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

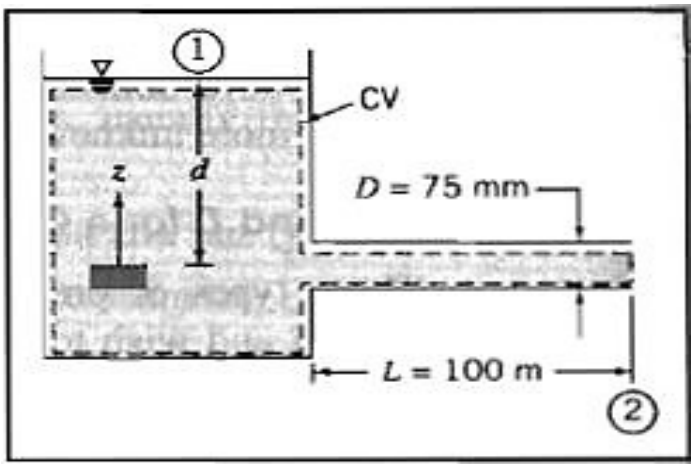
CLASS: BTECH — **SEMESTER : III/ADD**
BRANCH: CHEMICAL & FT — **SESSION : MO/2024**

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)	An oil of specific gravity 0.8 is flowing through a pipe. A differential manometer is connected at the two points, say A and B, and shows a difference in the mercury level as 20 cm. What will be the difference between the pressures at the two points? Take density of mercury = 13600 kg/m^3 and g = 10 m/s^2.	[5]	CO1	BL5
Q.1(b)	If a vertical circular plate of diameter 'd' is submerged in water and coincides with water surface, what is the depth of centre of pressure from the water surface?	[5]	CO1	BL4
Q.2(a)	A fluid flowing through a pipe of diameter 450 mm with velocity 3 m/s is divided into two pipes of diameters 300 mm and 200 mm. The velocity of flow in 300 mm diameter pipe is 2.5 m/s, then find the velocity of flow through 200 mm diameter pipe?	[5]	CO2	BL4
Q.2(b)	State Boundary Layer Theory and discuss Prandtl Boundary Layer with a neat sketch.	[2+3]	CO2	BL2
Q.3(a)	Using a sketch and using the concept of boundary layer, explain the fully developed flow condition. Consider the steady, laminar, incompressible, and fully developed pressure-driven flow of a Newtonian fluid between two parallel plates separated by a distance *H*. Perform the force balance in rectangular cartesian coordinate system and derive the velocity profile. Draw the velocity profile and show the location of minimum and maximum velocities.	[[1+1+3+1]]	CO3	BL4
Q.3(b)	Water flows at 0.01 m^3/s through 75 mm diameter smooth pipe, with *L* = 100m, attached to a constant-level reservoir. Square-edged inlet. Calculate the reservoir depth *d* to maintain the flow. Data: density of water (ρ) = 1000 kg/m^3, viscosity of water (μ) = 0.001 Pa. s., friction factor (f) = 0.0162, loss coefficient *K* = 0.5, kinetic energy correction factor = 1.	[4]	CO3	BL4



PTO

Q.4(a)	Briefly explain drag and lift force. Write down the expression of the drag coefficient for laminar flow. Using the force balance approach, derive the expression of the terminal settling velocity for the gravitational settling motion of an isolated spherical particle.	[1+1+4]	CO4	BL3
Q.4(b)	Explain briefly the flow through a packed bed. What is fluidized bed and what is the condition for fluidization? Write down the two dimensionless numbers in the context of agitation.	[2+1+1]	CO4	BL3
Q.5(a)	A venturimeter of 20 mm throat diameter is used to measure the velocity of water in a horizontal pipe of 40 mm diameter. If the pressure difference between the pipe and throat sections is found to be 30 kPa then, neglecting frictional losses, determine the flow velocity.	[5]	CO5	BL5
Q.5(b)	Discuss the working principle of centrifugal pump with a neat sketch and also discuss the centrifugal pump specification and important efficiencies of centrifugal pump.	[3+1+1]	CO5	BL2

::::::21/11/2024::::::E