 16/Re (ii) 24/Re

(iii) Both (i) & (ii) (iv) None of these

i. Prandtle mixing length l_m is CO4 PO1

(i) U'×(du/dy) (ii) U'/(du/dy)

(iii) $U'/(du/dy)^2$ (iv) $U'^2/(du/dy)$

j. According to Newton's Resistance Law friction factor is CO4 PO1

(i) 0.4 (ii) 0.44

(iii) 0.5407 (iv) 0,079

PART – B: (Short Answer Questions) **(2 x 10=20 Marks)**

Q.2. Answer ***ALL*** questions [CO#] [PO#]

a. Define Scalar, vector and Tensor. CO1 PO1

b. What is combined momentum flux? CO1 PO1

c.	Write the shear stress expression for Power law and Bingham fluid model.	CO1	PO1
d.	Write Fourier's Law of heat conduction with linear temp. gradient.	CO2	PO1
e.	Define thermal conductivity and its unit in MKS system.	CO2	PO1
f.	How diffusivity of liquids is varies with temperature?	CO2	PO2
g.	Write Fick's Law of diffusion	CO3	PO1
h.	What is friction factor?	CO4	PO1
i.	Write the Prandtle formula for friction factor.	CO4	PO1
j.	What are molecular and convective molar fluxes?	CO3	PO1

PART – C: (Long Answer Questions) (10 x 4=40 Marks)

Answer ***ALL*** questions		Marks	[CO#]	[PO#]
3.a.	Derives an expression for average velocity in a circular pipe of radius R and length L when a Newtonian fluid is flowing inside the pipe vertically downward	10	CO1	PO2
	(OR)			
b.	Derives an expression for velocity profile in a circular pipe of radius R and length L when a Bingham fluid is flowing inside the pipe vertically downward	10	CO1	PO2
4.a.	A heated sphere of radius R is suspended in a large container of motionless body of fluid. Show that, $Nu = \frac{hD}{K} = 2$.	10	CO2	PO2
	(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, T=T_b, Derive an expression for dimensionless temperature difference profile in terms of Brinkman number (Br), where $Br = \frac{\mu v^2}{k(Tb - To)}$	10	CO2	PO2
5.a.	Diffusion of A through a stagnant gas film. Derive a expression for mass flax in z-direction i.e. $N_{Az} = \frac{CD_{AB}}{z_2 - z_1}(x_{A1} - x_{A2})$, by neglecting $x_A(N_A+N_B)$.	10	CO3	PO2
	(OR)			
b.	Derive an expression for steady state equimolar counter diffusion.	10	CO3	PO2
6. a.	Show the time average of fluctuating velocity component is zero	5	CO3	PO2
b.	Derive the formula for Fanning friction factor	5	CO4	PO2
	(OR)			
c.	Convert the differential equation into dimensionless form with Reynolds number and Prandtle number. $K\frac{d^2T}{dz^2} = \rho Cp\frac{dT}{dt}$	5	CO4	PO2
d.	Derive the formula for friction factor in creeping flow around sphere	5	CO4	PO2

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