BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2024)

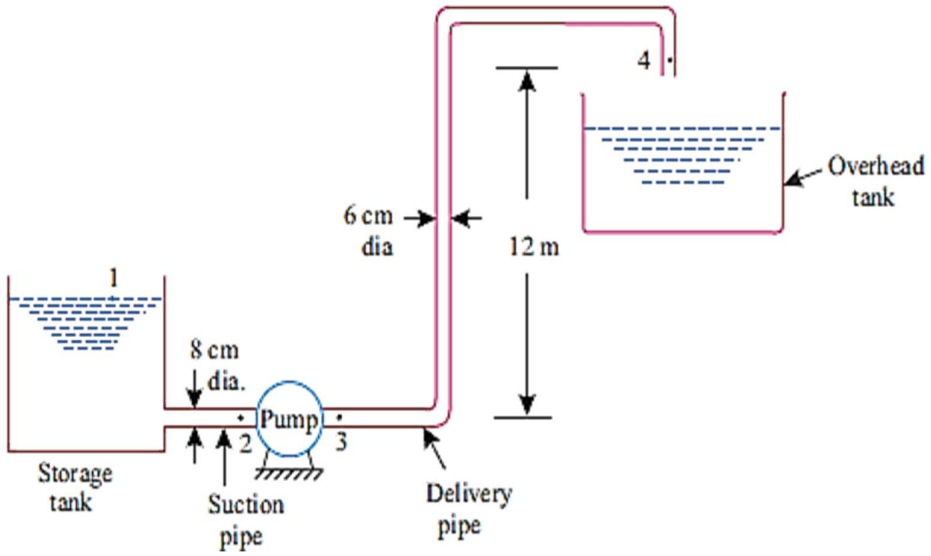
CLASS: B.TECH **SEMESTER : IV**
BRANCH: BIOTECHNOLOGY **SESSION : SP/2024**

SUBJECT: BE209 FLUID MECHANICS AND HEAT TRANSFER

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	An incompressible fluid (kinematic viscosity, 7.4×10^{-7} m^2 /s , specific gravity, 0.88) is held between two parallel plates. If the top plate is moved with a velocity of 0.5 m/s while the bottom one is held stationary, the fluid attains a linear velocity profile in the gap of 0.5 mm between these plates; Calculate the shear stress in Pascals on the surfaces of top plate?	[2]	1	1
Q.1(b)	An oil of sp. gr. 0.7 is flowing through a pipe of diameter 300mm at the rate of 500 liters/s. Find the head lost due to friction and power required to maintain the flow for a length of 1000m. Kinematic viscosity=0.29 stokes	[3]	1	3
Q.2(a)	Fig. shows a pump drawing a solution (specific gravity =1.8) from a storage tank through an 8 cm steel pipe in which the flow velocity is 0.9 m/s. The pump discharges through a 6 cm steel pipe to an overhead tank, the end of discharge is 12 m above the level of the solution in the feed tank. If the friction losses in the entire piping system are 5.5 m and pump efficiency is 65 per cent, determine: (i) Power rating of the pump. (ii) Pressure developed by the pump.	[5]	1	4



Q.3(a)	A pipe carrying water experiences a sudden reduction in area. The area at point (1) is 0.002 m^2 and at point (2) it is 0.001 m^2 . The pressure at point (2) is 500 kPa and the velocity is 8 m/s. The loss coefficient K is 0.4. The density of water is 1000 kg/m^3.Calculate the following. i. The mass flow rate. ii. The pressure at point (1)	[5]	1	3

PTO

Q.4(a)	An orifice meter with orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. The pressure difference measured by a mercury oil differential manometer on the two sides of the orifice meter gives a reading of 50 cm of mercury. Find the rate of flow of oil of sp. Gravity 0.9 when the coefficient of discharge of orifice meter = 0.64	[5]	2	4
Q.5(a)	A sub marine moves horizontally in sea and has its axis 15 m below the surface of water. A pitot tube properly placed just in front of the sub marine and along its axis is connected to the two limbs of U- tube containing mercury. The difference of mercury level is found to be 170 mm. Find the speed of sub marine knowing that the sp gravity of mercury is 13.6 and that of sea water is 1.026 with respect of fresh water.	[5]	2	3

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