Roll No: | | | | | | | | | | | | |

BTECH
(SEM III) THEORY EXAMINATION 2023-24
FLUID MECHANICS

TIME: 3HRS   **M.MARKS: 70**

Note: **1.** Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. **Attempt all questions in brief.**   **2 x 7 = 14**

a.	What is the continuum assumption of fluid flow?
b.	Calculate the density, specific weight, and weight of one liter of petrol of specific gravity = 0.7
c.	Give the name of types of fluid flow.
d.	Write the basic components of compressible flow.
e.	What is meant by streamlined flows?
f.	Write the name of forces present in fluid flow.
g.	What do you know about model analysis?

SECTION B

2. **Attempt any three of the following:**   **7 x 3 = 21**

a.	What do you mean by single column manometer? How are they used for the measurement of pressure?
b.	The following equation represents the two velocity components, determine the third components of velocity such that satisfies the continuity equation, $U = x^2 + y^2 + z^2$; $v = xy^2 - yz^2 + x\,y$
c.	Find the sonic velocity for the following fluids: (i) Crude oil of sp. Gr. 0.8 and bulk modulus 153036 N/cm^2. (ii) Mercury having a bulk modulus of 2648700 N/cm^2.
d.	Draw the neat sketch of Venuti meter show in parts, Find out the expression for rate of flow through venturi meter.
e.	In a 1 in 20 model of stilling basin, the hydraulic jump in the model is observed to be 0.20 mtr. What is the height of the hydraulic jump in the prototype? If the energy dissipated in the model is 1/10 kw, what is the corresponding value in prototype.

SECTION C

3. **Attempt any one part of the following:**   **7 x 1 = 7**

(a)	Determine 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 of the plate is 3 m below the free surface of water. Find the position of centre of pressure also.
(b)	How will you determine the meta-centric height of floating body experimentally? Explain with neat sketch.

4. **Attempt any one part of the following:**   **7 x 1 = 7**

(a)	The stream function for a two-dimensional flow is given by $\psi = 2\,xy$, calculate the velocity at the point P (2, 3).Find the velocity potential φ.
(b)	Write the assumptions of continuity equation. Find the derivation of continuity equation.

5. **Attempt any one part of the following:**   **7 x 1 = 7**

(a)	An orifice meter with orifice diameter 10 cm is inserted in a pipe of 20 cm diameter. the pressure gauges filled 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. Find the discharge of water through pipe.
(b)	Show that the loss of head due to sudden expansion in pipeline is a function of velocity head.

6. **Attempt any one part of the following:**   **7 x 1 = 7**

(a)	Determine the distance from the pipe wall at which the local velocity is equal to the average velocity for turbulent flow in pipe.

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(b)	
	For the velocity profile in laminar boundary layer as $\dfrac{u}{U} = \dfrac{3}{2}\left(\dfrac{y}{\delta}\right) - \dfrac{1}{2}\left(\dfrac{y}{\delta}\right)^3$ Find the thickness of the boundary layer and the shear stress 1.5 m from the leading edge of plate is 2 m long and 1.4 m wide and is placed in water which is moving with a velocity of 200 mm per second. Find the total drag force on the plate if μ for water = 0.1 poise.

7.   **Attempt any *one* part of the following:**   **7 x 1 = 7**

(a)	Find out the expression for thee drag on a sphere, when the Reynold's number of the flow is up to 0.2?
(b)	The efficiency η of a fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity ω, diameter of the rotor D and the discharge Q. Express η in terms of dimensionless parameters by Buckingham's π-theorem.