

GUJARAT TECHNOLOGICAL UNIVERSITY**M.E -IVth SEMESTER-EXAMINATION – MAY- 2012****Subject code: 741601****Date: 12/05/2012****Subject Name: Advanced Transport Phenomena****Time: 02:30 pm – 05:00 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) Discuss in brief about friction factors for packed bed. **07**
 (b) Explain friction factors for flow around spheres. **07**

Q.2 (a) Evaluate the pressure gradient required to flow a fluid in horizontal smooth circular tube of inside diameter 4 cm at a mass rate of 1020 g/s at 20°C. At this temperature the density of the fluid is 0.95 g/cc and its viscosity is 1.95 cp. Assume suitable value of friction factor. **07**
 (b) Discuss definition of Heat transfer coefficient **07**

OR

(b) Explain heat transfer coefficient for forced convection in tubes **07**

Q.3 (a) Discuss in brief about mass transfer coefficient in two phases **07**
 (b) For mass transfer and reaction discuss model insensitive correlations for absorption with rapid reaction **07**

OR

Q.3 (a) Give a brief account on mass transfer for flow around spheres **07**
 (b) A large volume of pure water at 26.1°C is flowing parallel to flat plate of solid benzoic acid where $L = 0.244$ m in the direction of flow. The water velocity is 0.061 m/s. The solubility of benzoic acid in water is 0.0298 kg/mol/m³. The diffusivity of benzoic acid in water is 1.245×10^{-9} m²/s. Calculate the mass transfer coefficient and flux. **07**

Q.4 (a) A liquid of constant density and viscosity is in cylindrical container. The container is caused to rotate about its own axis, the cylindrical axis is vertical. Find the shape of free surface of the liquid when steady state has been established. **07**
 (b) Discuss Taylor series development in the viscous sub layer for time smoothed velocity profile near a wall. **07**

OR

Q.4 (a) Write in brief about 'Heat transfer coefficient for forced convection through packed beds'. **07**
 (b) Air at 70°F and 1 atm. is to be pumped through a straight 2 inch i. d. tube at a rate of 70 lbm/hr. A section of the tube is to be heated to an inside wall temperature of 250°F to raise the air temperature to 230°F. The value of Prandtl Number is 0.7 and viscosity ratio $\mu_b / \mu_o = 0.89$. What heated length is required. **07**

Q.5 (a) Obtain concentration profile equation for diffusion with homogeneous chemical reaction. **07**
 (b) Discuss features and applications of Computational fluid dynamics **07**

OR

Q.5 (a) Write briefly about Free convection. **07**
 (b) Develop equation of motion with usual notations. **07**
