Name: **Enrolment No:**	**UPES SAP ID:**

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End semester Examination, May' 2021

Course: Fluid Mechanics and Machinery **Semester: IV**
Program: B. Tech (Mechatronics) **Time: 03 hrs.**
Course Code: MECH 2025 **Max. Marks: 100**

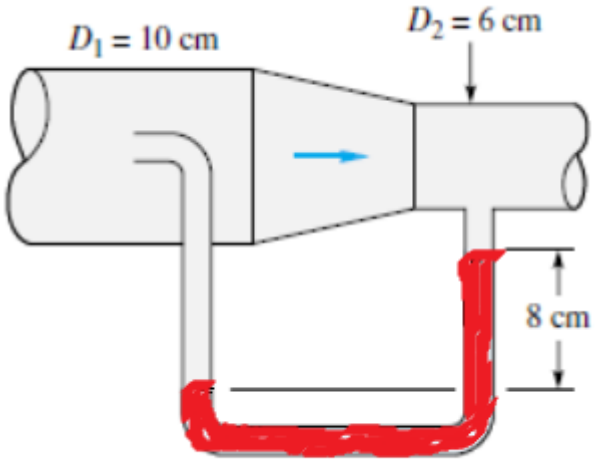
Note: The paper consists of 3 sections A, B and C. All questions are compulsory.

Section A

Q1.	Explain principle of pressure-measuring devices like Bourdon tube and Manometer.	**05**	**CO1**
Q2.	Explain Kinematic Viscosity and Dynamic viscosity of fluid.	**05**	**CO1**
Q3.	Define hydraulic and mechanical losses in hydraulic machines.	**05**	**CO1**
Q4.	Define pipe roughness and Reynolds number for the flow through pipes.	**05**	**CO1**
Q5.	Explain in brief: i) Bulk Modulus of elasticity ii) Piezometer	**05**	**CO1**
Q6.	Explain impulse and reaction turbine.	**05**	**CO1**

Section B

Q1.	A Pelton wheel with single jet rotates at 750 rpm. The pitch circle diameter of the wheel 1.5 m and the buckets deflect the jet through an angle of 170°. The net head on the wheel is 500 m and discharge through the nozzle is 0.2 m^3/s. Determine the power available at the nozzle, and hydraulic efficiency of the turbine. Take coefficient of velocity as 0.98.	**10**	**CO2**
Q2.	An unsteady velocity field is given by $u = t^2 + 3y$ $v = 4t + 5x$ Calculate the acceleration at the point (5,3) at time t = 2 units	**10**	**CO2**
Q3	The velocity along the centerline of the Hagen-poiseuille flow in a 0.1 m diameter pipe is 2 m/s. If the viscosity of the fluid is 0.07 kg/ms and its specific gravity is 0.92, calculate volumetric flow rate	**10**	**CO3**
Q4.	The velocity along the centerline of the Hagen-poiseuille flow in a 0.1 m diameter pipe is 2 m/s. If the viscosity of the fluid is 0.07 kg/ms and its specific gravity is 0.92, calculate shear stress of the fluid at the pipe wall	**10**	**CO3**

Q5.	In Fig. 1 given below the flowing fluid is CO_2 at 20°C. Neglect losses. If p_1 = 170 kPa and the manometer fluid is Meriam red oil (SG = 0.827), estimate (*a*) p_2 and (*b*) the gas flow rate in m^3/h.  Fig. 1: Arrangement for flow measurement	**10**	**CO3**
	Section C		
Q1.	A reaction turbine operating under a head of 70 m runs at 400 rpm. Its diameter at inlet is 1 m and the flow area is 0.35 m^2. The angle made by absolute and relative velocity at inlet are 15° and 45° respectively, with the tangential velocity. For radial discharge at outlet, find the volume flow rate, the power developed and hydraulic efficiency. **OR** A centrifugal pump delivers water against a net head of 10.0 m at a design speed of 1000 rpm. The vanes are curved backwards and make an angle of 30˚ with the tangent at the outer periphery. The impeller diameter is 30 cm and has a width of 5 cm at the outlet. Determine the discharge of the pump if the manometric efficiency is 95%.	**20**	**CO3**