Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY 2025

Date: 28-05-2025 **Time:** 01:00 pm – 04:00 pm

School: SOE	**Program:** B. Tech (PET)	
Course Code: PET2012	**Course Name:** Reservoir Fluid Mechanics	
Semester: IV	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	20	20	30	30	N.A.

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

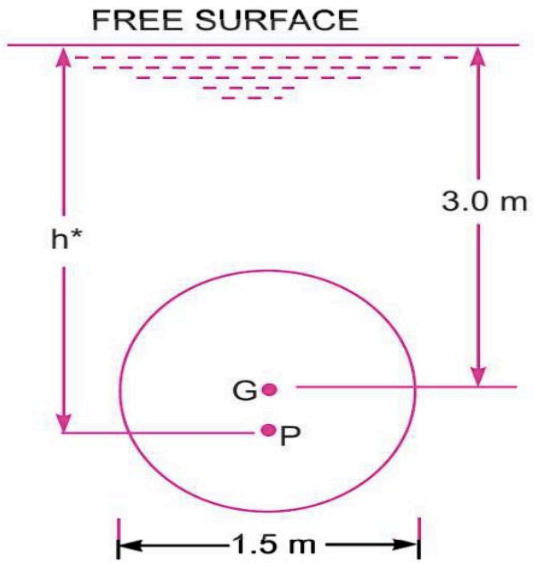
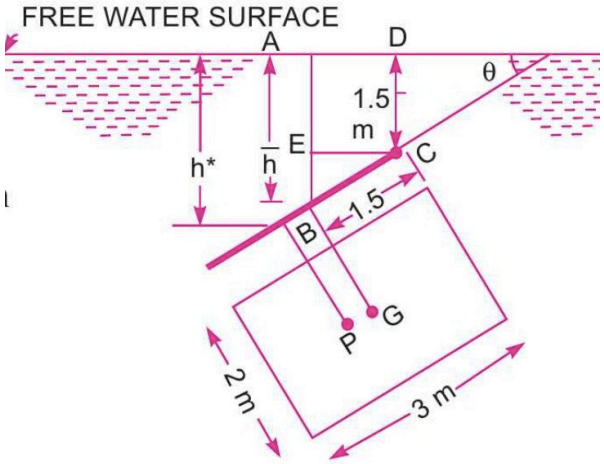
1.	Recall Bernoulli's equation.	**2 Marks**	**L1**	**CO3**
2.	Identify the correct answer from the below options: The continuity equation for incompressible flow in three-dimensional Cartesian coordinates is- A) $\partial^2u/\partial x^2 + \partial^2v/\partial y^2 + \partial^2w/\partial z^2 = 0$ B) $\partial p/\partial x + \partial p/\partial y + \partial p/\partial z = 0$ C) $u + v + w = 0$ D) $\partial u/\partial x + \partial v/\partial y + \partial w/\partial z = 0$	**2 Marks**	**L1**	**CO3**
3.	Recall the mathematical expression of velocity at any point of a pitot tube.	**2 Marks**	**L1**	**CO3**
4.	Describe the Newton's second law of motion.	**2 Marks**	**L1**	**CO3**
5.	Memorize four assumptions of Bernoulli's theorem.	**2 Marks**	**L1**	**CO3**
6.	Memorize difference between compressible and incompressible flow.	**2 Marks**	**L1**	**CO4**

7.	A pipe carries water at a velocity of 5 m/s. If the diameter of the pipe is 0.09 m, state the mass flow rate. (Consider the density of the fluid is 1000 kg/m^3; do not skip any steps)	**2 Marks**	**L1**	**CO4**
8.	Recall the correct answer from the options as given below: The head loss due to sudden contraction when C_c is not given to you will be- A) $h_c = 0.375\frac{V_2^2}{2g}$ B) $h_c = 0.5\frac{V_2^2}{2g}$ C) $h_c = 0.375\frac{V_1^2}{2g}$ D) $h_c = 0.5\frac{V_1^2}{2g}$	**2 Marks**	**L1**	**CO4**
9.	Identify the correct answer from the below options: The expression for head loss due to sudden enlargement can be expressed as- A) $h_e = \frac{(V_2 - V_1)^2}{3g}$ B) $h_e = \frac{(V_1 - V_2)^2}{2g}$ C) $h_e = \frac{(V_2 - V_1)^2}{4g}$ D) $h_e = \frac{(V_1 - V_2)^2}{4g}$	**2 Marks**	**L1**	**CO4**
10.	State stagnation pressure.	**2 Marks**	**L1**	**CO4**

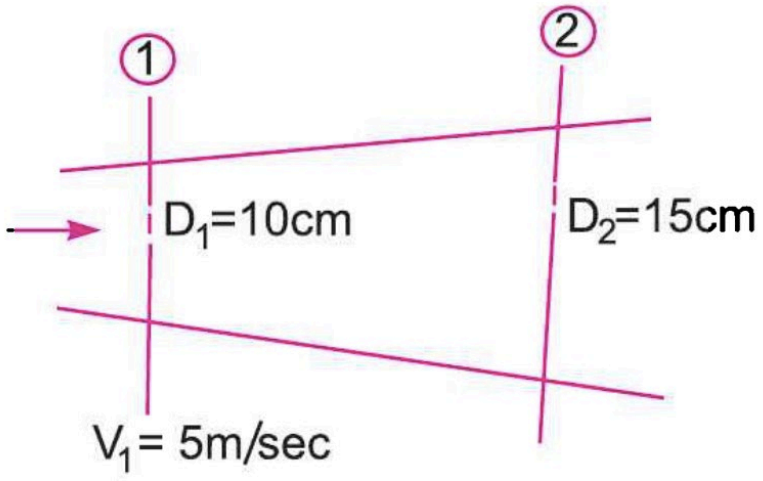
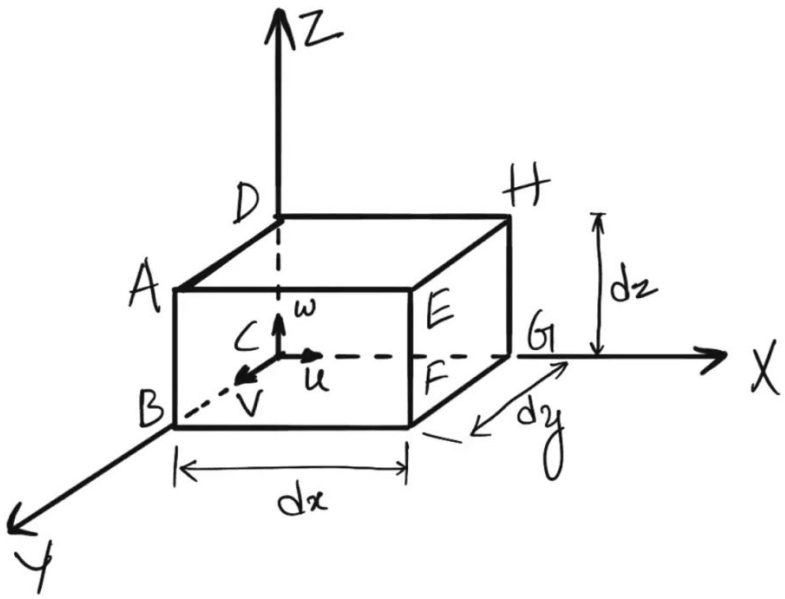
Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	Show that for a vertical surface submerged in liquid $$h^* = \frac{I_G + A\overline{h^2}}{A\bar{h}} = \frac{I_G}{A\bar{h}} + \bar{h}$$	**10 + 10 Marks**	**L3**	**CO1**
	b.	Demonstrate that for an inclined surface submerged in liquid $$h^* = \frac{I_G \sin^2\theta}{A\bar{h}} + \bar{h}$$		**L3**	**CO1**
Or					
12.	**a.**	Solve for the total pressure on a circular plate of diameter 1.5 m which is placed vertically in water in such a way that the centre		**L3**	**CO1**

		of the plate is 3 m below the free surface of water. Also solve the position of centre of pressure also (see below figure).  	**10 + 10 Marks**		
	b.	A rectangular plane surface 2 m wide and 3 m deep lies in water in such a way that its plane makes an angle of 30° with the free surface of water. Solve for the total pressure and position of centre of pressure when the upper edge is 1.5 m below the free water surface.  		**L3**	**CO1**

13.	**a.**	The diameter of a pipe at the sections 1 and 2 (see below figure) are 10 cm and 15 cm, respectively. Solve for the discharge through the pipe if the velocity of water flowing through the pipe at section 1 is 5 m/s. Solve also the velocity at section 2.	**10 + 10 Marks**	**L3**	**CO2**

					
	b.	A 25 cm diameter pipe caries oil of specific gravity 0.9 at a velocity of 3 m/s. At another section the diameter is 20 cm. Solve for the velocity at this section and also mass rate of flow of oil.		**L3**	**CO2**
		Or			
14.	**a.**	A fluid element is flowing in x, y, and z directions, respectively. Show the empirical relationship for incompressible fluid flow and at steady flow. 	**10 + 10 Marks**	**L3**	**CO2**
	b.	For a fluid flow in a Cartesian system with a velocity of V, show that the acceleration A = $\sqrt{a_x^2 + a_y^2 + a_z^2}$		**L3**	**CO2**

15.	**a.**	From the Euler's equation of motion produce Bernoulli's equation.	**10 + 10 Marks**	**L3**	**CO3**
	b.	Water is flowing through a pipe of 10 cm diameter under a pressure of 30.43 N/cm^2 (gauge) and with mean velocity of 4.0		**L3**	**CO3**

		m/s. Solve for the total head or total energy per unit weight of the water at a cross-section, which is 10 m above the datum line.			
Or					
16.	**a.**	An orifice meter with orifice diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauge fitted upstream and downstream of the orifice meter gives readings of 19.62 N/cm^2 and 9.81 N/cm^2, respectively. Co-efficient of discharge for the orifice meter is given as 0.6. Solve for the discharge of water through pipe.	**10 + 10 Marks**	**L3**	**CO3**
	b.	A pipe, through which water is flowing, is having diameter, 30 cm and 20 cm at the cross-sections 1 and 2, respectively. The velocity of water at section 1 is given 6 m/s. Solve for the velocity head at sections 1 and 2 and also rate of discharge.		**L3**	**CO3**

17.	**a.**	Major loss in a pipe can be calculated if velocity (V) and Chezy's constant (C) value is known to you. Show that $\boldsymbol{V = C\sqrt{mi}}$	**10 + 10 Marks**	**L3**	**CO4**
	b.	A crude oil of kinematic viscosity 0.4 stoke is flowing through a pipe of diameter 300 mm at the rate of 300 liters/s. Solve for the head lost due to friction for a length of 50 m of the pipe.		**L3**	**CO4**
Or					
18.	**a.**	Demonstrate the mathematical expression for energy loss in a pipe due to sudden enlargement.	**10 + 10 Marks**	**L3**	**CO4**
	b.	Solve for the loss of head when a pipe of diameter 300 mm is suddenly enlarged to a diameter of 600 mm. The rate of flow of water through the pipe is 350 liter/s.		**L3**	**CO4**