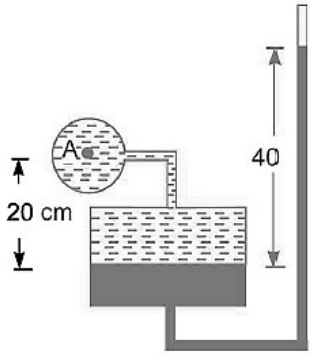
BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BTECH **SEMESTER : III/ADD**
BRANCH: MECHANICAL ENGINEERING **SESSION : MO/2025**
SUBJECT: ME24203 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)	Define the center of pressure and determine the total pressure on a circular plate of diameter 1.5 m which is placed vertically in water such a way that center of the plate is 3.0 m below the free surface of water. Also determine the position of center of pressure.	[5]	2	L
Q.1(b)	A single column manometer is connected to a pipe containing liquid of specific gravity of 0.9. Determine the pressure in the pipe, if the area of the reservoir is 100 times the area of the tube for the manometer reading shown in Figure. The manometric fluid is mercury with specific gravity of mercury as 13.6.	[5]	2	M



Q.2(a)	Derive the Euler's equation of motion along a stream line. State the basic assumptions made to derive it.	[5]	2	M
Q.2(b)	The velocity components in a two-dimensional flow are u = (y^3)/3 + 2x – (x^2) y and v = x (y^2) – 2y – (x^3)/3. Determine whether the flow is rotational of irrotational.	[5]	3	M
Q.3(a)	What is Boundary Layer? Explain with a neat sketch the phenomena of boundary layer separation. How the separation of boundary layer can be controlled.	[5]	1	L
Q.3(b)	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 a reading of 19.62 N/cm^2 and 9.81 N/cm^2 of water respectively. Take the value of the coefficient of discharge of the orifice plate as 0.6. Determine the discharge through the pipe.	[5]	3	M
Q.4(a)	What is governing of a turbine? With a neat sketch explain the mechanism of governing of an impulse turbine.	[5]	1	L
Q.4(b)	The following data is given for an inward flow reaction turbine. Net head = 60 m, speed = 700 rpm, shaft power = 294.3 kW, overall efficiency = 84%, hydraulic efficiency = 93%, flow ration = 0.2, breadth ratio = 0.1, outer diameter of the runner = 2 times inner diameter of the runner. The thickness of the vanes occupy 5% of circumferential area of the runner. The velocity of the flow is constant at inlet and outlet and discharge is radial at outlet. Draw the velocity triangles and determine (i) guide blade angle, (ii) runner vane angles at inlet and outlet, (iii) diameter of the runner at inlet and outlet.	[5]	4	H
Q.5(a)	Explain with a net sketch the working of a double acting reciprocating pump fitted with air vessels. Also draw its ideal characteristics.	[5]	1	L
Q.5(b)	What is cavitation? How does it different from priming? Clearly mention the effect of cavitation and Precaution against cavitation of centrifugal pumps and turbines.	[5]	1	L

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