U.S.N.										

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

Autonomous Institute Affiliated to VTU

April 2024 Semester End Main Examinations

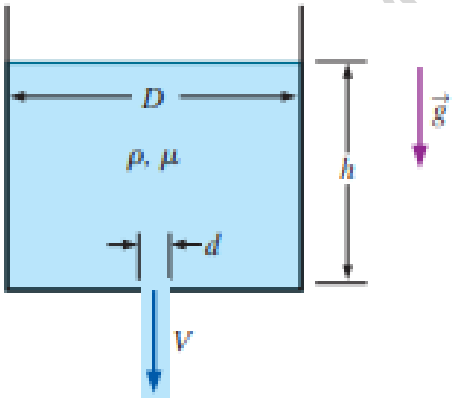
Programme: B.E. **Semester: III**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 19ME3DCFME **Max Marks: 100**
Course: Fluid Mechanics

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.

			CO	PO	Marks
		UNIT - I			
1	a)	With a sketch, explain the variation of shear stress of different kind of fluids with reference to velocity gradient.	*CO1*	*PO1*	**06**
	b)	The velocity of distribution for flow over a plate is gives by $u = 2y-y^2$, where u is the velocity in m/s at a distance 'y' meters above the plate. Determine the velocity gradient and shear stress at the boundary and 1.5 from it. Take the dynamic viscosity of fluid as 0.9 N s/m^2.	*CO1*	*PO2*	**08**
	c)	State and prove the Pascal's law.	*CO1*	*PO2*	**06**
		UNIT - II			
2	a)	Determine the total pressure and center of pressure for an vertical plane submerged in liquid.	*CO1*	*PO1*	**06**
	b)	A circular plate 1.5 m diameter is submerged in water, with its greatest and least depths below the surface being 2 m and 0.75 m respectively. Determine: (i) The total pressure on one face of the plate, and (ii) The position of the centre of pressure.	*CO1*	*PO2*	**06**
	c)	Define Metacentric height. Prove that the height between the point of buyoncy (B) and point of meta center (M) is given by BM=1/V.	*CO1*	*PO1*	**08**
		UNIT - III			
3	a)	Derive the continuity equation in 3D Cartesian coordinate system	*CO2*	*PO1*	**08**
	b)	Find the velocity and acceleration at a point (1, 2, 3) after 1 sec. for a three dimensional flow given by u = yz + t, v = xz – t, w = xy m/s.	*CO2*	*PO2*	**08**
	c)	Explain the methods of describing fluid Motion.	*CO2*	*PO2*	**04**
		OR			

	4	a)	A horizontal venturimeter with inlet diameter 200 mm and throat diameter 100 mm is used to measure the flow of water. The pressure at inlet is 0.18 N/mm^2 and the vacuum pressure at the throat is 280 mm of mercury. Find the rate of flow. Considering the value of C_d is 0.98.	*CO2*	*PO2*	**06**
		b)	State and prove Bernoulli's equation and also list the assumptions made.	*CO2*	*PO1*	**07**
		c)	Water is flowing through a pipe of 5 cm diameter under a pressure of 29.43 N/cm^2 (gauge) and with mean velocity of 2.0 m/s. Find the total head or total energy per unit weight of the water at a cross-section, which is 5 m above the datum line.	*CO2*	*PO2*	**07**
			UNIT - IV			
	5	a)	Prove that the maximum velocity in a circular pipe for viscous flow is equal to two times the average velocity of the flow.	*CO2*	*PO1*	**10**
		b)	A horizontal pipe of diameter 500mm is suddenly contracted to a diameter of 250mm. The pressure intensities in the large and smaller pipe is given as 13.724 N/cm^2 and 11.772 N/cm^2 respectively. Find the loss of head due to contraction if C_c =0.62. Also determine the rate of flow of water.	*CO2*	*PO2*	**10**
			OR			
	6	a)	Derive force exerted by jet strikes the curved plate at one end tangentially when the plate is symmetrical curved plate	*CO2*	*PO1*	**08**
		b)	Explain the force exerted by a flowing fluid on a stationary body in terms Lift an drag.	*CO2*	*PO2*	**08**
		c)	A prototype automobile has an overall drag coefficient of 0.35. Compute the total drag as it moves at 25 m/s through still air at 25°C. The maximum projected frontal area is 2.50 m^2.	*CO2*	*PO2*	**04**
			UNIT - V			
	7	a)	List the uses of 'Dimensional Homogeneity'.	*CO3*	*PO1*	**04**
		b)	Define and write significance of; i) Reynolds number, ii) Mach Number, iii) Weber's number, and iv) Euler's number	*CO3*	*PO1*	**08**

		c)	Albert Einstein is pondering how to write his equation. He knows that energy E is a function of mass m and speed of light c, but he does not know the functional relationship. Pretend that Albert knows nothing about dimensional analysis, you help Albert come up with his equation. A liquid of density ρ and viscosity μ flows by gravity through a hole of diameter d in the bottom of a tank of diameter D (Figure.1).At the start of the experiment, the liquid surface is at height h above the bottom of the tank, as sketched. The liquid exits the tank as a jet with average velocity V straight down as also sketched. Using dimensional analysis, generate a dimensionless relationship for V as a function of the other parameters in the problem. Identify any established non dimensional parameters that appear in your result. (Hint: There are three length scales in this problem. Choose h, ρ and g as repeating variables)  Figure.1	*CO3*	*PO2*	**08**

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