

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**PDDC - SEMESTER-III • EXAMINATION – WINTER • 2014**

**Subject Code: X 31901****Date: 24-12-2014****Subject Name: Fluid Mechanics****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)** Define the following terms. **07**
- (1) Mass density
  - (2) Weight density
  - (3) Specific volume
  - (4) Specific gravity
  - (5) Surface tension
  - (6) Dynamic viscosity
  - (7) Kinematic viscosity
- (b)** The dynamic viscosity of an oil used for lubrication between a shaft and sleeve is 10 poise. The shaft is of 70 mm diameter and rotates at 300 rpm. Calculate the power lost in the bearing for a sleeve length of 150 mm. The oil film is maintain at 1.0 mm thickness. **07**
- Q.2 (a)** What do you understand by single column manometer ? Deduce an expression for the pressure measurement. **07**
- (b)** State and explain Pascal's law . **07**
- OR**
- (b)** A fluid flow field is given by  $V = x^2yi + y^2zj - (2xyz + yz^2)k$  , show that it is case of possible steady incompressible fluid flow, calculate resultant velocity at point (2,1,3) **07**
- Q.3 (a)** Differentiate between the following : **07**
- (1) Laminar flow and Turbulent flow
  - (2) Compressible flow and Incompressible flow
  - (3) Uniform flow and Non uniform flow
- (b)** A crude oil of viscosity 0.93 poise and relative density 0.87 is flowing through a horizontal circular pipe of diameter 120 mm and a length of 6 meter long. Calculate the difference of pressure at the two ends of the pipe, if flow rate is 0.003 m<sup>3</sup>/s **07**
- OR**
- Q.3 (a)** Define total hydrostatic force and centre of pressure. Derive an expression for the force exerted on a sub-merged vertical plane surface by the static liquid and locate the position of centre of pressure. **07**
- (b)** Determine the total pressure on a circular plate of diameter 2.0 meter which is placed vertically in water such that the center of plate is 5.0 meter below the free surface of water. Find the position of centre of pressure . **07**
- Q.4 (a)** Deduce an expression for the meta centric height of a floating body experimentally with usual notation **07**
- (b)** A wooden block of size 2.0 meter x 1 meter x 0.8 meter floats in water. Determine meta centric height of the block. Specific gravity = 0.73 for wooden block. **07**

**OR**

- Q.4** (a) State Buckingham's  $\pi$  theorem. What do you mean by repeating variables ? How are the repeating variables selected in dimensional analysis **07**
- (b) Derive an expression for velocity of sound wave for a compressible fluid when the process is assumed as : **07**
- (1) Isothermal
- (2) Adiabatic

- Q.5** (a) Derive an expression for the velocity distribution for viscous flow through a circular pipe. Also sketch the velocity distribution and shear stress distribution across a section of the pipe. **07**
- (b) A crude oil of viscosity 0.90 poise and relative density 0.88 is flowing through a horizontal circular pipe of diameter 100 mm and a length of 5 meter long. Calculate the difference of pressure at the two ends of the pipe, if flow rate is  $0.005 \text{ m}^3/\text{s}$  **07**

**OR**

- Q.5** (a) A horizontal Venturimeter 60 cm x 30 cm is used to measure the water flow through a pipe. The head causing the flow is measured as 13 cm of Hg by mercury U tube manometer. Find the flow rate in liters/min. Take  $C_d=0.90$  **07**
- (b) Derive an expression for the discharge of water over the V notch with usual notation. **07**

\*\*\*\*\*