

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III • EXAMINATION – WINTER • 2014****Subject Code:2130502****Date:01/01/2015****Subject Name: Fluid Flow Operation****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)** State and Explain Newton's law of viscosity. Explain Newtonian and Non-Newtonian fluids. **07**
- (b)** A simple U-Tube manometer is installed across an orifice meter. The manometer is filled with mercury (specific gravity 13.6), and the liquid above the mercury is carbon tetrachloride (specific gravity 1.6). The manometer reads 200mm. What is the pressure difference over the manometer in Newtons per square meter? **07**
- Q.2 (a)** Discuss with clear diagram construction and working of continuous gravity decanter. Derive equation for the height of the heavy liquid outlet above vessel bottom. **07**
- (b)** Derive Bernoulli's equation stating all assumptions. **07**
- OR**
- (b)** An oil is flowing in a 2.0 c.m. I.D. tube at rate 20 lit/min. The oil viscosity is 40 cp and its specific gravity is 0.98. Calculate pressure gradient, Wall shear Stress, and velocity at the centre of pipe. **07**
- Q.3 (a)** Define Drag coefficient. Show relation between Drag coefficient and Reynold's No. **07**
- (b)** A partial oxidation is carried out by passing air with Hydrocarbon (1.2 mole %) through 40 m.m. diameter tube packed with (3mm × 3mm) cylindrical catalyst pellets for 0.9 meter length. The air enters at 340°C and 2 atmosphere pressure with a superficial velocity of 1 meter/sec. What is the pressure drop through packed bed? Assume $\epsilon = 0.4$, Viscosity of air $\mu = 0.028$ cp. The pressure drop is given by
- $$\frac{\Delta P}{L} = \frac{150 V_o \mu (1 - \epsilon)^2}{\Phi_s^2 D_p^2 \epsilon^3} + \frac{1.75 \rho V_o^2 (1 - \epsilon)}{\Phi_s D_p \epsilon^3}$$
- OR**
- Q.3 (a)** Discuss with neat diagram construction and working of any one flow meter. **07**
- (b)** Natural gas consisting essentially of methane is to be transported through a .5 meter ID pipeline over flat land. Each pumping station increases the pressure to 7.0 Kg/cm² abs and the pressure drops to 1.75 Kg/cm² abs at the inlet to the next pumping station 75 K.M. away. What is the gas flow rate in cubic feet per hour measured at 15°C and 760 mm Hg pressure? **07**
- Q.4 (a)** Discuss construction and working of single stage centrifugal pump. **07**
- (b)** Explain what is cavitation and when priming is required? Explain what NPSH is. **07**
- OR**
- Q.4 (a)** Discuss with illustration application of Dimensional analysis. **07**

- (b) Discuss velocity Distribution for laminar flow for Newtonian fluids in circular pipe and Derive Hagen- Poiseuille equation. **07**
- Q.5** (a) Estimate the terminal velocity for $D_p = 0.161$ mm of lime stone with density 2800 Kg/M^3 falling in water at 30°C . Viscosity of water is 0.8 cp and take drag coefficient equal to 20. Find N_{Rep} . **07**
- (b) Discuss Fluidization. **07**
- OR**
- Q.5** (a) Discuss different types of valves used in chemical industries. **07**
- (b) Discuss various types of flow observed in two phase flow. **07**
