Name: Enrolment No:	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2018

Course: Fluid Mechanics-1 — **Semester: III**

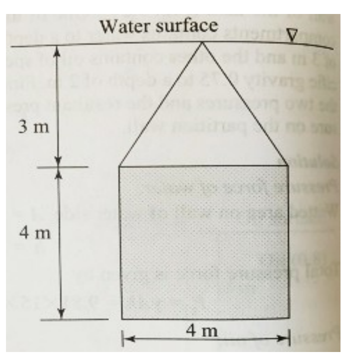
Programme: B Tech Civil Engineering — **Time: 03 hrs.**

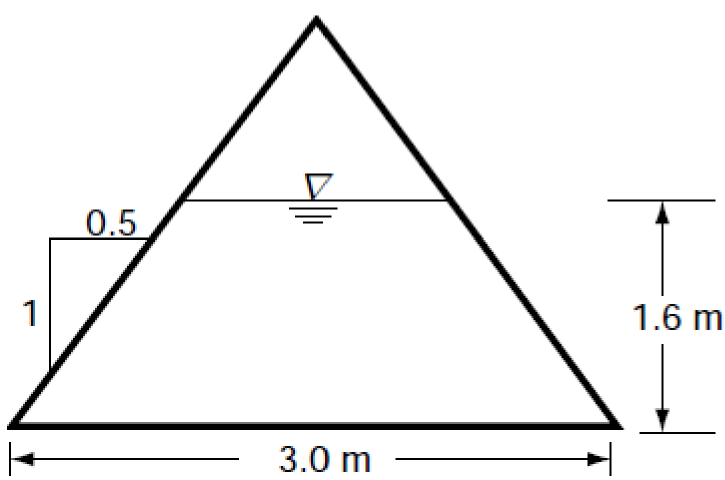
Max. Marks: 100 — **Course Code: CIVL 2006**

Instructions: Write your assumptions carefully and attempt all the questions

Set A

SECTION A

S. No.		Marks	CO
Q1.	Explain the process of cavitation in pipe flow and how it can be avoided.	**4**	**CO1**
Q2.	The least radius of gyration of a ship is 9 m and the metacentric height is 750 mm. Find the time period of oscillation of the ship.	**4**	**CO2**
Q3.	Explain why deep water runs calm.	**4**	**CO3**
Q4.	A dam 15m long is to discharge water at the rate of 120 cumecs under a head of 3m. Design the model head , if the supply available in lab is 50lps.	**4**	**CO4**
Q5.	Explain the working principle behind pitot tube and also explain stagnation point in the same reference.	**4**	**CO3**
SECTION B			
Q6.	A fluid of absolute viscosity 8 poise flows past a flat plate and has a velocity 1 m/s at the vertex, which is at 0.2m from the plate surface. Make calculations for the shear stress at points 0.05, 0.1, and 0.15m from the boundary. Assume a) Straight line velocity distribution b) Parabolic velocity distribution	**10**	**CO1**
Q7.	A plate of composite section as shown in fig. is immersed vertically in water. Find the total pressure and the center of pressure of the surface 	**10**	**CO2**

Q8.	A 2-D flow is described by the velocity components, $u=5x^3$; and $v= -15x^2y$. Evaluate the stream functions, velocity and accelerations at the point P(1,2).	**10**	**CO2**
	OR		
Q8.	If in a 2-D irrotational flow, the speed is constant everywhere, show that the direction is also constant.	**10**	**CO2**
Q9.	Explain the constructional details of Venturimeter and also derive the equation to calculate the discharge in Venturimeter.	**10**	**CO3**
	SECTION-C		
Q10.	a) Find the thrust F, on the propeller of a ship. This thrust will be a function of density ρ and dynamic viscosity υ of the liquid and the diameter d, speed of advance v, and rotational speed n of the propeller.	**15**	**CO4**
	b) Explain the applications of Weber model law in detail.	**5**	**CO4**
	OR		
Q10.	In order to estimate the energy loss in a pipeline of 2m diameter through which kerosene of specific gravity 0.8 and dynamic viscosity of 0.02 poise is to be transported at the rate of 2000 lps, model tests were conducted on a 0.1m diameter pipe using water at 20°C. Calculate the discharge required for the model pipe. If the energy head loss in 30m length of the model pipe is measured 5m of water, determine the corresponding head loss in the prototype. Also determine the value of Darcy's friction factor for the prototype pipe. Tae the absolute viscosity of water at 20°C as 10^{-2} poise.	**20**	**CO4**
Q11.	a) Water is flowing a critical depth at a section in a Δ shaped channel, with side slope of 0.5 H: I V. If the critical depth is 1.6 m, estimate the discharge in the channel and the specific energy at the critical depth section.  	**10**	**CO5**
	b) Derive the relation between hydraulic radius and depth for the most efficient trapezoidal channel section.	**10**	**CO5**

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Set B

SECTION A

S. No.		Marks	CO
Q1.	With the help of graph, explain the effect of temperature on viscosity of fluids.	4	CO1
Q2.	An object when immersed in water weighs 900N, and when immersed in oil of specific gravity 0.9 weighs 1200 N. Determine the volume specific gravity, and weight of the body in air	4	CO2
Q3.	Oil of specific gravity 0.8 flows through a 0.2m diameter pipe under a pressure of 100kN/m^2. If the datum is 5 m below the centerline of the pipe and the total energy with respect to the datum is 35Nm/N, calculate the discharge.	4	CO3
Q4.	In 1:40 model of a spillway, the velocity and discharge are 2m/s and 2.5m^3/s. Find the corresponding velocity and discharge in the prototype.	4	CO4
Q5.	Which is a better flow measuring device Orificemeter or Venturimeter? Explain.	4	CO3
	SECTION B		
Q6.	A plate weighing 150 N and measuring 0.8mx 0.8m slides down an inclined plane over an oil film of 1.2mm thickness. For an inclination of 30° and a velocity of 0.2m/s, compute viscosity of the liquid.	10	CO1
Q7.	A square lamina is immersed in water with one of its diagonals verticals. The top vertex is 0.8m below the water surface.Calculate the force on one side and the location of center of pressure.	10	CO2
Q8.	The velocity distribution is given by u = kx, v= -ky and w= 0, where k is constant. Plot the streamlines.	10	CO2
	OR		
Q8.	Explain the stability condition for completely submerged and partially submerged body with the help of a neat diagram.	10	CO2
Q9.	A Venturimeter of 40mm throat diameter is fitted in a horizontal pipe of 80mm diameter. The pressure difference between the pipe and the throat is 60 KPa. Water is flowing through the pipe. Find the velocity in the pipe.	10	CO3
	SECTION-C		
Q10.	a) The variable controlling the motion of a floating vessel through water are the	15	CO4

	drag force F, the speed v, the length l, the density ρ. Dynamic viscosity μ of water and gravitational constant g. If the non-dimensional groups are Reynolds number (Re), Weber number (We), Prandtl number (Pr) and Froude number (Fr), find the expression for F.		
	b) Explain the applications of Euler's model law in detail.	**5**	**CO4**
Q11.	A rectangular channel is 3.5 m wide and conveys a discharge of 15. 0 m^3/s at a depth of 2.0 m. It is proposed to reduce the width of the channel at a hydraulic structure. Assuming the transition to be horizontal and the flow to be frictionless determine the water surface elevations upstream and downstream of the constriction when the constricted width is (a) 2.50 m, and (b) 2.20 m.	**10+10**	**CO5**
	OR		
Q11.	a) A trapezoidal channel with a bed width of 4.0 m and side slopes of 1.5 H: I V carries a certain discharge. (a) Based on observations, if the critical depth of the flow is estimated as 1.70 m, calculate the discharge in the channel. (b) If this discharge is observed to be flowing at a depth of 2.50 m in a reach, estimate the Froude number of the flow in that reach.	**10**	**CO5**
	b) Derive the best side slope for the most economical trapezoidal channel section.	**10**	**CO5**