Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. Sem – IV Examination May 2011

Subject code: 741601

Subject Name: Advanced Transport Phenomena

Date:16/05/2011 **Time: 10.30 am – 01.00 pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Write a detail note on definition of friction factors **07**

(b) Discuss about friction factors for flow in tubes **07**

Q.2 **(a)** For forced convection through tubes and slits, describe about analytical calculation of heat transfer coefficient. **07**

(b) Explain how heat transfer coefficient is calculated for forced convection around submerged objects. **07**

OR

(b) A smooth flat thin fin of copper extending out from a tube is 51 mm by 51 mm square. Its temperature is approximately uniform at 82.2 ^{o} C. Cooling air at 15.6 ^{o} C and 1 atm abs flows parallel to the fin at a velocity of 12.2 m/s. for a laminar flow calculate the heat transfer coefficient. **07**

DATA for air:

k= 0.028 w/m.K Density= 1.097 kg/m ^{3}

μ= 1.95x 10^{-5} Pa.s Npr = 0.704

Q.3 **(a)** Discuss about mass transfer in falling films on plane surfaces and for flow around spheres **07**

(b) Describe estimation of interfacial area in a packed column and volumetric mass transfer coefficients for mass transfer and chemical reaction **07**

OR

Q.3 **(a)** For combined heat and mass transfer by free convection, derive expression for local and mean Sherwood numbers **07**

(b) Calculate the value of the mass transfer coefficient for a sphere of naphthalene to air at 45 ^{o}C and 1 atm abs flowing at a velocity of 0.305 m/s. The diameter of the sphere is 25.4 mm. The diffusivity of naphthalene in air at 45 ^{o}C is 6.92 x 10^{-6} m^{2} /s and the vapor pressure of solid naphthalene is 0.555 mm Hg. The other relevant data of air is as follows. **07**

Density of air = 1.113 kg/m ^{3}

Viscosity of air μ= 1.93x 10^{-5} Pa. s

Q.4 **(a)** Compare Laminar and turbulent flow in circular tubes, noncircular tubes and flat plates. **07**

(b) Describe about time smoothed velocity profile near a wall **07**

OR

Q.4 **(a)** For turbulent flow in ducts, discuss estimation of average velocity in a circular tube and application of Prandtl's mixing length formula. **07**

	(b)	A spherical tank of radius R and its drainpipe length of L and diameter D is completely filled with heavy oil. At time t=0 the valve at the bottom of the drainpipe is opened. How long will it take to drain the tank. There is air vent at very top of the tank. Make suitable assumptions.	**07**
Q.5	**(a)**	Write a brief note on 'Computational fluid dynamics'.	**07**
	(b)	Develop a velocity profile equation for free convection in terms of Grashof number	**07**

OR

Q.5	**(a)**	With usual notations, develop equation of continuity	**07**
	(b)	Discuss briefly about Marangoni effect related to effects of interfacial forces on Heat and mass transfer.	**07**

****