A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 57901

B.E./B.Tech. DEGREE EXAMINATION, NOV 2018

Seventh Semester

Chemical Engineering

15UCH701 - TRANSPORT PHENOMENA

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Flux is CO1- R

   (a) Intensive property (b) Extensive property

   (c) Both intensive and extensive property (d) None of these

2. Which fluid is time dependent fluid CO1- R

   (a) Thixotropic fluid (b) Pseudoplastic fluid

   (c) Rheopectic fluid (d) Viscoelestic fluid

3. Continuity equation is CO2- R

   (a) Mass balance equation (b) Momentum balance equation

   (c) Both mass and momentum balance equations (d) None of these

4. Viscosity of gas depends on CO2- R

   (a) T (b) T^2 (c) $T^{1/2}$ (d) $T^{3/2}$

5. Heat flux is a………. quantity CO3- R

   (a) Scalar (b) Tensor (c) Vector (d) None of these

6. Heat conduction in a cooling fin, T is a function of CO3- R

   (a) Time only (b) Space only (c) Both space and time (d) None of these

7. The mass diffusivity, the thermal diffusivity and the eddy momentum diffusivity are same for, $N_{Pr} = N_{Sc} =$ ___________ CO4- R

(a) 1 (b) 0.5 (c) 10 (d) 0

8. Mass transfer rate between two fluid phases does not necessarily depend on the ___________ of the two phases. CO4-R

(a) Chemical properties (b) Physical properties

(c) Degree of turbulence (d) Interfacial area

9. Stanton St number is defiends as CO5- R

(a) Molecular diffusivity of momentum / molecular diffusivity of heat

(b) Momentum diffusivity/ mass diffusivity

(c) Thermal diffusivity / mass diffusivity

(d) Heat transferred / thermal conductivity

10. Chilton and colburn J factor for turbulent flow region is CO5- R

(a) $J_D = \frac{K_c}{V_{avg}} (N_{Sc})^{2/3}$

(b) $J_D = \frac{K_c}{V_{avg}} (N_{sc}) 1/3$

(c) $J_D = \frac{K_c}{V_{avg}} (N_{sc}) 5/3$

(d) $J_D = \frac{K_c}{V_{avg}} (N_{sc}) 3/2$

PART – B (5 x 2= 10Marks)

11. Define kinematic viscosity. CO1- R

12. Outline the boundary conditions mostly used in shell and momentum balance. CO2- R

13. What is the wiedmann equation of thermal conductivity of solids? CO3- R

14. Compute the value of D_{AB} for the system CO (A)-CO_2(B) at 296.1 K & 1 atm total pressure. CO4-App

M_A= 28.01, T_{cA}=133K, p_{cA}=34.5atm, M_B= 44.01,T_{cB}= 304.2K, p_{cB} =72.9atm

15. Compare analogy between heat and momentum transfer. CO5- R

PART – C (5 x 16= 80Marks)

16.	(a)	Expalin the theory of vicosity of gases at low density.	CO1-U	(16)
		Or		
	(b)	The distance between two parallel plates is 0.00914 m. The lower plate is being pulled at a relative velocity of 0.366 m/s. greater then the top plate. The fluid used is soyabean oil with viscosity 0.4×10^{-2} Pa.s at 303°K. (i) calculate a shear stress and shear rate (ii) if glycerol at 293°K having a viscosity of 1.069 kg/m.s is used instead of soyabean oil, what relative velocity is needed using the same distance between the plates so that the same shear strees is obtained as (a) and what is the new shear rate?	CO1- App	(16)
17.	(a)	Derive the analog of hagen – poiseuille's equation for ostwald-de- waele model.	CO2-U	(16)
		Or		
	(b)	Derive the equation of motion for pure fluids.	CO2-U	(16)
18.	(a)	Derive the temperature distribution equation for fin and find the effectiveness of fin.	CO3-U	(16)
		Or		
	(b)	Saturated steam at 0.276MPa flows inside a steel pipe having an inside diameter of 2.09 cm and an outside diameter of 2.67 cm. The convective coefficients on the inner and outer pipe surfaces may be taken as 5680 W/m^2 K and 22.7W/m^2 K, respectively. The surrounding air is at 294K. Find the heat loss per meter of bare pipe and for a pipe having 3.8cm thickness of 85% magnesis insulation on its outer surface.	CO3- Ana	(16)

19.	(a)	Derive the mass trnasfer rate equation for hetrogenious chemical reaction.	CO4- U	(16)
		Or		
	(b)	The solute HCl (A) is diffusing through a thin film of water (B) 2mm thick at 283°K. The concentration of HCl at point (1) at one boundary of thin film is 12wt% HCl (density ρ_1 =1061 kg/m^3) and the other boundary at point (2) it is 6 wt% HCl(density ρ_2=1030 kg/m^3). The diffusion coefficient of HCl in water is 2.5× 10^{-9} m^2/sec. assuming steady-state conditions prevail and the boundary is impermeable to water, calculate the flux of HCl in kmole/m^2.sec.	CO4- Ana	(16)
20.	(a)	The reynolds analogy (v(t) = α(t), along with equation $\mu(t) = \mu \left(\frac{yv_*}{14.5v}\right)^3$ for the eddy viscosity, to estimate the wall heat flux q_0 for the turbulent flow in a tube diameter D= 2R. Express the result in terms of the temperature – difference driving force $T_0 - \vec{T_R}$, where T_0 is the temperature at the wall (y=0) and $\vec{T_R}$ is the time- smoothed temperature at the tube axis (y=R).	CO5-Ana	(16)
		Or		
	(b)	Compare Prandtl-Taylor analogy and Von Karman analogy between momentum and mass transfer.	CO5-Ana	(16)