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

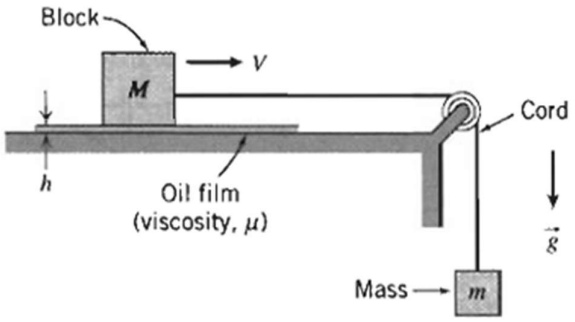
CLASS: BTECH — **SEMESTER : III**
BRANCH: CHEMICAL & FET — **SESSION : MO/2025**

SUBJECT: CL24203 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)	Write short notes on the various types of forces acting on a fluid element?	[2]	CO1	BL2
Q.1(b)	Determine the total pressure on a circular plate of diameter 1.5 m which is placed vertically in water in such a way that the centre of the plate is 3 m below the free surface of water. Find the position of centre of pressure also.	[4]	CO1	BL3
Q.1(c)	An open tank contains water upto a depth of 2 m and above it an oil of specific gravity of 0.9 for a depth of 1 m. Find the pressure intensity (i) at the interface of the two liquids, and (ii) at the bottom of the tank.	[4]	CO1	BL
Q.2(a)	Find out the momentum correction factor for laminar flow of a fluid through a pipe of circular cross-section under steady state.	[5]	CO2	BL3
Q.2(b)	A block with mass M and area A, slides on a thin film of oil as shown in the figure below. The film thickness is h. When another mass m is released with a cord connected to the block of mass M, it causes tension on the cord and the block is accelerated. Develop an algebraic expression for the viscous force when the block of mass M is moving at a velocity V. Derive a differential equation of V as a function of time.	[5]	CO2	BL5



Q.3(a)	In a vertical pipe conveying oil of specific gravity 0.8, two pressure gauges have been installed at A and B where the diameters of the pipes are 16 cm and 8 cm respectively. A is 2 meters above B. The pressure gauge readings have shown that the pressure at B is greater than at A by 0.981 N/cm^2. Neglecting all losses, calculate the flow rate.	[5]	CO3	BL4
Q.3(b)	Prove that the maximum velocity in a circular pipe for viscous flow is equal to two times the average velocity of the flow.	[5]	CO3	BL3
Q.4(a)	Determine the terminal velocity of a limestone particle (specific gravity 2.8) having a diameter of 0.16 mm falling in water under free settling conditions.	[5]	CO4	BL3
Q.4(b)	Water is entering a packed bed at a rate of 0.358 kg/s. The packed bed contains spheres of diameter 12.7 mm. Void fraction of the packed bed is 0.38, length of the bed is 2.44 m, and diameter is 0.601 m. Calculate the pressure drop in the packed bed.	[5]	CO4	BL3
Q.5(a)	Derive the expression of volumetric flow rate of a real fluid flowing through a venturimeter with a neat diagram.	[5]	CO5	BL5
Q.5(b)	Discuss the working principle of a reciprocating pump with a neat sketch.	[5]	CO5	BL3

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