

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-III • EXAMINATION – WINTER • 2014****Subject Code: 130101****Date: 30-12-2014****Subject Name: Fluid Mechanics****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)** Explain the following terms: (Any SEVEN) **07**
- |                        |                       |
|------------------------|-----------------------|
| 1. Surface Tension     | 2. Cavitation         |
| 3. Non-Newtonian Fluid | 4. Continuum          |
| 5. Buoyancy            | 6. Metacentre         |
| 7. Vorticity           | 8. Dynamic Similarity |
- (b)** An oil of viscosity 4 poise is used for lubrication between a shaft and sleeve. The diameter of the shaft is 0.5 m and it rotates at 250 rpm. Calculate the power lost in oil for a sleeve length of 100 mm. The thickness of oil film is 1 mm. **07**
- Q.2 (a)** An inverted differential manometer is connected with two pipes A and B in which water is flowing as shown in fig. 1. The manometric fluid is oil of specific gravity 0.8. Refer the figure and find the pressure difference between A and B. **07**
- (b)** Fig. 2 shows a gate having a quadrant shape of radius of 1 m subjected to water pressure. Find the resultant force and its inclination with the horizontal. Take the length of gate as 2 m. **07**
- OR**
- (b)** Explain the condition of stability for a submerged and floating body with neat diagram. **07**
- Q.3 (a)** A solid cube of sides 0.5 m each is made of a material of relative density 0.5. The cube floats in a liquid of relative density 0.95 with two of its faces horizontal. Examine its stability. **07**
- (b)** A rectangular channel 2 m wide has a discharge of 250 liters/sec, which is measured by a right angled V-notch. Find the position of the apex of the notch from the bed of the channel if maximum depth of water is not to exceed 1.3 m. Take  $C_d = 0.62$ . **07**
- OR**
- Q.3 (a)** Prove that the scale ratio for discharge for a distorted model is given as **07**
- $$Q_p / Q_m = (L_r)_H (L_r)_V^{1.5}$$
- (b)** The resisting force R of a supersonic plane during flight can be considered as dependent upon the length of the aircraft l, velocity V, viscosity of air  $\mu$ , air density  $\rho$  and bulk modulus of air K. Express the functional relationship between these variables with the resisting force. **07**
- Q.4 (a)** Distinguish between: (Any TWO) **07**
1. Steady flow – Unsteady flow
  2. Laminar flow – Turbulent flow
  3. Rotational flow – Irrotational flow
- (b)** The velocity component in a two-dimensional flow field for an incompressible fluid are as follows: **07**
- $$u = y^3/3 + 2x - x^2y \text{ and } v = xy^2 - 2y - x^3/3$$
- Obtain an expression for the stream function  $\psi$ .

**OR**

- Q.4 (a)** Water flows through a pipe AB 1.2 m diameter at 3 m/s and then passes through a pipe BC 1.5 m diameter. At C, the pipe branches. Branch CD is 0.8 m in diameter and carries one-third of the flow in AB. The flow velocity in branch CE is 2.5 m/s. Find the discharge in AB, the velocity in BC, the velocity in CD and the diameter of CE. **07**
- (b)** A vessel, cylindrical in shape and closed at the top and bottom, contains water up to a height of 80 cm. The diameter of the vessel is 20 cm and length of vessel 120 cm. The vessel is rotated at a speed of 400 r.p.m. about its vertical axis. Find the height of parabola formed. **07**
- Q.5 (a)** Derive an expression for the Hagen Poiseuille's formula. **07**
- (b)** Find the discharge of water flowing through a pipe 30 cm diameter placed in an inclined position where a venture meter is inserted, having a throat diameter of 15 cm. The difference of pressure between the main and throat is measured by a liquid of specific gravity 0.6 in an inverted U-tube which gives a reading of 30 cm. The loss of head between the main and throat is 0.2 times the kinetic head of the pipe. **07**

**OR**

- Q.5 (a)** Derive an expression for the loss of head due to friction in pipes. **07**
- (b)** Explain the propagation of pressure waves with neat sketch. **07**

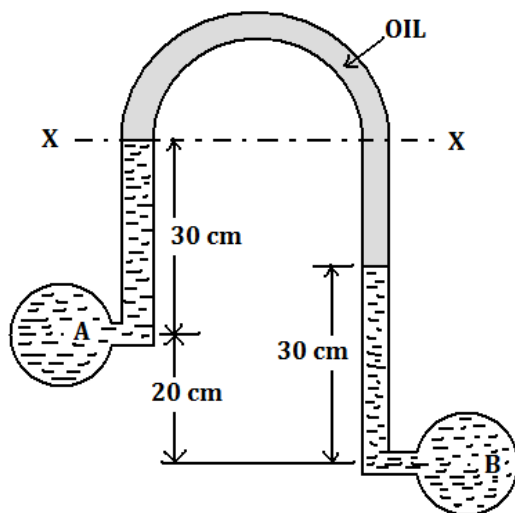


Fig. 1

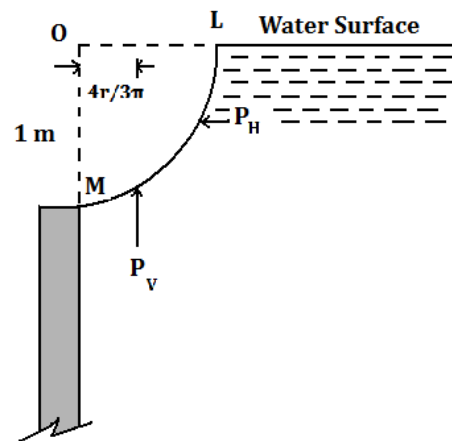


Fig. 2

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