Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Programme Name: B Tech Civil Engineering **Semester : IV**
Course Name : Fluid Mechanics-2 **Time : 02 hrs**
Course Code : CIVL 2015 **Max. Marks: 100**
Nos. of page(s) : 2
Instructions: Assume the required data suitably

Set A

SECTION A

S. No.		Marks	CO
Q1	A small glass sphere of specific gravity 2.65 has a diameter of 3mm. if the sphere falls 0.6m in 30 seconds through a liquid of specific gravity 0.85, what is the absolute viscosity of the liquid.	**4**	**CO1**
Q2	The pressure drop in a 100mm diameter horizontal pipe is 50 kPa over a length of 10m. Evaluate the shear stress at the pipe wall.	**4**	**CO1**
Q3	Find the critical depth of a rectangular channel of width 4.0 m for a discharge of 12 m^3/s.	**4**	**CO3**
Q4.	What is the necessary and sufficient condition for the separation of flow?	**4**	**CO2**
Q5.	The speed ratio of a Pelton wheel operating under a head of 900 m is 0.45. What is the peripheral velocity of the turbine wheel?	**4**	**CO4**
	SECTION B		
Q6.	A 0.3m diameter pipe 2340m long is connected with a reservoir whose surface is 72m above the discharge end of the pipe. If for the last 1170m, a second pipe of the same diameter to be laid beside the first and connected to it, what would be the increase in discharge? Take f as 0.02.	**10**	**CO1**
Q7.	An automobile moving at a velocity of 40km/h is experiencing a wide resistance of 2 kN. If the automobile is moving at a velocity of 50 km/h, find the power required to overcome the wind resistance.	**10**	**CO2**
	OR		
Q7	Determine the reduction in power that can be saved if the boundary layer control device is installed on the wing to ensure laminar flow over the entire wing's surface. For air, take density as 1.01 kg/m^3, and kinematic viscosity as $1.3x10^{-5}$ m/s^2.	**10**	**CO2**
Q8	Derive the velocity distribution for smooth pipes and also define the ageing of pipe.	**10**	**CO1**

Q9.	A submarine which may be supposed to approximate a cylinder 3m in diameter and 15 m long travels submerged at 1.54m/s in sea water at 4ºC. Find the drag exerted on it. Take kinematic viscosity as 1.67 x 10^{-6} m^2/s and density as 1025 kg/m^3. Also find the friction drag.	**10**	**CO2**
	SECTION-C		
Q10	A trapezoidal channel has a bed width B = 5.0 m, S_0 = 0.0004, side slope m = 2 H: 1V and n = 0.02. The normal depth of flow y_0 = 3.0 m. If the channel empties into a pool at the downstream end and the pool elevation is 1.25 m higher than the canal bed elevation at the downstream end, calculate and plot the resulting GVF profile.	**20**	**CO3**
	OR		
Q10.	a) What are the different types of Hydraulic jump on the basis of Froude no. Explain each type with the help a neat diagram. b) In a hydraulic jump taking place in a horizontal apron below an Ogee shaped weir the discharge per unit width is 0.25 $m^3/s/m$ and the energy loss is 2.75 m. Estimate the depths at the toe and heel of the jump.	**10+10**	**CO3**
Q11	a) With the help of neat sketch, explain all the main components of radial flow reaction turbine. Also explain the important functions of these components. b) A jet of water, moving at 45 m/s impinges without shock a series of vanes moving at a velocity of 15 m/s, the direction of motion of vanes is inclined at 20º to that of the jet. The relative velocity at outlet is 0.9 to that of inlet, and the absolute velocity of water at exit is to be normal to the motion of vanes. Find a) vane angles at entry and exit b) work done on vanes per unit weight of water supplied by the jet and c) hydraulic efficiency.	**10+10**	**CO4**

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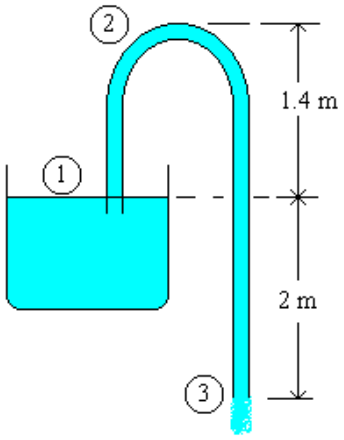
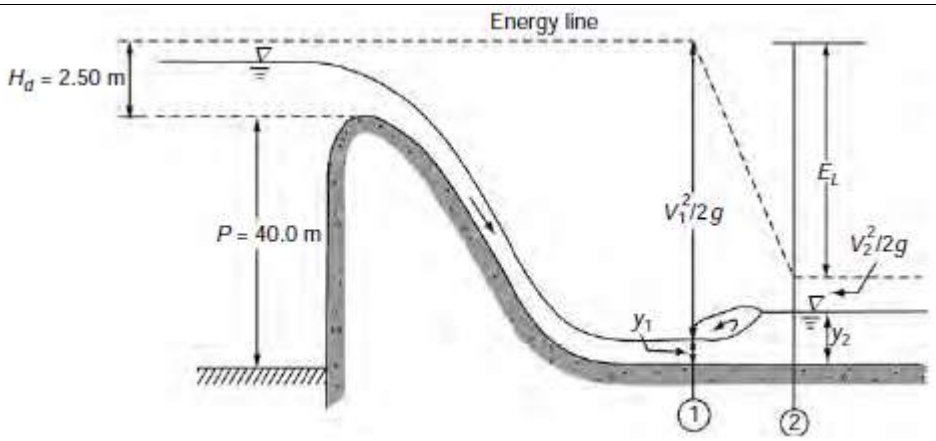
Set B

SECTION A

S. No.		Marks	CO
Q 1	What is the discharge through a circular pipe of 40mm diameter for a laminar flow having center-line velocity of 1.5 cm/s?	**4**	**CO1**
Q2.	Explain the classification for hydro-dynamically smooth boundary.	**4**	**CO1**
Q3.	Velocity of air passing through a rectangular duct and a circular duct is same. Which one of the following is the correct expression for the equivalent diameter of the circular duct in respect of a rectangular duct for the same pressure loss per unit length? (a and b are the length and breadth of the rectangular duct cross-section)	**4**	**CO3**
Q4.	Define shape factor in case of boundary layer theory.	**4**	**CO2**
Q5.	Explain the process of cavitation in case of turbines.	**4**	**CO4**
	SECTION B		
Q6	Find the maximum power the can be transmitted by a power station through a hydraulic pipe of 3 Km long 200 mm diameter. The pressure of water at the power station is 1500 kPa. Take f = 0.01	**10**	**CO1**
	OR		
Q6	A siphon has a uniform circular bore of 75 mm diameter and consists of a bent pipe with its crest 1.8 m above water level and a discharge to the atmosphere at a level 3.6 m below water level. Find the velocity of flow, the discharge and the absolute pressure at crest level if the atmospheric pressure is 98.1 kN/m2. Neglect losses due to friction.	**10**	**CO1**

			
Q7	Derive the velocity distribution for rough pipes and also define the laminar sub-layer.	**10**	**CO1**
Q8.	For air flow over a flat plate, velocity (U) and boundary layer thickness δ can be expressed respectively, as $$\frac{u}{U} = \frac{3y}{2\delta} - \frac{y3}{2\delta^3} \quad , \delta = \frac{4.64x}{\sqrt{Rex}}$$ If the free stream velocity is 4 m/s, and air has kinematic viscosity of 3×10^{-5} m/s and density of 1.2 kg/m^3,then find wall shear stress at x = 2 m.	**10**	**CO2**
Q9.	An airplane wing has a 7.62m span and 2.13m chord. Estimate the drag on the wing (two sides) treating it as a flat plate and the flight speed of 89.4 m/s to be turbulent from the leading edge onward.	**10**	**CO2**
	SECTION-C		
Q10	A river 200 m wide and 6.0 m deep has an average bed slope of 0.0005. Estimate the length of GVF profile produced by a low dam which raises the water surface just upstream if it by 2.50 m. Assume n = 0.035.	**20**	**CO3**
	OR		
Q10	An overflow spillway (Fig. 6.9) is 40.0 m high. At the design energy head of 2.5 m over the spillway fi nd the sequent depths and energy loss in a hydraulic jump formed on a horizontal apron at the toe of the spillway. Neglect energy loss due to flow over the spillway face. (Assume Cd = 0.738).	**20**	**CO3**

			
Q11.	a) A centrifugal pump delivers 30 litres per seconds of water to a height of 18m through a pipe of 90m long and of 100mm diameter. If the overall efficiency of the pump is 75%, find the power required to drive the pump. Take f = 0.012. b) With the help of neat sketch, explain all the main components of a high head impulse turbine. Also explain the important functions of these components.	**10+10**	**CO4**