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

CLASS: BTECH **SEMESTER : III**
BRANCH: CHEMICAL **SESSION : MO/2023**

SUBJECT: CL203 FLUID MECHANICS

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)	A rectangular plane surface 2 m wide and 3 m deep lies in water in such a way that its plane makes an angle of 30° with the free surface of water. Determine the total pressure and position of centre of pressure when the upper edge is 1.5 m below the free water surface.	[5]	CO1	BL5
Q.1(b)	The water in a tank is pressurized by air, and the pressure is measured by a multifluid manometer as shown in Fig. 1. The tank is located on a mountain at an altitude of 1400 m where the atmospheric pressure is 85.6 kPa. Determine the air pressure in the tank if h1 = 0.1 m, h2 = 0.2 m, and h3 = 0.35 m. Take the densities of water, oil, and mercury to be 1000 kg/m^3, 850 kg/m^3, and 13,600 kg/m^3, respectively.	[5]	CO1	BL5

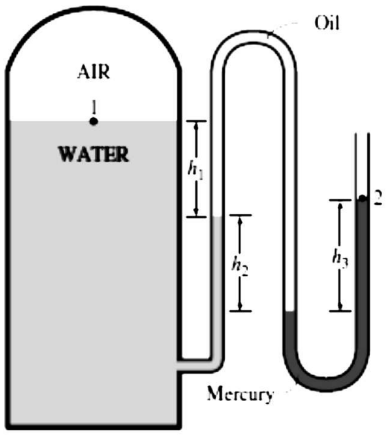

Fig. 1

Q.2(a)	Define "laminar flow" and "turbulent flow". Explain the nature and quantification of turbulence. Sketch stress versus strain diagram for Newtonian and Non-Newtonian fluid with example.	[5]	CO2	BL1
Q.2(b)	Discuss the following flow visualization with a neat diagram: i. Timeline ii. Pathline iii. Streamline iv. Stream tube	[5]	CO2	BL1
Q.3(a)	Define Fanning Friction Factor, what is the relationship between friction factor and Reynolds number in laminar and turbulent flow. Discuss the application of Bernoulli's equation for measuring the velocity of fluid flowing in the pipe. Explain the principle of venturimeter derive the equation of velocity in terms of the cross-sectional area of the pipe.	[5]	CO3	BL2
Q.3(b)	Water at 60ºC is pumped from a reservoir to the top of a mountain through a 15 cm pipe at a velocity of 3.5 m/s. The pipe discharges into the atmosphere at a level of 1000 m above the level in the reservoir. The pipe itself is 1500 m long. If the overall efficiency of the pump is 65%, calculate the power requirement.	[5]	CO3	BL2

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Q.4(a)	Discuss the concept of streamlining with a neat sketch.	[5]	CO4	BL2
Q.4(b)	Explain the various types of impellers in an agitated vessel with a neat sketch.	[5]	CO4	BL2
Q.5(a)	A sharp-edged orifice having a diameter of 0.0566 m is installed in a 0.1541m pipe through which oil having a density of 878 kg/m^3 and a viscosity of 0.41 cp is flowing. The measured pressure difference across the orifice is 93.2 KN/m^2. Calculate the volumetric flow rate in m^3/Sec. Assume that C_o = 0.61	[5]	CO5	BL2
Q.5(b)	Explain the working principle of reciprocating pump with a neat sketch.	[5]	CO5	BL2

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