Name: **Enrolment No:**	

UPES

End Semester Examination, December 2023

Course: Fluid mechanics and fluid machines **Semester : V**

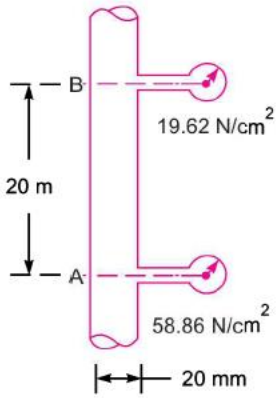
Program: B.Tech Mechatronics **Time : 03 hrs.**

Course Code: MECH3028 **Max. Marks: 100**

Instructions: Assume the suitable data if required

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain the phenomenon of capillarity. What is it caused by? How is it affected by the contact angle?	**4**	**CO1**
Q 2	Distinguish between: a) Compressible and incompressible flow b) Rotational and irrotational flow	**4**	**CO1**
Q 3	Explain the following: a) Displacement thickness b) Energy thickness	**4**	**CO1**
Q 4	Explain the need for a foot valve and strainer in a centrifugal pump system.	**4**	**CO1**
Q 5	Define the following terms as they are applied to a Pelton wheel a) Gross head b) Net Head c) Speed ratio d) Jet ratio	**4**	**CO1**
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	A 20 cm X 10 cm venturimeter is inserted in a vertical pipe carrying oil of specific gravity 0.8, the flow of oil is in upward direction. The difference of levels between the throat and inlet section is 50 cm. The oil mercury differential manometer gives a reading of 30 cm of mercury. Find the discharge of oil. Neglect losses.	**10**	**CO2**
Q 7	The force exerted by a flowing fluid on a stationary body depends upon the length (L) of the fluid, density (ρ) of fluid, viscosity (μ) of the fluid and acceleration (g) due to gravity. Find an expression for the force using dimensional analysis.	**10**	**CO4**

Q 8	A crude oil of viscosity 1.5 poise and relative density 0.9 flows through a 20 mm diameter vertical pipe. The pressure gauges fixed 20 m apart read 58.86 N/cm^2 and 19.62 N/cm^2 as shown in figure find the direction and rate of flow through the pipe.  	**10**	**CO2**
Q 9	The impeller of a centrifugal pump has an external diameter of 450 mm and internal diameter of 200mm and it runs at 1440rpm. Assuming a constant radial flow through the impeller at 2.5 m/s. and that the vanes at exit are setback at an angle of 250, (i) draw velocity triangles (ii) work done per unit weight of water flow. (OR) Derive Euler's equation for work done in rotodynamic machines. State all assumptions.	**10**	**CO3**
SECTION-C (2Qx20M=40 Marks)			
Q 10	A horizontal pipeline 50 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 30 m of its length from the tank, the pipe is 200 mm diameter, and its diameter is suddenly enlarged to 400 mm. The height of the water level in the tank is 10 m above the centre of the pipe. Considering all minor losses, determine the rate of flow. Take f= 0.01 for both sections of the pipe.	**20**	**CO4**
Q 11	A 137 mm diameter jet of water issuing from a nozzle impinges on the buckets of a Pelton wheel and the jet is deflected through an angle of 1650 by the buckets. The head available at the nozzle is 400m. Assuming coefficient of velocities as 0.97, speed ratio as 0.46, and reduction in relative velocity while passing through buckets as 15%, find (i) The force exerted by the jet on bucket in tangential direction, (ii) The power developed. (iii) efficiency. (OR) Explain the working of a Francis turbine with sketches. Draw velocity diagrams and derive the equation for hydraulic efficiency.	**20**	**CO3**