Name:

Enrolment No:

UPES

End Semester Examination, May 2023

Course: Introduction to Fluid Mechanics **Semester: IV**

Program: B Tech Civil Engineering **Tim: 03 hrs.**

Course Code: CIVL 2016 **Max. Marks: 100**

Instructions: Assume the suitable values wherever required

Attempt all the questions.

S. No.		Marks	CO
	SECTION A (5Qx4M=20Marks)		
Q 1	Compare the viscosity vs time curve for a) Honey b) Blood	**4**	**CO1**
Q 2	With the help of an illustrative example, explain the situation where path lines, streak lines and streamlines will be identical.	**4**	**CO2**
Q 3	Why is the diverging section of the venturimeter kept more than the converging section?	**4**	**CO3**
Q 4	A $\frac{1}{25}$ model of a ship is to be tested for estimating the wave drag. If the ship's speed is 1 m/s, calculate the speed at which the model must be tested.	**4**	**CO4**
Q 5	Form a dimensionless group from the variables ρ (density), ω (angular velocity), μ (dynamic viscosity) and D (characteristic diameter).	**4**	**CO4**
	SECTION B (4Qx10M= 40 Marks)		
Q 6	The velocity distribution of flow over a plate is parabolic, with the vertex 30cm from the plate where the velocity is 280 cm/s. If the fluid's viscosity is 2 Ns/m^2, find the velocity gradients and the shear stresses at 0, 20 and 40 cm from the plate.	**10**	**CO1**
Q 7	A circular plate 3m in diameter is immersed in water, its greatest and least depth below the free surface being 3m and 1m, respectively. Find the total pressure on one face of the plat and its position.	**10**	**CO1**
Q 8	What is the principle behind the working of a venturimeter? Give constructional details and derive an expression for the measurement of the discharge.	**2+3+5**	**CO3**
	OR		

Q 8	A venturimeter of 50mm throat diameter is fitted in a horizontal pipe of 100mm diameter. The pressure difference between the pipe and the throat is 100 KPa, and water flows through the pipe. Find the velocity in the pipe.	**10**	**CO3**
Q 9	A 10 cm diameter orifice discharges water at 55 litres per second under a head of 2.5m. A plate is held normally to the jet d/s from the vena contracta requiring a force of 300 N to resist the impact of the jet. Find the hydraulic coefficients.	**10**	**CO3**
SECTION-C **(2Qx20M=40 Marks)**			
Q 10	Work out the equation for discharge Q through a sharp-edged triangular notch assuming Q depends upon the central angle α of the notch, head H, gravitational acceleration g and the density ρ, viscosity μ, and surface tension σ of the fluid. Use Buckingham theorem.	**20**	**CO4**
OR			
Q 10	A test was made on a pipe model 25mm in diameter and 5m long with water flowing through it at the corresponding speed for frictional resistance. The head loss was found by measurement to be 10 m of water. The prototype pipe is 100mm in diameter and 100m long, flowing air at 3.0m/s. The density of water and air is 1000kg/m^3. And the viscosity coefficients of water and air are 0.01 and 1.8x10^{-4} poise, respectively. Find a) The corresponding speed of water in the model pipe for the dynamic similarity b) Pressure drop in prototype pipe.	**15+5**	**CO4**
Q 11	The velocity components in a 2-D flow field for an incompressible fluid are expressed as $$u = \frac{y^3}{3} + 2x - x^2 y$$ $$v = xy^2 - 2y - \frac{x^3}{3}$$ a) Show that the functions represent a possible case of an irrotational flow. b) Obtain an expression for stream function. c) Obtain an expression for velocity potential.	**6+8+8**	**CO2**