

Roll Number: \_\_\_\_\_

*Thapar University, Patiala*

**Department of Chemical/Civil Engineering**

B. E. (Second Year): Semester-III

Course Code: UES-011

Course Name: Thermo-Fluids (**Fluid Mechanics**)

Sep 20, 2016

Tuesday, 10.30 – 12.30 Hrs

Time: 2 Hours, M. Marks: 50

Name of Faculty: RM/SJS/TK/RB/JPK

**Note:** Attempt all questions.

All parts of a question must be attempted at a place

Attempt the paper as per the portion you have studied i.e. Thermodynamics/Fluid Mechanics

Write at the top of your answer sheet either Thermodynamics or Fluid Mechanics

Assume missing data, if any, suitably

**Q1:** Answer the following questions.

- (a) Derive Euler's equation of motion for a fluid flow. [3]
- (b) For a laminar flow in circular pipe, derive expressions for shear stress distribution and velocity distribution. Also, sketch the profiles. [2+4+1]
- (c) What is meant by boundary layer flow? What is its significance in fluid flow? [2]

**Q2:** (a) A cylinder of 150 mm radius rotates concentrically inside a fixed cylinder of 152 mm radius. Both cylinders are 500 mm long. Determine the viscosity of liquid, which fills the space between the cylinders if a torque of 1.2 N-m is required to maintain the angular velocity of 50 rpm. [5]

- (b) The pressure of water flowing through a pipe is measured by the arrangement shown in the Fig. 1. For the values given, calculate pressure in pipe. [5]

**Q3:** (a) **Figure 2** shows a radial gate AB of radius 2 m. The width of the gate is also 2 m. Determine the magnitude and direction of the resultant force acting on it. [5]

- (b) The diameter of a pipe bend is 150 mm at inlet and 350 mm at the outlet, and the flow is turned through  $60^\circ$  in the vertical plane. The axis at inlet is horizontal and the centre of outlet is 2 m below the centre at inlet. The total volume of fluid contained in the bend is  $0.1 \text{ m}^3$ . Neglecting friction, calculate the magnitude and direction of the force exerted on the bend by water flowing through it at  $0.23 \text{ m}^3/\text{s}$  when the inlet pressure is 2 bar. [6]

**Q4:** (a) A vertical venturimeter carries a liquid of specific gravity 0.80 and has inlet and throat diameters of 150 mm and 75 mm, respectively. The pressure connection at the throat is 150 mm above that at the inlet. If the actual flow rate is 40 litres per sec and the coefficient of discharge is 0.96, calculate (i) the pressure difference between the inlet and the throat and (ii) U-tube differential manometer reading connected between these points. [5]

- (b) A pipeline 0.225 m diameter and 1580 m long has a slope of 1 in 200 for the first 790 m and 1 in 100 for the next 790 m. The pressure at the upper end of pipeline is 107.91 kPa and at the lower end is 53.955 kPa. Taking friction factor = 0.032, determine discharge through the pipe. [5]

**Q5:** (a) Explain with the help of diagram, how a Pitot tube and a piezometer is used to measure the velocity of flow. [3]

(b) A Pitot-static tube inserted in a pipe of 400 mm diameter records stagnation pressure of  $10 \text{ kN/m}^2$  at the center of pipe. The static vacuum pressure is 100 mm of mercury. Determine the rate of flow of water through the pipe so that the mean velocity of flow is 0.8 times the velocity at the center. Given, coefficient of velocity = 0.93. [4]

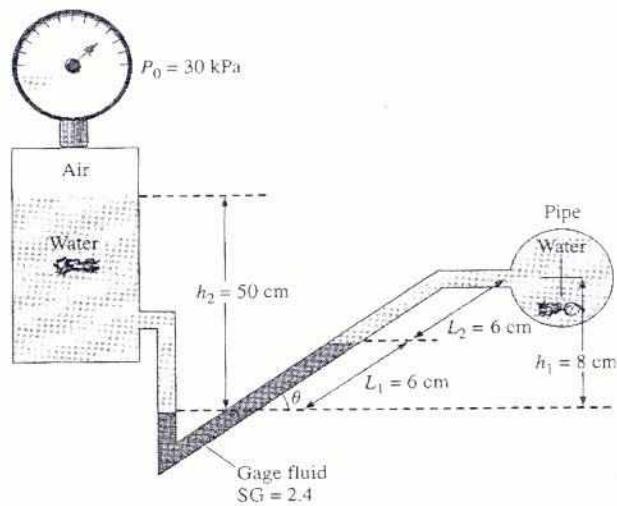


Fig. 1

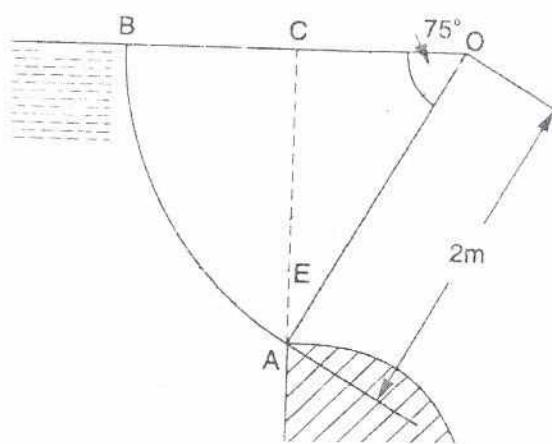


Fig. 2