Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER I - EXAMINATION – SUMMER 2017

Subject Code: 2713009 **Date:10/05/2017**

Subject Name: Advanced Transport Processes

Time: 02:30 pm to 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Describe Time smoothed velocity profile near wall for turbulent flow.	**07**
	(b)	Derive equation for Vankarmann's analogy.	**07**
Q.2	**(a)**	Derive the Equation of continuity for Cylindrical coordinate with neat sketch?	**07**
	(b)	A copper wire has a radius of 2 mm and a length of 5 m. For what voltage drop would the temperature rise at the wire axis be 10°C, if the surface temperature of the wire is 20°C? Data: Lorenz number, k/ke*To for copper wire is 2.23* 10^{-8} $volt^2/K^2$.	**07**
		OR	
	(b)	Discuss about equation of continuity for a multi component mixture?	**07**
Q.3		A laminar Newtonian fluid is flowing through vertical narrow slit formed by two parallel walls of width W at distance 2B apart. Neglect edge effect and Make a differential momentum balance, and obtain the expressions for the momentum-flux and velocity distributions, and maximum velocity?	**14**
		OR	
Q.3	**(a)**	Write about (i) Ostwald De Wale model,(ii) Eyring model for fluid in brief ?	**10**
	(b)	Briefly describe unsteady state heat conduction in solid?	**04**
Q.4		Derive the equations of Change for Non isothermal Systems using Cartesian Coordinates?	**14**
		OR	
Q.4		Derive an expression of temperature profile for heat conduction with viscous heat source for a flow of an incompressible Newtonian fluid between two coaxial cylinders maintain at different temperature? Inner cylinder, temperature t_0 is stationary and outer cylinder, temperature t_b is rotating. (t_b>t_0) Neglect the curvature effect and assume temp is only function of radius.	**14**
Q.5	**(a)**	Derive the expression of concentration profile for Steady-state diffusion of A through stagnant B with the liquid vapor interface maintained at a fixed position?	**07**
	(b)	Discuss about various time derivatives with suitable examples?	**07**
		OR	
Q.5		In a catalytic reactor, porous catalyst with radius R is submerged in a gas stream containing the reactant A and the product B. Concentration of A is C_{AR} moles of A per unit volume. Species A diffuses through the tortuous passages in the catalyst and is converted to B on the catalytic surfaces. Using effective diffusivity, D_A of spices A	**14**

in porous medium and first order reaction of A→B develop an expression for effectiveness factor as a function of Thiele modulus.

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