Q. Code: 140013

Reg. No. | | | | | | | | | |

M.E. / M.TECH. DEGREE EXAMINATIONS, DEC 2019

Second Semester

CL18201 – ADVANCED TRANSPORT PHENOMENA

(Chemical Engineering)

(Regulation 2018)

Time: Three Hours **Maximum : 100 Marks**

(Permitted to use Appendices A, B, C from Transport Phenomena by Bird, Stewart, Light foot)

Answer **ALL** questions

PART A - (10 X 2 = 20 Marks)

		CO	RBT
1.	Write the physical meaning of $[\nabla \cdot \rho \mathbf{vv}]$?	1	U
2.	Draw velocity profile for laminar and turbulent flow in pipe	1	AN
3.	Differentiate between steady and unsteady equation of change of momentum transfer.	2	AN
4.	Write mechanical energy equation in macroscopic form.	2	R
5.	Draw temperature profiles in electrical heat source.	3	U
6.	What is molecular heat flux?	3	R
7.	Define Prandtl mixing length.	4	R
8.	Concentration of fluoride was measured in a process at 5 minutes intervals as 18, 14, 16,12 mg/l. Calculate time smoothed concentration.	4	AP
9.	Define boundary layer for momentum and mass transfer flows.	5	R
10.	Which term is added in continuity equation if first order chemical reaction is included?	5	U

PART B - (5 X16 = 80 Marks)

11.	(a)	Using equation of change for motion derive velocity profile in a circular vertical tube of radius R and Length L. Fluid is incompressible having constant density, viscosity and the flow is in steady state.	**(16)**	1	AP

(OR)

	(b)	It is desired to predict the flow behaviour in a large tank as a function of the impeller rotation speed. We propose to do this by means of model experiments in a smaller, geometrically similar system. Determine the conditions necessary for the model studies to provide a direct means of prediction.	**(16)**	**1**	**AP**
12.	(a)	Develop the equations for finding the fluid temperature profiles for the fully developed laminar flow in a tube.	**(16)**	**2**	**AP**
		(OR)			
	(b)	A solid material occupying the space from $y = 0$ to $y = \infty$ is initially at temperature T_0. At time $t = 0$, the surface at $y = 0$ is suddenly raised to temperature T_1 and maintained at that temperature for $t > 0$. Find the time-dependent temperature profiles $T(y, t)$	**(16)**	**2**	**AP**
13.	(a)	Derive the equation of continuity for a multicomponent system.	**(16)**	**3**	**AP**
		(OR)			
	(b)	Using the equation of continuity for binary mixers setup an equation for concentration profile for mass transfer from a stagnant film.	**(16)**	**3**	**AP**
14.	(a)	Derive the equation for macroscopic mass balance in a flow system.	**(16)**	**4**	**AP**
		(OR)			
	(b)	An incompressible fluid flows from a small circular tube into a large tube in turbulent flow. The cross-sectional areas of the tubes are S_1, and S_2. Obtain an expression for the pressure change between planes 1 and 2 and for the friction loss associated for the sudden enlargement in cross section	**(16)**	**4**	**AP**
15.	(a)	Discuss interface mass transfer in single phase. Explain Chilton-Colburn Analogy.	**(16)**	**5**	**U**
		(OR)			
	(b)	Discuss wet and dry bulb psychometry with respect to two phase mass transfer coefficients.	**(16)**	**5**	**U**