SLOT: D1+TD1

REG. NO.: 24MEO7[illegible]

VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF MECHANICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST - I
FALL SEMESTER 2025-2026

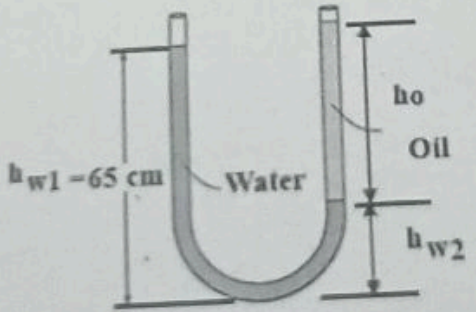
Programme Name & Branch : B.Tech- Automotive, Mechanical, Manufacturing Engineering

Course Code : BMEE204L
Course Name : Fluid Mechanics and Machines
Faculty Name(s) : Anuj Kumar, Aruna Kumar Behura, Gundabattini Edison, Mohamed Ibrahim M, Sreeja Sadasivan
Class Number(s) : VL2025260102051, VL2025260102049, VL2025260102050, VL2025260102048, VL2025260102047
Date of Examination : 20-08-2025, 9.30 AM to 11 AM
Exam Duration : **90 minutes** **Maximum Marks: 50**

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcome Statements:

CO 1: Demonstrate the significance of fluid properties and laws of fluid statics to engineering systems.
CO 2: Describe the flow fields using Lagrangian and Eulerian approaches.

Q. No	Question	M	CO	BL
1.	The dynamic viscosity of the oil used for lubrication between a shaft and a sleeve is 6 poise. The shaft has a diameter of 0.4 meters and rotates at 190 rpm. Calculate the power lost in the bearing due to viscous shear, if the length of the sleeve is 90 mm and the thickness of the oil film is 1.5 mm.	10	1	3
2.	Consider a U-tube whose arms are open to the atmosphere. Now water is poured into the U-tube from one arm, and light oil (ρ = 790 kg/m^3) from the other. One arm contains 65 cm high water, while the other arm contains both fluids with an oil-to-water height ratio of 6. Determine the height of each fluid in that arm.  Fig.1	10	1	3

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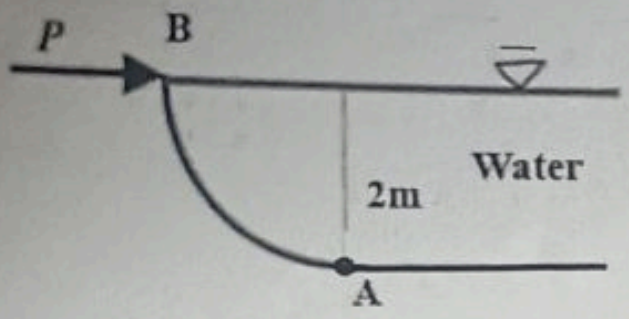
3.	A vertical quarter-circular gate is submerged in water and hinged at point A. The gate has a radius of 2 meters and a width of 3 meters. Neglecting the weight of the gate, determine the horizontal force required at the top of the gate to keep it stationary.  **Fig. 2**	10	1	4
4.	An idealized velocity field is given by the formula $\mathbf{V} = 4tx\mathbf{i} - 2t^2y\mathbf{j} + 4xz\mathbf{k}$ Is this flow field steady or unsteady? Is it two or three dimensional? At the point (x, y, z) = (-1, 1, 0), compute the acceleration vector. What are the local acceleration and convective acceleration in terms of 't' in this case?	10	2	4
5.	A steady, incompressible two-dimensional flow in the x-y plane is defined by the velocity components: $\mathbf{u} = A/x$, $\mathbf{v} = Ay/x^2$ where A= 2 m^2/s, and u and v are the velocity components in the x- and y-directions respectively. (a) Derive the equation of the streamline that passes through the point (x, y) = (1 m, 3 m). (b) Determine the time required for a fluid particle to move from x=1m to x=3m along the streamline.	10	2	3