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

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: III**

Branch: Aerospace Engineering **Duration: 3 hrs.**

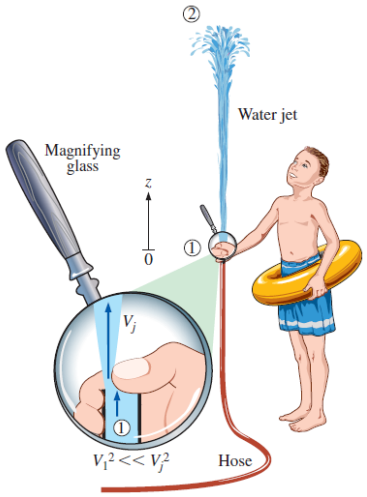
Course Code: 23AS3PCFMS **Max Marks: 100**

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.

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)		Define the following i. Newtonian and a non-Newtonian fluid ii. Surface tension iii. Intensive properties and extensive properties with an example iv. Capillarity v. Density and specific weight of a fluid	*CO 1*	*PO 1*	**10**
	b)		Derive an expression to find the magnitude of the resultant force (F_R) and the vertical location of the line of action of the resultant force (y_P) acting on a plane surface of a completely submerged plate in a homogeneous fluid at an angle θ.	*CO 2*	*PO 1,2*	**10**
			OR			
2	a)		i. Define fluid. How does it differ from solid? ii. State and give an expression for Newton's law of viscosity with a neat sketch. iii. Explain the concept of a fluid as continuum. Why is this concept essential in fluid mechanics?	*CO 1*	*PO 1*	**10**
	b)		State Pascal's law and derive an expression for the following with proper assumptions i. Pressure at a point ii. Variation of pressure with depth	*CO 1*	*PO 1,2*	**10**
			UNIT - II			
3	a)		Explain five different types of flows in detail with a neat sketch.	*CO 1*	*PO 1*	**10**
	b)		Derive continuity equation for a 3D flow and deduce an expression considering unsteady and incompressible flow.	*CO 2*	*PO 1,2*	**10**
			OR			
4	a)		i. Define stream line, streak line and path line with a neat sketch	*CO 1*	*PO 1*	**10**

			ii. Differentiate between Lagrangian and Eulerian descriptions of fluid flow			
		b)	The velocity vector in a fluid flow is given by $\vec{V} = 4x\hat{i} - 10x^2y\hat{j} + 2t\hat{k}$ Find the velocity and acceleration of a fluid particle at (2,1,3) at time t=1.	*CO 3*	*PO 1,2*	**10**
			UNIT - III			
	5	a)	Differentiate between Venturi meter and Orifice meter with a neat sketch.	*CO 1*	*PO 1,4*	**8**
		b)	Water is flowing from a garden hose (Figure 1). A child places his thumb to cover most of the hose outlet, causing a thin jet of high-speed water to emerge. i. The pressure in the hose just upstream of his thumb is 400 kPa. If the hose is held upward, what is the maximum height that the jet could achieve? ii. What is the maximum height that the jet could achieve if the pressure in the hose just upstream of his thumb is increased to 600 kPa?  Figure 1: Schematic for the problem 5b. Insert shows a magnified view of the hose outlet region.	*CO 2*	*PO 1,2,4*	**12**
			OR			
	6	a)	Define static and stagnation pressures with a neat sketch.	*CO 1*	*PO 1*	**4**
		b)	Describe different types of notches that are used in open channels? Based on your understanding, in which type of notch, the discharge would be higher?	*CO 1*	*PO 1,4*	**4**
		c)	State and derive an expression for Bernoulli's equation. Write down all the assumptions involved in its derivation.	*CO 3*	*PO 1,2,4*	**12**
			UNIT - IV			
	7	a)	Briefly explain the terms i. Displacement thicknesses ii. Momentum thicknesses iii. Energy thicknesses	*CO 1*	*PO 1*	**6**

		b)	Perform the order of magnitude analysis for boundary layer equations (continuity, x-momentum and y-momentum equation) showing how inertia and viscous terms behave with pressure gradient by stating the proper assumptions.	*CO 2*	*PO 1,2*	**14**
			OR			
	8	a)	Find the displacement thickness for the velocity distribution in the boundary layer given by $\frac{u}{U} = 2\frac{y}{\delta} - 4\left(\frac{y}{\delta}\right)^2 + 2\left(\frac{y}{\delta}\right)^3$.	*CO 3*	*PO 1,2*	**4**
		b)	Derive an expression for Darcy-Weisbach equation and deduce an expression for Chezy's formula with proper assumptions.	*CO 2*	*PO 1,2*	**16**
			UNIT - V			
	9	a)	i. What is meant by dimensional homogeneity? Explain with an example. ii. Define dimension and different types of dimensions.	*CO 1*	*PO 1*	**10**
		b)	Show that the Bernoulli equation is a good example of a dimensionally homogeneous equation.	*CO 3*	*PO 1,2*	**10**
			OR			
	10	a)	Define the following with proper sketches i. Geometric similarity ii. Kinematic similarity iii. Dynamic similarity	*CO 1*	*PO 1*	**6**
		b)	Explain the procedure of dimensional analysis using the Buckingham Pi theorem with an example.	*CO 2*	*PO 1,2*	**14**

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