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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

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

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

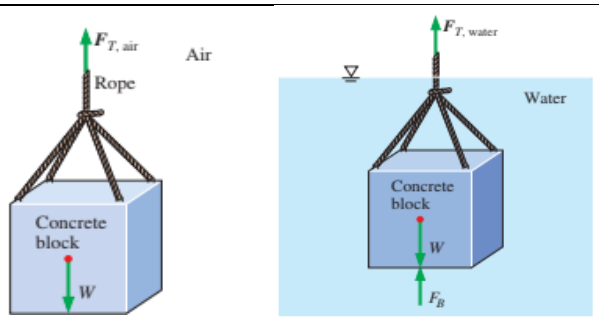
Course Code: 23AS3PCFMS **Max Marks: 100**

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)	Explain Newton's law of viscosity and differentiate between dynamic and kinematic viscosity.	*CO 1*	*PO 1*	**05**
	b)	Define surface tension and capillarity. Discuss their significance in fluid mechanics with examples.	*CO 1*	*PO 1*	**05**
	c)	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)	Define the following i. Newtonian and a non-Newtonian fluid ii. Surface tension iii. Intensive properties and extensive properties. Explain with examples iv. Capillarity v. Vapour pressure	*CO 1*	*PO 1*	**10**
	b)	A crane is used to lower weights into the sea (density = 1025 kg/m^3) for an underwater construction project (Figure 1). Determine the tension in the rope of the crane due to a rectangular 0.4 m x 0.4 m x 3 m concrete block of density = 2300 kg/m^3, when it is- i. Suspended in the air ii. Completely immersed in water	*CO 3*	*PO 1,2*	**10**

			 Figure 1: Schematic for the problem 2b.			
			UNIT - II			
	3	a)	Describe the types of fluid flow based on density variation and viscous effect with suitable examples for each.	*CO 1*	*PO 1*	**05**
		b)	Define streamlines, pathlines, and streaklines. Discuss their importance in fluid mechanics.	*CO 1*	*PO 1*	**05**
		c)	Water flows through a pipe with a diameter of 0.25 m at a velocity of 4 m/s. If the diameter reduces to 0.125 m. Calculate the velocity in the smaller section.	*CO 3*	*PO 1,2*	**10**
			OR			
	4	a)	Derive the continuity equation for an incompressible fluid in three dimensions.	*CO 2*	*PO 1,2*	**10**
		b)	A velocity field is given as V=2x−3y. Verify if the flow satisfies the continuity equation.	*CO 3*	*PO 1,2*	**10**
			UNIT - III			
	5	a)	State Bernoulli's theorem and derive its expression with proper assumptions.	*CO 2*	*PO 1,2*	**12**
		b)	Explain the working principle of a Pitot tube for velocity measurement.	*CO 1*	*PO 1,4*	**08**
			OR			
	6	a)	i. Differentiate between Venturi meter and Orifice meter with neat sketches. ii. Describe the application of Bernoulli's theorem in a venturi meter with a neat diagram.	*CO 1*	*PO 1,4*	**10**
		b)	A venturi meter has a throat diameter of 0.1 m and an inlet diameter of 0.2 m. If the pressure difference is 15 kPa, calculate the flow rate.	*CO 3*	*PO 1,2,4*	**10**
			UNIT - IV			
	7	a)	Define boundary layer and explain its development over a flat plate.	*CO 1*	*PO 1*	**06**
		b)	State and derive Hagen-Poiseuille's equation for laminar flow through circular pipes.	*CO 2*	*PO 1,2*	**14**
			OR			
	8	a)	Calculate the major head loss in a 100 m long pipe with a diameter of 0.25 m carrying water at a velocity of 2 m/s. Use Darcy-Weisbach equation with f = 0.02.	*CO 3*	*PO 1,2*	**10**

		b)	Using Darcy-Weisbach equation, deduce an expression for Chezy's formula.	*CO 2*	*PO 1,2*	**10**
			UNIT - V			
	9	a)	Explain dimensional homogeneity and its importance in fluid mechanics	*CO 1*	*PO 1*	**05**
		b)	Discuss the Buckingham Pi theorem and illustrate its application with an example.	*CO 2*	*PO 1,2*	**10**
		c)	What are dimensionless numbers? Explain their significance with examples (e.g., Reynolds number, Froude number).	*CO 1*	*PO 1*	**05**
			OR			
	10	a)	The drag force F on a sphere is a function of velocity V, diameter D, fluid density ρ, and viscosity μ. Use dimensional analysis to find the relationship between these variables.	*CO 3*	*PO 1,2*	**10**
		b)	i. Define dimension and different types of dimensions. ii. Distinguish between kinematic similarity and dynamic similarity.	*CO 1*	*PO 1*	**10**

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