Seat No.: Enrolment No
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Subject Code: 130101

**Instructions:** 

**Subject Name: Fluid Mechanics** 

1. Attempt all questions.

2. Make suitable assumptions wherever necessary.

3. Figures to the right indicate full marks.

Time: 02.30 pm - 05.00 pm

## **GUJARAT TECHNOLOGICAL UNIVERSITY**

BE - SEMESTER-III • EXAMINATION – WINTER • 2014

Date: 30-12-2014

**Total Marks: 70** 

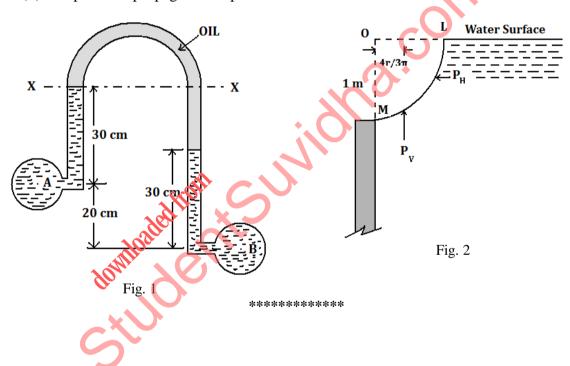
<b>Q.1</b>	(a)	Explain the following terms: (Any SEVEN)	07
		<ol> <li>Surface Tension</li> <li>Cavitation</li> </ol>	
		3. Non-Newtonian Fluid 4. Continuum	
		5. Buoyancy 6. Metacentre	
		7. Vorticity 8. Dynamic Similarity	
	<b>(b)</b>	An oil of viscosity 4 poise is used for lubrication between a shaft 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 menometric fluid is oil of specific gravity 0.8. Refer the figure and find the pressure difference between A and B.	07
	<b>(b)</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
	<b>(b)</b>	Explain the condition of stability for a submerged and floating body with neat diagram.	07
Q.3	(a)	A solid cube desides 0.5 m each is made of a material of relative density 0.5. The cube thats in a liquid of relative density 0.95 with two of its faces	07
	(b)	horizontal Examine its stability. 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 $Q_p / Q_m = (L_r)_H (L_r)_V^{1.5}$	07
	(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)  1. Steady flow – Unsteady flow  2. Laminar flow – Turbulent flow  3. Rotational flow – Irrotational flow	07
	(b)	The velocity component in a two-dimensional flow field for an incompressible fluid are as follows: $u=y^3/3+2x-x^2y \text{ and } v=xy^2-2y-x^3/3$	07
		Obtain an expression for the stream function $\psi$ . <b>OR</b>	
			1

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- 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.
  - (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.
- Q.5 (a) Derive an expression for the Hagen Poiseuille's formula.
  - (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.

OR

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



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