Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A Constituent Institution of MAHE, Manipal)

V SEMESTER B.TECH. (CHEMICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV 2018

SUBJECT: TRANSPORT PHENOMENA [CHE 3103]

REVISED CREDIT SYSTEM

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.	**3**
1B.	Consider steady state axial flow of an incompressible liquid in an annular region between two co-axial cylinders of radius kR and R . the fluid is flowing up-ward in the tube that is against the gravity. Derive an equation for shear stress, velocity, maximum velocity and average velocity.	**7**
2A.	Derive the expression for temperature profile in the rectangular fin with its ends insulated. State assumptions for it.	**8**
2B.	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= 0.06096m.	**2**
3.	Consider a spherical nuclear fuel element, it consists of a sphere of fissionable material with radius R^F, surrounded by a spherical shell of aluminum cladding outer radium R^C. The source of thermal energy resulting from nuclear fission is given by Sn(Cal/cm^3.s) and source can be a simple parabolic function $Sn = Sno\ [1+b\ (r/R^F)^2]$ Develop a total temperature profile for the system.	**10**
4.	Gas A dissolves in liquid B in beaker and diffuses isothermally into liquid phase. as it diffuses, A also undergoes an irreversible first order homogeneous chemical reaction A+B → AB, treat this as a binary solution of A and B, ignoring the small amount of AB that is present (the pseudo binary assumption).Derive an expression for concentration of A as a function of liquid depth , also obtain an expression for average concentration in liquid phase and molar flux of A at gas – liquid interphase . Rate is given by k'''C_A. P.T.O	**10**

5A.	Derive the equation of continuity from the concept of mass conservation with neat diagram.	**4**
5B.	Establish Navier-Stokes equation from the fundamental momentum balance with neat diagram.	**6**