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

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

Course: Fluid Mechanics in Petroleum Engineering. **Semester: III**
Program: B.Tech APE UP **Time 03 hrs.**
Course Code: PEAU 2005 **Max. Marks: 100**

Instructions: All questions are Mandatory.

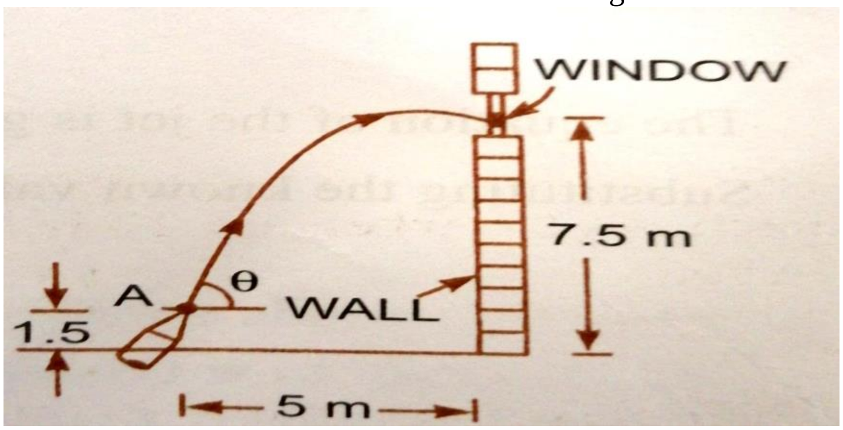
SECTION A

S. No.		Marks	CO
Q 1	Define continuity equation and Bernoulli's equation?	**4**	**CO3**
Q 2	What are the advantages of triangular notch or weir over rectangular notch?	**4**	**CO4**
Q 3	How would you distinguish between hydrodynamically smooth and rough boundaries?	**4**	**CO5**
Q 4	What do you understand by terms: a) Isothermal Process. b) Adiabatic Process and c) Universal Gas Constant.	**1 + 1 + 2**	**CO1**
Q 5	What is the difference between dynamic viscosity and kinematic viscosity? State their units and measurements?	**4**	**CO2**

SECTION B

Q 6	In a vertical pipe conveying oil of specific gravity 0.8, two pressure gauges have been installed at A and B where the diameters are 16 cm and 8 cm respectively. A is 2 meters above B. The pressure gauge readings have shown that the pressure at B is greater than at A by 0.981 $\frac{N}{cm^2}$. Neglecting all losses, calculate the flow rate. If the gauges at A and B are replaced by tubes filled with the same liquid and connected to a U-tube containing mercury, calculate the difference of level of mercury in the two limbs of the U-tube?	**10**	**CO3**
Q 7	An oil of viscosity $0.1\frac{Ns}{m^2}$ and relative density 0.9 is flowing through a circular pipe of diameter 50 mm and of length 300 m. The rate of flow of fluid through the pipe is 3.5 litres/s. Find the pressure drop in a length of 300 m and also the shear stress at the pipe wall?	**10**	**CO4**
Q 8	a) A jet of water from a 25 mm diameter nozzle is directed vertically upwards. Assuming that the jet remains circular and neglecting any loss of energy, that will be the diameter at a point 4.5 m above the nozzle, if the velocity with which the jet leaves the nozzle is 12 $^{m}/_{s}$. b) The following cases represent the two velocity components, determine the third component of velocity such that they satisfy the continuity equation: (i) $u = x^2+y^2+z^2$; $v = xy^2-yz^2 + xy$ (ii) $v = 2y^2, w = 2xyz.$	**5+ 5**	**CO2**

(OR)

Q 8	a) Derive the expression for meta centric height for a floating vessel using experimental approach? b) A solid cylinder of 10 cm diameter and 40 cm long, consists of two parts made of different materials. The first part at the base is 1.0 cm long and of specific gravity = 6.0. The other part of the cylinder is made of the material having specific gravity 0.6. State, if it can float vertically in water?	**5 + 5**	**CO2**
Q 9	Derive Euler's equation of motion? and Bernoulli's equation from Euler's equation?	**10**	**CO3**
	(OR)		
Q 9	a) A fire-brigade man is holding a fire stream nozzle of 50 mm diameter as shown in figure. The jet issues out with a velocity of 13 $\frac{m}{s}$ and strikes the window. Find the angle or angles of inclination with which the jet issues from the nozzle. What will be the amount of water falling on the window?  b) Determine the maximum height attained by the jet for free liquid jets?	**6 + 4**	**CO3**
	SECTION-C		
Q 10	a) Evaluate velocity distribution, ratio of maximum velocity to average velocity, drop of pressure head for a given length and shear stress distribution for the flow if viscous fluid between two parallel plates? b) There is a horizontal crack 40 mm wide and 2.5 mm deep in a wall of thickness 100 mm. water leaks through the crack. Find the rate of leakage of water through the crack if the difference of pressure between the two ends of the crack is 0.02943 $\frac{N}{cm^2}$. Take the viscosity of water equal to 0.01 poise.	**15 + 5**	**CO4**
Q 11	a) Derive the expression for displacement thickness for fluid flow having free-stream velocity (U) over a smooth thin plate which is flat and placed parallel to the direction for free stream of fluid? b) For the velocity profile for laminar boundary layer flows given as $\frac{u}{U} = 2\left({}^{y}/_{\delta}\right) - \left({}^{y}/_{\delta}\right)^2$ find an expression for boundary layer thickness (δ), shear stress (τ_o) and co-efficient of discharge (C_D) in terms of Reynolds number?	**10 + 10**	**CO5**
	(OR)		
Q 11	a) Derive the expression for velocity distribution for turbulent flow through smooth pipes and rough pipe in terms of average velocity? b) For turbulent flow in a pipe of diameter 300 mm, find the discharge when the center-line velocity is 2.0 $\frac{m}{s}$ and the velocity at a point 100 mm from the center as measured by pitot tube is 1.6 $\frac{m}{s}$?	**10 + 10**	**CO5**