


Name:			
Enrolment No:			
<b>UPES</b> <b>End Semester Examination, May 2024</b>			
<b>Course: Fluid Mechanics</b> <b>Program: B.Tech Sustainable Engineering</b> <b>Course Code: MECH 2023</b>		<b>Semester: IV</b> <b>Time: 03 hrs.</b> <b>Max. Marks: 100</b>	
<b>Instructions: All questions are compulsory to attempt.</b>			
<b>SECTION A</b> <b>(5Qx4M=20Marks)</b>			
S. No.	Answer all the questions.	Marks	CO
Q 1	Define Newtonian and Non-Newtonian fluids with examples.	2x2=4	CO1
Q 2	Define the following: (i) Steady flow (ii) Unsteady flow (iii) Compressible flow (iv) Incompressible flow	4x1 = 4	CO2
Q 3	What is dimensional analysis?	4	CO4
Q 4	Define velocity potential function and stream function.	2x2=4	CO2
Q 5	What is pitot-tube? How will you determine the velocity at any point with the help of pitot-tube.	2x2=4	CO3
<b>SECTION B</b> <b>(4Qx10M= 40 Marks)</b>			
Q 6	A liquid has a specific gravity of 1.9 and kinematic viscosity of 6 stokes. What is its dynamic viscosity and specific volume?	5x2=10	CO1
Q 7	A pipe (1) 450 mm in diameter branches into two pipes (2 and 3) of diameters 300 mm and 200 mm respectively. If the average velocity in 450 mm diameter pipe is 3 m/s find: (i) Discharge through 450 mm diameter pipe, (ii) Velocity in 200 mm diameter pipe if the average velocity in 300 mm pipe is 2.5 m/s.	5x2=10	CO2
Q 8	If, cross sectional area of pipe and throat of a venturimeter are $a_1$ and $a_2$ respectively. Then, derive the expression of actual flow rate: $Q_{act} = C_d * \frac{a_1 a_2}{\sqrt{a_1^2 + a_2^2}} * \sqrt{2gh}$ Where, “h” is difference of pressure head and “ $C_d$ ” is coefficient of discharge.	10	CO3
Q 9	What are repeating variables? How are these selected by dimensional analysis?	5x2=10	CO4

	OR		<b>CO3</b>
	A fluid flow field is given by $V = x^2yi + y^2zj - (2xyz + yz^2)k$ Calculate velocity and acceleration at the point (2, 1, 3).		
<b>SECTION-C</b> <b>(2Qx20M=40 Marks)</b>			
Q 10	An orifice meter with the orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. The pressure gauges fitted upstream and downstream of the orifice meter give readings of 14.715 N/cm <sup>2</sup> and 9.81 N/cm <sup>2</sup> respectively. Find the rate of flow of water through the pipe in litres/s. Take $C_d = 0.6$ .  Also, if instead of water, oil of sp. gravity 0.8 is flowing through the orifice meter in which the pressure difference is measured by a mercury oil differential manometer on the two sides of the orifice meter, find the rate of flow of oil when the reading of manometer is 40 cm.	<b>2x10 = 20</b>	<b>CO3</b>
Q 11	Describe Buckingham's method or $\pi$ -theorem to formulate a dimensionally homogeneous equation between the various physical quantities effecting a certain phenomenon.  OR  A wooden block of specific gravity 0.75 floats in water. If the size of the block is 1 m $\times$ 0.5 m $\times$ 0.4 m, find its metacentric height?	<b>20</b>	<b>CO4</b>  <b>CO2</b>