Name: **Enrolment No:**	

UPES

End Semester Examination, Dec. 2023

Course: Fluid Mechanics **Semester: III**

Program: B.Tech (Fire & Safety Engineering) **Time: 03 hrs.**

Course Code: MECH 2023 **Max. Marks: 100**

Instructions: All questions are compulsory to attempt.

SECTION A
(5Qx4M=20Marks)

S. No.	Answer all the questions.	**Marks**	**CO**
Q 1	One litre of crude oil weighs 9.6 N. Calculate its specific weight and density.	**2x2 = 4**	**CO2**
Q 2	Define the following: (i) U-tube manometer (iii) Pascal law	**2x2 = 4**	**CO1**
Q 3	State Bernoulli's theorem for steady flow of an incompressible flow. Write an expression for Bernoulli's theorem.	**2x2=4**	**CO3**
Q 4	Explain the term co-efficient of friction. On what factors does this co-efficient depends?	**2x2=4**	**CO4**
Q 5	Explain the conditions of equilibrium of floating body with neat sketch.	**4**	**CO3**
	SECTION B **(4Qx10M= 40 Marks)**		
Q 6	Find the kinematic viscosity of an oil having density 980 kg/m^3 when at a certain point in the oil, the shear stress is 0.25 N/m^2 and velocity gradient is 0.3 /s.	**10**	**CO1**
Q 7	A rectangular plane surface is 2 m wide and 3 m deep. It lies in vertical plane in water. Determine the total pressure and position of centre of pressure on the plane surface when its upper edge is horizontal and (i) coincides with water surface, (ii) 2.5 m below the free water surface.	**2x5=10**	**CO4**
Q 8	Derive an expression for the loss of head due to friction in pipes.	**10**	**CO4**
Q 9	A circular plate 4 m diameter is immersed in water in such a way that its greatest and least depth below the free surface are 5 m and 2 m respectively. Determine the total pressure on one face of the plate and position of the Centre of pressure. OR	**10**	**CO3**

	Explain the principle of venturimeter with a neat sketch. Derive the expression for the rate of flow of liquid through it.		
SECTION-C (2Qx20M=40 Marks)			
Q 10	The stream function for a two-dimensional flow is given by $\Psi = 2xy$, calculate the velocity at the point P (2,3). Find the velocity potential function ϕ.	**2x10 = 20**	**CO3**
Q 11	A pitot-static tube placed in the centre of a 300 mm pipe line has one orifice pointing upstream and other perpendicular to it. The mean velocity in the pipe is 0.80 of the central velocity. Find the discharge through the pipe if the pressure difference between the two orifices is 60 mm of water. Take the co-efficient of pitot tube as C_v = 0.98. OR A smooth pipe of diameter 100 mm and 1000 m long carries water at the rate of 0.740 m^3/minute. Calculate the loss of head, wall shearing stress, centre line velocity, velocity and shear stress at 40 mm from the pipe wall. Take kinematic viscosity of water as 0.02 stokes. Take the value of co-efficient of friction 'f' from the relation given as $$f = \frac{0.0791}{(R_e)^{1/4}}$$ Where R_e = Reynolds number., Use below equation to calculate velocity at any point inside the pipe $\frac{u}{u_*} = 5.75 \log_{10} \frac{u_* y}{\upsilon} + 5.55$ Where $u_* = \sqrt{\frac{\tau_0}{\rho}}$	**20**	**CO5**