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

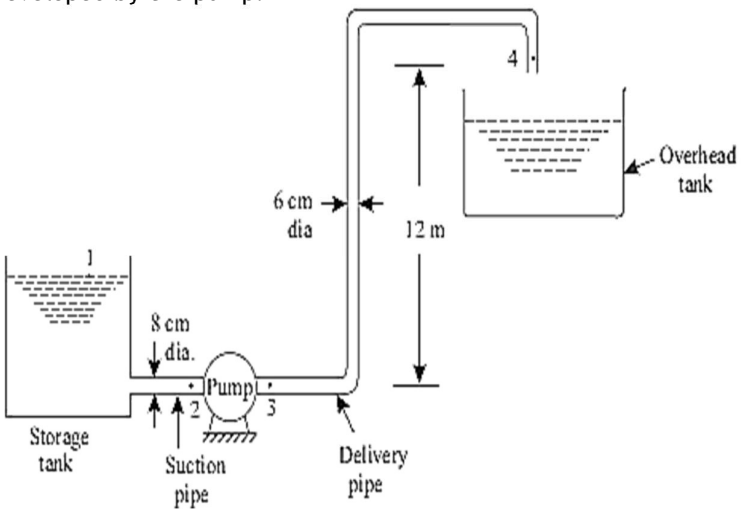
CLASS: B.TECH **SEMESTER : IV**
BRANCH: BIOTECHNOLOGY **SESSION : SP/2025**

SUBJECT: BE209 FLUID MECHANICS AND HEAT TRANSFER

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)	In a pipe of 300 mm diameter and 800 m length an oil of specific gravity 0.8 is flowing at the rate of 0.45 m^3/s. Find (i) Head lost due to friction (ii) Power required to maintain the flow. The kinematic viscosity of oil as 0.3 stoke.	[5]	1	Analyze
Q.1(b)	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]	2	Applying



Q.2(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]	3	Evaluate
Q.2(b)	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]	3	Evaluate

PTO

Q.3(a)	A spherical vessel of 0.5 m outside diameter is insulated with 0.2 m thickness of insulation of thermal conductivity 0.04 W/m degree. The surface temperature of the vessel is –195 degree Celsius and outside air is at 10 degree Celsius. Determine heat flow per m^2 based on inside area	[5]	4	Create
Q.3(b)	A thick walled tube of stainless steel (K = 19 W/m˚C) with 2 cm inner dia and 4 cm outer dia is covered with a 3 cm layer of asbestos insulation (K= 0.2 W/m˚C). If the inside wall temperature of the pipe is maintained at 600 ˚C and the outside temperature is 100 ˚C . Calculate the heat loss per meter of length? Also calculate the tube insulation interface temperature?	[5]	4	Analyze
Q.4(a)	A vertical pipe 80 mm diameter and 2 m height is maintained at a constant temperature of 120° C. the pipe is surrounded by still atmospheric air at 30°C . Find heat loss by natural convection. Properties of water at film temperature are ρ= 1.0145 kg/m^3 : Kinematic viscosity = 20.55 x10^{-6} m^2/s :Pr = 0.693: k = 30.06 x 10^{-3} W/mK.	[5]	4	Remembering
Q.4(b)	A thick walled tube of stainless steel (K = 19 W/m˚C) with 2 cm inner dia and 4 cm outer dia is covered with a 3 cm layer of asbestos insulation (K= 0.2 W/m˚C). Air at 600 ˚C flows through the pipe and the convective heat transfer coefficient from the air to the inside of the pipe has the value of h_i = 35 W/m^2 K . The outside surface of the pipe is surrounded by air which is at 100 ˚C and the convective coefficient for the outside is h_o= 10 W/ m^2 K. Calculate the heat loss through 50 m of this pipe?	[5]	4	Analyze
Q.5(a)	Two large plates are maintained at a temperature of 900 K and 500 K respectively. Each plate has area of 6m^2. Compare the net heat exchange between the plates for the following cases. (i) Both plates are black (ii) Plates have an emissivity of 0.5	[5]	4	Analyze
Q.5(b)	The sun emits maximum radiation at λ = 0.52 μm. Assuming the sun to be a black body, calculate the surface temperature of the sun. Also calculate the monochromatic emissive power of the sun's surface. Data: c_1 = 0.374X10^{-15} Wm^2 : C_2 =14.4X10^{-3} mK.	[5]	4	Evaluate

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