BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

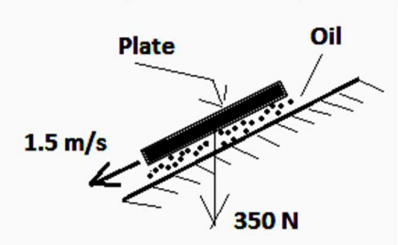
CLASS: B.TECH. **SEMESTER: III**
BRANCH: MECHANICAL ENGG **SESSION: MO/2022**

SUBJECT: ME203 FLUID MECHANICS AND HYDRAULIC MACHINES

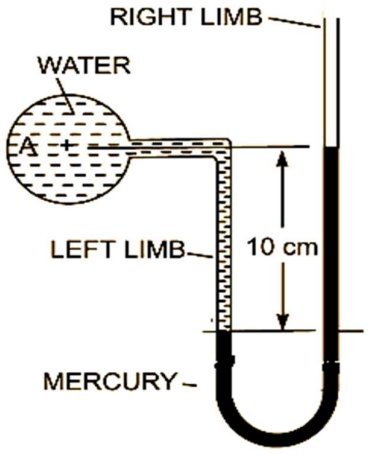
TIME: 2 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 25.
2. Candidates attempt for all 25 marks.
3. Before attempting the question paper, be sure that you have got the correct question paper.
4. The missing data, if any, may be assumed suitably.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

				CO	BL
Q1	(a)	Explain the importance of viscosity in fluid motion.	[2]	CO-1	L-2
Q1	(b)	A square plate of size 1 m x 1 m and weighting 350 N slides down an incline plane with a uniform velocity of 1.5 m/s as shown in Figure below. The incline plane is laid on a slope of 5 vertical to 12 horizontal and has an oil film of 1 mm thickness. Determine the dynamic viscosity of oil in SI Unit.	[3]	CO-3	L-3



Q2	(a)	What is a manometer? How they are classified?	[2]	CO-1	L-2
Q2	(b)	A U-Tube manometer is used to measure the pressure of water in a pipeline, which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and is open to atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in level of mercury in the limbs of U tube is 10 cm and free surface of mercury is in the level with center of the pipe line as shown in Figure below.	[3]	CO-3	L-3



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Q3	(a)	Derive the continuity equation in differential form for a 2D flow in Cartesian coordinate system.	[2]	CO-3	L-3
Q3	(b)	The following case represents two velocity components. Determine the third component of velocity, such that they satisfy the continuity equation. $u = x^2 + y^2 + z^2$; $v = x\,y^2 - y\,z^2 + x\,y$	[3]	CO-3	L-3
Q4	(a)	Distinguish between (i) steady and un-steady flow.(ii) uniform and non-uniform flow, (iii)Rotational and irrotational flow and (iv) Laminar and turbulent flow.	[2]	CO-2	L-1
Q4	(b)	A fluid flow is given by $V=8x^3i-10x^2yj$. Determine the shear strain rate and state whether the flow is rotational or irrotational.	[3]	CO-3	L-3
Q5	(a)	What do you understand by the term losses of energy of the flowing fluids in pipes.	[2]	CO-2	L-2
Q5	(b)	A crude oil of kinematic viscosity 0.4 x10^-4 m^2/s is flowing through a pipe of diameter 300 mm at a rate of 0.3 m^3/s. Using Darcy-Weisbach equation, determine the head lost due to friction for a length of 50 m of the pipe. Given that the friction factor $f = \frac{0.079}{(R_e)^{\frac{1}{4}}}$. Here R_e is the Reynolds Number.	[3]	CO-3	L-3

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