

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-III • EXAMINATION – WINTER • 2014****Subject Code: 130502****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) Answer the following: 07**

- i. Laminar flow
- ii. Significance of Reynolds Number
- iii. Stream tube
- iv. Potential flow
- v. Cavitation
- vi. NPSH
- vii. Define hydraulic radius

**(b) Discuss Rayleigh Method for the application of dimensional analysis to fluid flow: 07**

For the flow of fluid through long, straight and circular pipe, the pressure drop/loss due to friction depends upon the following variables like diameter of pipe, length of pipe, velocity of fluid, density of fluid and viscosity of fluid. Obtain the relation between pressure drop and these variables.

$$\Delta P = f(D, u, \rho, \mu, L)$$

**Q.2 (a) Explain hydrostatic equilibrium for stationary fluid and derive barometric equation. 07****(b) Differentiate between the Newtonian and Non Newtonian fluids. 07****OR****(b) A simple U-tube manometer is installed across an orifice meter. The manometric fluid is mercury (having sp.gr.13.6) and flowing fluid through piping is carbon tetrachloride (sp.gr.1.6). The manometer reads 200 mm. What is the pressure difference over a manometer in N/m<sup>2</sup>? 07****Q.3 (a) Derive Bernoulli's equation for the flow with friction through inclined stream tube. 07****(b) Derive the relation between mass velocity and average velocity. 07****OR****Q.3 (a) Find the drop in pressure due to friction in a 60m long and 25 mm i.d. pipe when water is flowing at a rate of 10kg/s. If the pressure drop falls by one half, what will the new flow rate be? 07**

Density of water: 1000 kg/m<sup>3</sup> and viscosity of water: 0.0008 Pa.s

**(b) Explain centrifugal decanter in detail. 07**

**Q.4 (a)** The velocity profile for laminar flow in a circular pipe is given by **07**

$$u = u_{\max} \{1 - (r/R)^2\}$$

$u_{\max}$  = constant velocity at the centre line of the pipe

$r$  = radial distance from the centre line of pipe

$R$  = radius of pipe

(i) What is average velocity?

(ii) Show that the velocity gradient varies linearly with radius.

(iii) Find the velocity gradient at the wall and also at the centre line.

**(b)** Explain construction and working principle of venturimeter. **07**

**OR**

**Q.4 (a)** Discuss different types of valves. **07**

**(b)** Define minimum fluidization velocity and conditions for the fluidization. **07**

**Q.5 (a)** Water at 303 K flows through a horizontal pipe 20mm in diameter, in which the pressure drop per meter length is to be limited to 2.35 Pa/m. Calculate the volumetric flow rate. **07**

Data: density: 996 kg/m<sup>3</sup> and viscosity of water = 0.8 mPa.s

**(b)** What is hydraulically smooth pipe and also explain the importance of roughness parameter. **07**

**OR**

**Q.5 (a)** Define and explain: **07**

i. Define drag coefficient.

ii. Discuss bubbling fluidization.

iii. Differentiate gate valves and globe valves.

iv. Write down the velocity equation for the orifice meter.

v. What is draft tubes?

vi. Write down barometric equation and its significance.

vii. Draw a diagram for development of turbulent boundary layer on a flat plate.

**(b)** Explain the effects of pipe fittings, valves and joints on the flow of fluids. **07**

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