Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2018

Programme Name: B.Tech. CERP | **Semester : III**

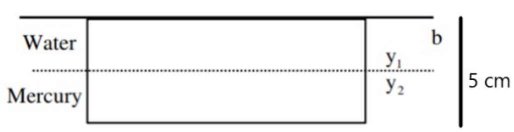
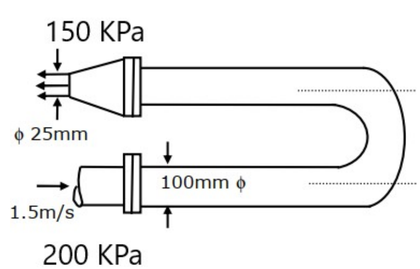
Course Name : Momentum Transfer | **Time : 03 hrs**

Course Code : CHCE 2003 | **Max. Marks : 100**

Nos. of page(s) : 3

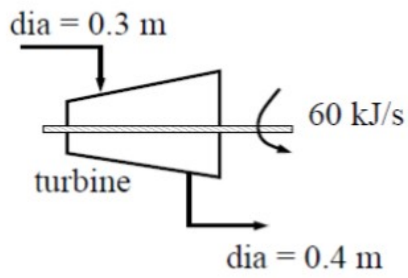
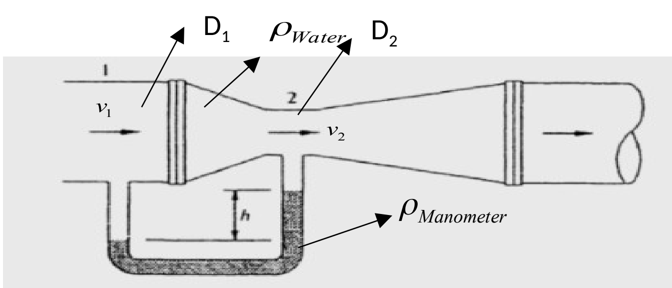
Instructions: Assume the appropriate value of missing data if any.

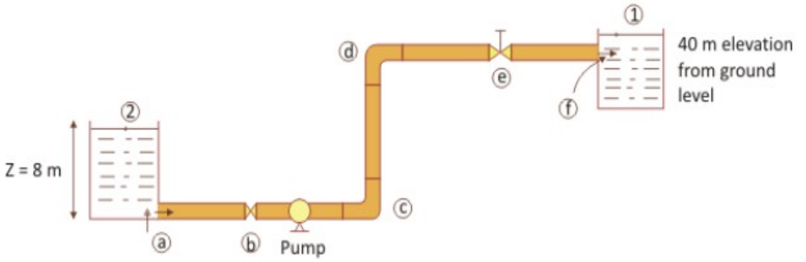
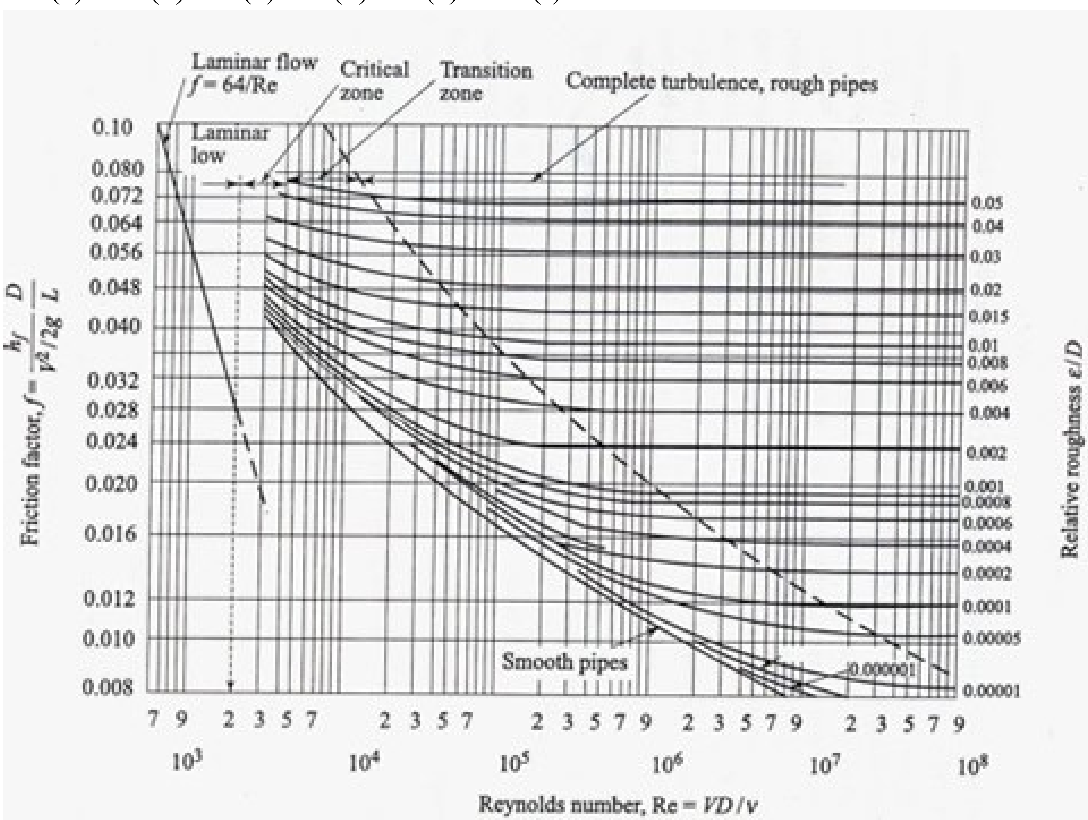
SECTION A

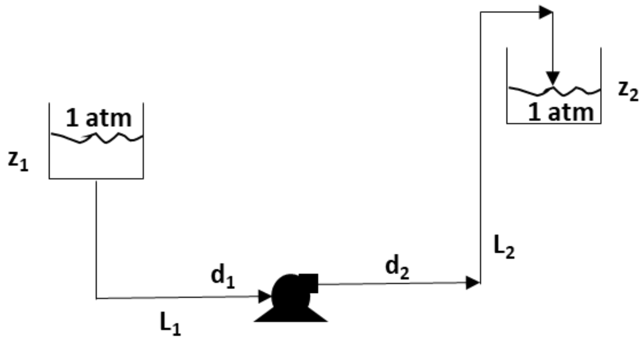
S. No.		Marks	CO
Q 1	Reynold number is ratio of which two forces? (2) Draw a diagram between stress and rate of strain for three different fluids with viscosities μ_1, μ_2 *and* μ_3, where $\mu_1 > \mu_2 > \mu_3$. (2)	**4**	**CO1**
Q 2	 Figure shows a block of steel in equilibrium at a mercury water interface. Find the depths y1 and y2 for equilibrium of the block. Take the specific gravity of mercury and steel equal to 13.6 and 7.85.	**4**	**CO1**
Q 3	What are the three graphical methods of flow description? (2) which one of these is completely Lagrangian and which one is completely Eulerian description? (2)	**4**	**CO2**
Q 4	Write the Naiver Stokes Equation with mentioning the all the assumptions. (2+2)	**4**	**CO2**
Q 5	 What will be the outlet velocity in the given figure? What will be the total force on pipe? (2+2)	**4**	**CO3**

SECTION B

Q 6	Explain how the shear stress transfers reaction in a fluid flow between two flat plates with bottom plate stationary using the newton's third law of action and (4). If the three fluids (μ_1, μ_2 *and* μ_3, where $\mu_1 > \mu_2 > \mu_3$) (same as in question 1) are flowing between two flat plates with bottom plate stationary, and if the shear stress on the top plate is same then draw the velocity profiles of the three fluids (2) And tell what will be the relative order of velocity of upper plate $(v_1, v_2$ *and* $v_3)$ at steady state? (2)	**10**	**CO1**

	If a specific velocity of upper plate, *v*, is required, then what will be the order of required shear stress $(\tau_1, \tau_2 \; and \; \tau_3)$ for the three fluids? (2)		
Q 7	 A turbine (shown in the figure) is supplied with 0.6 m^3/s of water from a 0.3m diameter pipe; the outlet pipe has 0.4m diameter. Assume flow to be steady, incompressible, and non-viscous. Determine the pressure drop across the turbine if the rate at which work is produced by the turbine is 60kJ/s. OR Derive the Hagen Poiseuille Formula by applying integral form of momentum balance in the pipe. (6) An incompressible flow fluid is flowing in a pipe as laminar flow and at steady state. If the diameter is halved and discharge (Q m^3/s) is reduced to 1/4th of its value then what will be effect on pressure drop? (2) What will happen in the above case if the flow is turbulent? (2)	**10**	**CO3**
Q 8	 Derive the formula for measuring the velocity in the Venturi-meter shown below? (6) Calculate the volumetric flow rate if D_1 = 10 mm, D_2 = 5 mm, h = 2 cm, $\rho_{water} = 10^3 \, kg/m^3$ $\rho_{manometer} = 13.6 \times 10^3 \, kg/m^3$, g = 10 m/s^2. (4)	**10**	**CO4**
Q 9	While performing model testing of a typical centrifugal pump what conditions are valid between the two pumps if (a) N, Q and H of the two pumps are known (2.5) (b) H, D and N of the two pumps are known (2.5) (c) Q, D and N of the two pumps are known (2.5) (d) P, D and N of the two pumps are known (2.5)	**10**	**CO5**
	SECTION-C		

Q 10	 Design the power of the pump with efficiency of 80 %. The pump delivers water $\rho = 10^3\ kg/m^3$ $\eta = 10^{-3}\ Pa - s$ from one reservoir to another reservoir at 6×10^{-3} m^3/s through 140 m of 0.05-m-diameter pipe. See the figure below for several pipe–fittings installed on the pipe-line. The surface of the pipe is rough (ϵ/D = 0.001). The equivalent lengths for (a): 5D (b) 3D (c) 2D (d) 2D (e) 10D (f) 5D. 	**20**	**CO4**
Q 11	Explain how you will design the pump shown in below figure using *characteristic curve* of pump and *system characteristics*. Explain how will you be able to operate the pump at Best Efficiency Point (BEP) both by controlling pump characteristic and system characteristic curves.	**20**	**CO5**

	 OR Explain the characteristic curve of a typical centrifugal pump (5). A centrifugal pump is used to remove water from a vessel at $3.4*10^4$ N/m^2 pressure. The NPSH is 3 m above the cavitation vapor pressure of $6.75*10^3$ N/m^2. If the losses in the suction pipe are equivalent to 1.5 m of liquid head, Design for the last height of the liquid level in the vessel above the pump inlet. (15)		