Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

V SEMESTER B.TECH. (CHEMICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2017

SUBJECT: TRANSPORT PHENOMENA [CHE 3103]

REVISED CREDIT SYSTEM
27/11/2017

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A.	State and describe a) Newton's law of viscosity, b) Fourier's Law of heat conduction c) Fick's law of diffusion.	**4**
1B.	Consider steady state laminar flow of the fluid at constant density in a very long circular tube of length L and radius R. Derive the velocity profile by performing a shell balance on thin cylindrical shell a) Maximum Velocity b) Average velocity	**6**
2A.	Two immiscible, incompressible fluids are flowing in a horizontal thin slit of length L and width W, under the influence of a pressure gradient, the fluid rates are so adjusted that the slit is half filled with fluid 1 (more dense phase) and half filled with fluid 2 (less dense phase). Determine the velocity distribution and the average velocity for the system.	**10**
3A.	Derive the expression for temperature profile in the rectangular fin with its ends insulated. State assumptions for it.	**8**
3B.	Thermocouple in a cylindrical well inserted into a gas stream, estimate the true temperature of gas stream if thermocouple junction (wall) temperature 260^{o}C, pipe wall temperature is 176.7^{o}C, h= 681.36 w/m^2 ^{o}C, K = 103.8 w/m ^{o}C, B= 2.032x10^{-3} m L= 0.06096 m.	**2**
4.	Derive an expression for diffusion through a spherical shell of radius 'r_1' and gas film radius 'r_2' to get concentration profile and molar flux. a) When there is no temperature change between spherical surface and gas film. b) Extend this result to describe the diffusion in Non-isothermal film in which the temperature changes with distance according to the following relation $\frac{T}{T_1} = (\frac{r}{r_1})^n$ Where T_1 is at temperature r_1. P.T.O	**10**

	Assume as rough approximation that D_{AB}, varies as 3/2 power of temperature $$\frac{D_{AB}}{D_{AB1}} = (\frac{T}{T_1})^{3/2}$$	
5A.	Derive the equation of continuity from the concept of mass conservation.	**4**
5B.	Establish Navier-Stokes equation from the fundamental momentum balance.	**6**