Q. Code: 423224

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

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

Seventh Semester

CH16704 – TRANSPORT PHENOMENA

(Chemical Engineering)

(Regulation 2016)

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

(Appendix- B & C shall be provided)

Answer **ALL** questions

PART A - (10 X 2 = 20 Marks)

		CO	RBT
1.	Distinguish substantial time derivative and total time derivative using an example.	1	AN
2.	Verify that momentum per unit area per unit time has the same dimensions as force per unit area.	1	AP
3.	List the common boundary conditions used in shell momentum balance.	2	U
4.	What are the implied assumptions in the derivation of the Hagen-Poiseuille equation?	2	R
5.	Write any two dimensionless numbers significant for mass transfer operations.	3	AN
6.	Write the general property balance for energy transport.	3	U
7.	Specify the vector form of equation of motion.	1	U
8.	Mention the significance of Biot number in heat exchanging operations.	2	AN
9.	Write the significance of J_D factor and J_H factor in transport processes.	4	AN
10.	Write the expressions involved in Prandtl analogy.	4	U

PART B - (5 X16 = 80 Marks)

11.	(a)	(i)	Discuss the classification of transport processes.	(4)	1	R
		(ii)	Discuss the importance of transport phenomena for a chemical process.	(6)	1	AN
		(iii)	State and explain Newton's Law of viscosity and discuss how it is analogous with Fourier's Law of heat conduction and Fick's Law of binary diffusion.	(6)	1	AN
			(OR)			
	(b)	(i)	Show that the viscosity varies with temperature and pressure for dilute gases and liquids using kinetic theory?	(12)	1	E
		(ii)	Glycerine at 26.5°C is flowing through a horizontal tube 1 ft long and with 0.2 in. inside diameter. For a pressure drop of	(6)	1	E

40 psi, the volume flow rate is 0.00398 ft^3/min. The density of glycerine at 26.5°C is 1.261 g/cm^3. From the flow data, evaluate the viscosity of glycerine in centipoise.

12.	(a)	A viscous fluid is in laminar flow through a narrow slit, a distance 2B apart. The length and width of the plates are L and W respectively. Obtain the expressions for the distribution of velocity, maximum velocity, average velocity and volumetric flow rate. Assume that the liquid is flowing from top to bottom.	**(16)**	**2**	**AP**
		(OR)			
	(b)	Determine the velocity distribution, the ratio of maximum velocity to average velocity, shear stress distribution and drop of pressure for a laminar flow of a fluid through a circular pipe.	**(16)**	**2**	**AP**
13.	(a)	Consider a gas A diffusing in to liquid B. As it diffuses, it undergoes no chemical reaction. Draw the concentration profile and give the expression to estimate the molar flux at the surface.	**(16)**	**3**	**U**
		(OR)			
	(b)	Derive the expression of temperature distribution with a viscous heat source.	**(16)**	**3**	**U**
14.	(a)	Discuss the significance of equation of continuity for a single component and explain its difference from a multicomponent mixture.	**(16)**	**3**	**AN**
		(OR)			
	(b)	Explain the steps involved in deriving the velocity distribution in Couette- viscometer from equation of change.	**(16)**	**3**	**U**
15.	(a)	Derive the time-smoothed equations of motion for an incompressible fluid.	**(16)**	**4**	**U**
		(OR)			
	(b)	Mention the significance of following analogies in transport processes.			
		(i) Reynolds analogy	**(5)**	**4**	**AN**
		(ii) Prandtl analogy	**(5)**	**4**	**AN**
		(iii) Colburn analogy and Von-Karman hypothesis	**(6)**	**4**	**AN**