Name: **Enrolment No:**	

UPES

End Semester Examination, May 2024

Course: Fundamental Fluid Mechanics — **Semester: IV**

Program: B Tech Civil Engineering — **Time: 03 hrs.**

Course Code: MECH 2010 — **Max. Marks: 100**

Instructions: Assume any data required suitably (within the known range of the fluid parameters)

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain the dominance of molecular momentum transfer in the case of viscosity variation for gases.	**4**	**CO1**
Q 2	With the help of a conceptual diagram, differentiate between Eulerian and Langrangian approaches for analyzing fluid motion.	**4**	**CO2**
Q 3	Why venturi meter is a better flow measuring device as compared to a Pitot tube and orificemeter?	**4**	**CO3**
Q 4	In a fluid machine, the relevant parameters are volume flow rate, density, viscosity, bulk modulus, pressure difference, power consumption, rotational speed, and characteristic dimension. Using the Buckingham pi (π) theorem, what would be the number of independent non-dimensional groups? Also, specify the repeating variables that will be selected for the analysis.	**4**	**CO4**
Q 5	A sphere is moving in water with a velocity of 2 m/s. Another sphere twice the diameter is placed in a wind tunnel and tested with air, which is 800 times less dense and 80 times less viscous than water. Find the velocity of air that will give dynamically similar conditions.	**4**	**CO4**
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	A square plate of size 1m x 1m and weighing 350 N slides down an inclined plane with a uniform velocity of 1.5 m/s. The inclined plane is laid on a slope of 5V:12 H and has an oil film of 1mm thickness. Calculate the dynamic viscosity of oil.	**10**	**CO1**
Q 7	A circular plate 3m diameter is submerged in water with its plane making an angle of 30^0 with the water surface. If the top edge of the plate is 1m below the water surface, find the force on one side of the plate and its location.	**10**	**CO1**
Q 8	Define the various hydraulic coefficients. Explain their experimental determination. Give their respective ranges also.	**2+3+5**	**CO3**

Q 8	**OR** What is the principle behind the working of a pitot tube? Give constructional details and derive an expression for the measurement of the velocity. Define stagnation point.		
Q 9	A 10 cm diameter orifice discharges water at 45 liters per second under a head of 2.75m. A plate is held normal to the jet just d/s from the vena contracta requiring a force of 310N to resist the impact of the jet. Find the hydraulic coefficients.	**10**	**CO3**
SECTION-C **(2Qx20M=40 Marks)**			
Q 10	A Test was made on a pipe model 15mm in diameter and 3m long with water flowing through it at the corresponding speed for frictional resistance. The head loss was found by measurement to be 7 m of water. The prototype pipe is 300mm in diameter and 240m long through which air is flowing at 3.6m/s. The density of water and air is 1000 kg/m^3. The coefficients of viscosity 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. **OR**	**15+5**	**CO4**
Q 10	A. Find the thrust F, on the propeller of a ship. This thrust will be a function of density ρ and dynamic viscosity υ of the liquid and the diameter d, speed of advance v, and rotational speed n of the propeller. B. Drive the scale ratio for the Froude number.		
Q 11	A 2-D field is given as: **φ = 3xy** Determine (i) Stream function (ii) Velocity at P(1, 3) and Q(3,3) (iii) The pressure difference between the points P and Q. (iv)The discharge between the streamlines passing through points P and Q.	**8+4+4+4**	**CO2**