Code No: **R41081** **R10** **Set No. 1**

IV B.Tech I Semester Supplementary Examinations, Mar/April - 2016

TRANSPORT PHENOMENA

(Common to Chemical Engineering and Petroleum Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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1 a) What is the Newton's Law of viscosity? Explain the terms shear rate thinning, shear rate thickenining and Bingham plastic fluids [8]

b) What is the Fouriers law of conduction? Write down the equation of this in three dimensional Cartesian coordinate system [7]

2 Consider an incompressible fluid is flowing in steady state in a annular region between two coaxial circular cylinder of outer radius (KR) in inner cylinder and inner radius (R) of outer cylinder. Show that volumetric flow through it is

$$Q = \frac{\pi (P_0 - P_L) R^4}{8 \mu L} \left[(1 - K^4) - \frac{(1 - K^2)^2}{\ln \left(\frac{1}{K} \right)} \right]$$

State clearly all the assumptions and also find expression for max. velocity $V_{Z,max}$

[15]

3 A heated sphere of radius 'R' at temperature TR is suspended in a large motionless body of the fluid. The temperature of the fluid at r = ∞ may be taken as T∞. It may be assumed that heat is transferred by conduction only in the fluid and free convection effects are neglected. Using shell energy balance approach arrive at the relation between steady state heat flux at the surface and show that the dimensionless heat transfer coefficient is given by Nu=2. [15]

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4 Two vertical plates are spaced 6mm apart. One is maintained at 100^0C and the other at 20^0C. Air is flowing between plates at a pressure of 1atmosphere and you may assume that the volumetric flow of upward moving stream is same as that of downward moving stream. Evaluate average velocity of air if $\mu = 2 \times 10^{-6}$ poise. [15]

5 a) The distance between the plates is 0.5 cm and velocity is 10 cm/sec, and the fluid is ethyl alcohol at 273K having a viscosity of 1.77 cp. Calculate the shear stress and shear rate. [8]

b) Explain two parameter models for non-Newtonian fluids. [7]

6 Derive the equations for velocity profile and average velocity for flow of two immiscible fluids between a pair of horizontal plates under the influence of a pressure gradient. [15]

7 a) Derive the equation of continuity considering spherical co-ordinates. [12]

b) Reduce the equation for incompressible fluids. [3]

8 a) What is intensity of turbulence? [3]

b) Explain instantaneous velocity, time smoothed velocity and velocity fluctuation. [6]

c) Discuss the concepts of mixing length and eddy viscosity. How do they help to explain turbulent nature of the fluid? [6]