U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

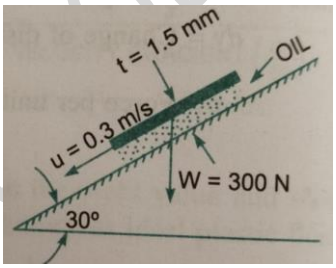
Autonomous Institute Affiliated to VTU

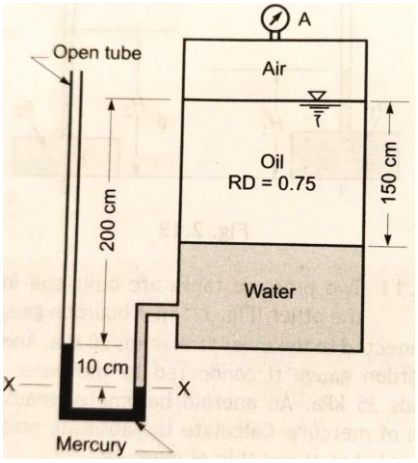
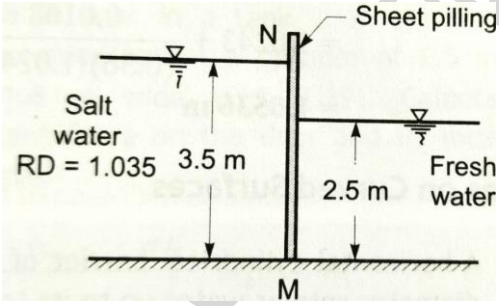
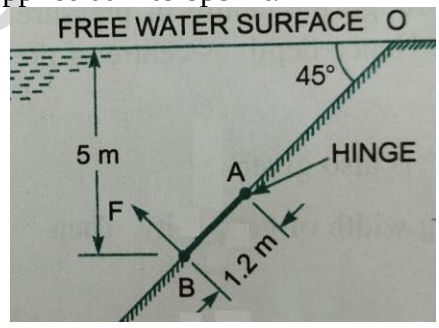
June / July 2024 Semester End Make-Up Examinations

Programme: B.E. **Semester: III**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 23CV3PCFME / 22CV3PCFME **Max Marks: 100**
Course: Fluid Mechanics

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	CO	PO	Marks
1	a)	The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. Centre of the pipe is 12 cm below the level of mercury in the right limb. Determine the pressure of the fluid in the pipe if the difference of mercury level in the two limbs is 20 cm.	CO 1	PO1	6
	b)	Calculate the dynamic viscosity of an oil, which is used for lubrication between a square plate of size 0.8 m x 0.8 m and an inclined plane with angle of inclination 30º as shown in Fig. 1. The weight of the square plate is 300 N and it slides down the inclined plane with a uniform velocity of 0.3 m/s. The thickness of oil film is 1.5 mm.  Fig. 1	CO 1	PO1	6
	c)	In a static fluid mass, prove that the pressure does not change along the x or y direction. Also, derive the expression for the variation of pressure along the z-direction.	CO 1	PO1	8
		OR			
2	a)	A hydraulic press has a ram of 150 mm and a plunger of 20 mm diameter. Calculate the force required on the plunger to lift a weight of 40 kN, when the plunger level is 10 cm above that of the ram level and fluid in the hydraulic press is water.	CO 1	PO1	6
	b)	Define capillarity and explain the factors affecting the same. Also, derive the expression for capillarity in a small tube.	CO 1	PO1	6

		c)	A tank in Fig. 2 is closed at top and contains air at a pressure p_A. Calculate the value of p_A for the manometer reading shown in the figure.  Fig. 2	*CO 1*	*PO1*	**8**
			UNIT - II			
	3	a)	A sheet piling holds fresh water and salt water (sp.gr. = 1.035) on either sides of it as shown in Fig. 3. Determine (i) the magnitude and direction of the resultant total pressure on the piling and (ii) the moment about the base M.  Fig. 3	*CO 1*	*PO1*	**10**
		b)	An inclined rectangular sluice gate AB, 1.2 m deep x 5 m wide as shown in Fig. 4 is installed to control the discharge of water. The end A is hinged. Determine the force normal to the gate required to be applied at B to open it.  Fig. 4	*CO 1*	*PO1*	**10**
			UNIT - III			
	4	a)	Explain continuity equation. Derive the expression for the same in Cartesian coordinate system, for a steady incompressible flow.	*CO 2*	*PO1*	**10**
		b)	The stream function $\Psi = 4xy$ describes the incompressible flow. Determine (i) the total velocity and acceleration at points A (x = 3, y = 0) and B (x = 3, y =1) and (ii) the flow across AB.	*CO 2*	*PO1*	**10**

			UNIT - IV			
	5	a)	Pressure difference between the static and stagnation tubes of a Prandtl pitot tube placed at the centre of a 200 mm pipe line is 40 mm of water. Discharge of water through the pipe is 1365 litres/minute. Assume the average velocity through the pipe as 0.83 times the centre velocity. Calculate the coefficient of the pitot tube.	***CO** 2*	***PO1***	**5**
		b)	A pipe 300 m long has a slope of 1 in 100 and tapers from 1.2 m diameter at the high end to 0.6 m diameter at the low end. Quantity of water flowing is 5400 litres/minute. If the pressure at the higher end is 68.67 kPa, determine the pressure at the lower end. Neglect the losses in the pipe.	***CO** 2*	***PO1***	**7**
		c)	A venturi meter is connected to a vertical pipeline in which the flow is upward. With a neat sketch, explain the term venturi head and derive the expression for discharge through the venturi meter.	***CO** 2*	***PO1***	**8**
			OR			
	6	a)	With a neat sketch explain the term vena contracta for a free jet from an orifice, and discuss its importance in fluid mechanics.	***CO** 2*	***PO1***	**5**
		b)	A triangular notch is used to measure flow in a channel under a head of 0.2 m. If the discharge is to be measured within 3% accuracy, determine the maximum velocity of approach that can be neglected.	***CO** 2*	***PO1***	**7**
		c)	The maximum flow through a rectangular flume 1.8 m wide and 1.2 m deep is 1.65 m^3/s. It is proposed to install a suppressed sharp crested rectangular weir across the flume to measure the flow. Determine the maximum height at which the weir crest can be placed in order that water may not overflow the sides of the flume. Assume coefficient of discharge $C_D = 0.6$.	***CO** 2*	***PO1***	**8**
			UNIT - V			
	7	a)	It is a common experience that when a domestic water tap is closed very quickly, a heavy knocking sound is heard and the entire pipe vibrates. Explain this phenomenon and the factors affecting it.	***CO** 3*	***PO1***	**5**
		b)	Determine the rate of flow of water through a pipe of diameter 20 cm and length 50 m when one end of the pipe is connected to a tank and other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of water in the tank is 4 m above the centre of the pipe. Consider all minor losses. Coefficient of friction for the pipe is 0.009.	***CO** 3*	***PO2***	**7**
		c)	The rate of flow of water through a horizontal pipe is 0.25 m^3/s. The diameter of the pipe is suddenly enlarged from 200 mm to 400 mm. Pressure intensity in the smaller pipe is 11.772 N/cm^2. Determine (i) loss of head due to sudden enlargement and (ii) pressure intensity in the large pipe.	***CO** 3*	***PO1***	**8**

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