Name: **Enrolment No:**	UPES

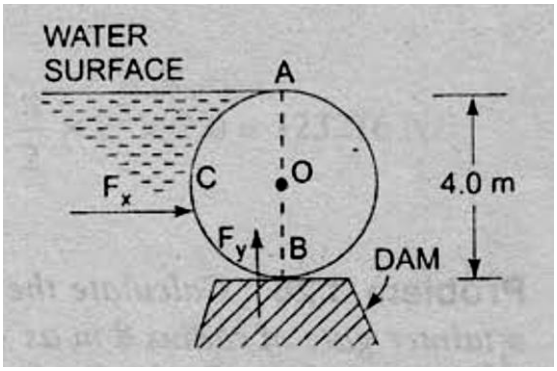
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, Dec. 2019

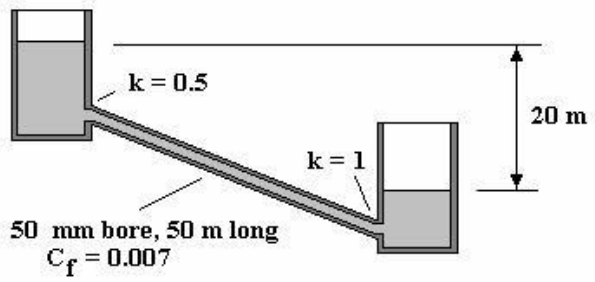
Programme Name: B.Tech/ASE & ASE-AVE **Semester : III**
Course Name : Applied fluid mechanics **Time : 03 hrs**
Course Code : MECH 2002 **Max. Marks : 100**
Nos. of page(s) : 03
Instructions: Attempt all the questions as directed. Assume suitable data if missing.

SECTION A

S. No.		Marks	CO
Q 1	Explain the phenomenon of capillarity and obtain an expression for capillary rise of a liquid.	**5**	**CO1**
Q 2	Differentiate between free and forced vortex flow along with suitable examples.	**5**	**CO3**
Q 3	An oil of viscosity 9 poise and specific gravity 0.9 is flowing through a horizontal pipe of 60 mm diameter. The pressure drop in 100 m length of the pipe is 1800 kN/m^2. Determine the rate of flow of oil.	**5**	**CO4**
Q 4	Discuss the kinetic energy and momentum correction factors.	**5**	**CO4**

SECTION B

Q 5	Find the magnitude and direction of the resultant force due to water acting on a roller gate of cylindrical form of 4 m diameter, when the gate is placed on the dam in such a way that water is just going to spill. Take the length of the gate as 8 m.  	**10**	**CO1**
Q 6	For the following velocity profile in the boundary layer on a flat plate, calculate the displacement and momentum thickness in terms of the nominal boundary layer thickness δ. **$u/U = 2\eta - 2\eta^3 + \eta^4$**	**10**	**CO5**

Q 7	The diagram shows a tank draining into another lower tank through a pipe. Note the velocity and pressure is both zero on the surface on a large tank. Calculate the flow rate using the data given on the diagram.  	**10**	**CO4**
Q 8	Calculate the weight of a ball of diameter 15 cm which is just supported by a vertical air stream of velocity 10 m/s, ρ_a = 1.25 kg/m^3 and kinematic viscosity = 1.5 stoke. The variation of C_D with Reynolds number Re is as follows: Re 10^4 10^5 >3x10^5 C_D 0.4 0.5 0.2 **OR** A kite of dimensions 0.8 m x 0.8 m and weighing 6 N is maintained in air at an angle of 10^0 to the horizontal. The string attached to the kite makes an angle of 45^0 to the horizontal and at this position the drag and lift coefficients are estimated to be 0.6 and 0.8 respectively. Determine : i. Wind speed ii. Tension in the string Tale density of air as 1.2 kg/m^3.	**10** **10**	**CO4** **CO4**
	SECTION-C		
Q 9	For a two-dimensional flow, the velocity function is given by the expression Ø = x^2-y^2. i. Determine the velocity component in x and y directions. ii. Show that the velocity components satisfy the conditions of flow continuity and irrotationality. iii. Determine stream function and flow rate between the streamlines (2, 0) and (2, 2). iv. Show that the streamline and potential lines intersect orthogonally at the point (2, 2).	**20**	**CO2**
Q 10	A 45^0 reducing bend is connected in a pipeline. The diameter at the inlet and outlet of the bend being 600 mm and 300 mm respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet to bend is 8.829 N/cm^2 and rate of flow of water is 600 liter/s.	**20**	**CO4**

	OR A jet of water having a velocity of 15 m/s strikes a curved vane which is moving with a velocity of 6 m/s in the same direction of the jet at the inlet. The vane is so shaped that the jet is deflected through 135º. The diameter of the jet is 150 mm. Assuming the vane to be smooth, find a. The force exerted by the jet on the vane in the direction of motion b. Power of the vane c. Efficiency of the vane		