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

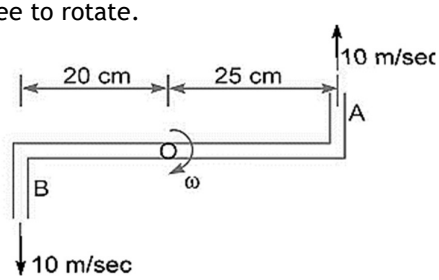
CLASS: BTech. **SEMESTER : III**
BRANCH: Mechanical Engg. **SESSION : MO/2023**

SUBJECT: ME203 FLUID MECHANICS & HYDRAULIC MACHINES

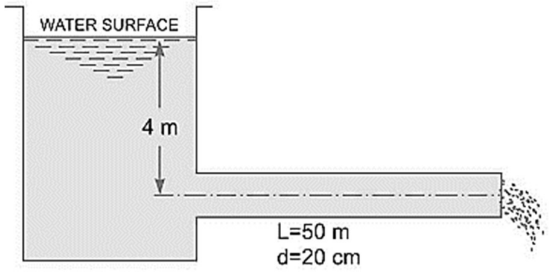
TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	State and prove the Pascal's law of static pressure.	[5]	1	M
Q.1(b)	A vertical gap 2.2 cm wide of infinite extent contains a fluid of viscosity 2.0 N-s/ m^2 and specific gravity of 0.9. A metallic plate of 1.2m x 1.2m x 0.2cm is to be lifted up with a constant velocity of 0.15 m/sec, through the gap. If the plate is in middle of the gap, determine the force required. The weight of the plate is 40N.	[5]	1	M
Q.2(a)	Explain the following terms: (i)Linear translation, (ii)linear deformation, (iii)angular deformation, (iv)rotation, and (v) vorticity of a fluid element.	[5]	2	M
Q.2(b)	A lawn sprinkler as shown in **figure below,** has 0.8 cm diameter nozzle at the end of a rotating arm and discharges water with a velocity of 10 m/s. Determine the torque required to hold the rotating arm stationary. Also determine the constant speed of rotation of the arm, if free to rotate.	[5]	2	M



Q.3(a)	What is an orifice meter? Prove that the discharge through an orifice meter is given by the relation $Q = C_d \frac{a_0 a_1}{\sqrt{a_1^2 - a_0^2}} \sqrt{2gh}$, where a1=area of the pipe in which the orifice meter is fitted, and a0= area of the orifice.	[5]	3	M
Q.3(b)	Determine the rate of flow of water through a pipe of diameter 20cm and length 50m,when one end of the pipe is connected to a tank and other end of the pipe is open to the atmosphere as shown in **figure below**. The pipe is horizontal and the height of water in the tank is 4m above the centerline of the pipe. Consider all minor losses and take f=0.009 in the Darcy–Weisbach equation. Also draw the Total Energy line and Hydraulic Gradient Line of it.	[5]	3	M



PTO

Q.4(a)	A Francis turbine of overall efficiency of 75% is required to produce 148.25 kW power. It is working under a head of 7.62m. The peripheral velocity = 0.26(2gH)^0.5 and the radial velocity of flow at inlet is 0.96(2gH)^0.5. The wheel runs at 150 rpm and the hydraulic losses in the turbine are 22% of the available energy. Assuming the radial discharge, determine (i) the guide blade angle , and (ii) wheel vane angle.	[5]	4	M
Q.4(b)	What is governing of a hydraulic turbine. Briefly explain the governing of an impulse turbine.	[5]	4	L
Q.5(a)	A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm, works against a total head of 40m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set backward at an angle of 40 degrees at outlet. If the outer diameter of the impeller is 500mm and width at the outlet is 50mm, determine the work done by the impeller on water per second.	[5]	5	M
Q.5(b)	Briefly explain the working of a Reciprocating pump.	[5]	5	L

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