U.S.N.										

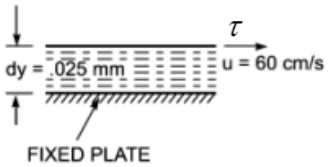
B.M.S. College of Engineering, Bengaluru-560019

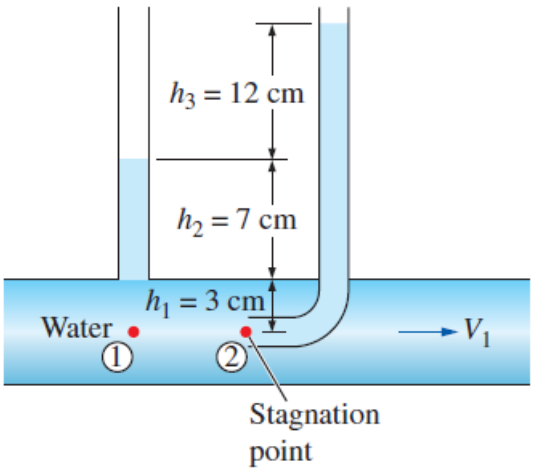
Autonomous Institute Affiliated to VTU

April 2024 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 23AS3PCFMS **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.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Define the following i) Solids and Fluids ii) Buoyancy iii) Centre of pressure iv) Vapour pressure and cavitation v) Newtonian and Non-Newtonian fluid	*CO 1*	*PO 1*	**10**
	b)	What is the bulk modulus of elasticity of a liquid which is compressed in a cylinder from a volume of 0.0125 m^3 at 80 N/cm^2 pressure to a volume of 0.0124 m^3 at 150 N/cm^2 pressure?	*CO 1*	*PO 1* *PO 2*	**05**
	c)	A plate 0.025 mm distant from a fixed plate, moves at 60 cm/s and requires a shear stress of 2 N/m^2 to maintain this speed (Figure 1). Determine the fluid viscosity between the plates.  Figure 1: Schematic for Problem 1c.	*CO 1*	*PO 1* *PO 2*	**05**
		OR			
2	a)	What is the boundary layer? What happens to the flow velocity near the wall? Draw the velocity profile inside the boundary layer.	*CO 1*	*PO 1* *PO 2*	**04**
	b)	Consider the steady, two-dimensional velocity field, $\vec{V} = (u,v) = (0.5+0.8x)\hat{i} + (1.5-0.8y)\,j$ where lengths are in units of meters (m), time in seconds (s), and velocities in m/s. Calculate the various kinematic properties, namely, i) Rate of translation ii) Rate of rotation	*CO 1*	*PO 1* *PO 2*	**06**

			iii) Linear strain rate, shear strain rate and volumetric strain rate iv) Verify if this flow is incompressible			
		c)	State Pascal's Law and derive an expression for the following i) Pressure at a point ii) Variation of pressure with depth	*CO 1*	*PO 1*	**10**
			UNIT - II			
	3	a)	Derive continuity equation for a three dimensional (3D) flow and deduce an expression considering unsteady and incompressible flow.	*CO 1*	*PO 1* *PO 2*	**10**
		b)	Explain any five different types of flows in detail with neat sketches.	*CO 1*	*PO 1*	**10**
			UNIT - III			
	4	a)	State Bernoulli's theorem for steady flow of an incompressible fluid and derive an expression for Bernoulli's equation. Write down all the assumptions involved in its derivation.	*CO 2*	*PO 1* *PO 2*	**12**
		b)	A piezometer and a Pitot tube are tapped into a horizontal water pipe, as shown in figure 2, to measure static and stagnation (static and dynamic) pressures. For the indicated water column heights, determine the velocity at the center of the pipe.  Figure 2: Schematic for Problem 4b.	*CO 4*	*PO 1* *PO 2* *PO 4*	**08**
			UNIT – IV			
	5	a)	Define Reynold's number. What is the significance of it?	*CO 2*	*PO 1*	**04**
		b)	Deduce an expression for the Hagen-Poiseuille equation considering viscous fluid flow through a circular pipe.	*CO 2*	*PO 2*	**16**
			OR			
	6	a)	Derive an expression for Darcy-Weisbach equation and Chezy's formula.	*CO 2*	*PO 1*	**14**

		b)	Analyze the following boundary layer parameters for the velocity distribution $\frac{u}{U} = \left(\frac{y}{\delta}\right)^3$. i) Displacement thickness ii) Momentum thickness iii) Energy thickness	*CO 2*	*PO 2*	**06**
			UNIT - V			
	7	a)	Define dimension and differentiate between primary and secondary dimension.	*CO 3*	*PO 1*	**05**
		b)	i) State and explain about the Buckingham's pi-theorem. ii) Check the dimensional homogeneity of the following Bernoulli's equation $P_1 + \frac{1}{2}\rho V^2 + \rho g z = C$	*CO 3*	*PO 1* *PO 2*	**10**
		c)	Distinguish between geometric similarity and kinematic similarity.	*CO 3*	*PO 1*	**05**

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