U.S.N.										

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

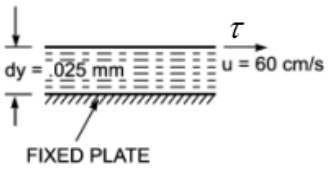
Autonomous Institute Affiliated to VTU

April 2024 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 19AE3DCAFM / 22AS3PCFMS **Max Marks: 100**
Course: Aero - Fluid Mechanics / Fluid Mechanics Systems

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) Solids and Fluids ii) Intensive properties and extensive properties. Explain with examples iii) Mass density 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	**5**
	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. Determine the fluid viscosity between the plates.  Figure 1: Schematic for problem 1c.	CO 1	PO 1 PO 2	**5**
			OR			
2	a)		What is the boundary layer and what happens to the flow velocity near the wall? Draw the velocity profile inside the boundary layer.	CO 1	PO 1 PO 2	**4**
	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, iii) Linear strain rate, shear strain rate and volumetric strain rate. iv) Verify if this flow is incompressible.	CO 1	PO 1 PO 2	**6**

		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 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	1,2	**12**
		b)	A venturimeter of inlet diameter 300 mm and throat diameter 150 mm is inserted in vertical pipe carrying water flowing in the upward direction. A differential mercury manometer connected to the inlet and throat gives a reading of 200 mm. Find the discharge if the coefficient of discharge of meter is 0.98.	CO 4	PO 1 PO 2 PO 4	**8**
			UNIT – IV			
	5	a)	Define Reynold's number and what is the significance of it?	CO 2	PO 1 PO 2	**4**
		b)	Deduce an expression for the Hagen-Poiseuille equation considering viscous fluid flow through a circular pipe.	CO 2	PO 1 PO 2	**16**
			UNIT – V			
	6	a)	i) Define rotational and irrotational flows. ii) Explain the terms, favorable and adverse pressure gradient. Describe flow separation phenomenon with appropriate diagram. iii) Define Mach number and what is the significance of it?	CO 1	PO 1	**8**
		b)	Analyze the following boundary layer parameters for the velocity distribution $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$ i) Displacement thickness ii) Momentum thickness iii) Energy thickness iv) Also calculate the value of δ*/θ	CO 1	PO 1 PO 2	**12**
			OR			
	7	a)	Define dimension and differentiate between primary and secondary dimension.	CO 3	PO 1	**5**
		b)	i) State and explain about the Buckingham's pi-theorem. ii) Check the dimensional homogeneity of the following common equations in the field of hydraulics $$P_1 + \frac{1}{2}\rho V^2 + \rho g z = C$$	CO 3	PO 1 PO 2	**10**
		c)	Distinguish between Geometric similarity and Kinematic similarity.	CO 3	PO 1	**5**

******