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

CLASS: B.TECH. **SEMESTER : III**
BRANCH: MECHANICAL ENGG **SESSION : MO/2022**

SUBJECT: ME203R1 FLUID MECHANICS & HYDRAULIC MACHINES

TIME: 3:00 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.

Q.1(a) Define the following terms (i) Density,(ii) weight density, (iii)specific gravity,(iii) specific volume. [2] (CO-1,L-1)

Q.1(b) A plate 0.025 mm distant from a fixed plate, moves at 60 cm/s and requires a force of 2 N/sq.m to maintain this speed. Determine the fluid dynamics viscosity between the plates. (CO-1,L-3) [3]

Q.1(c) An inverted differential manometer as shown below, connected to two pipes A and B containing water. The fluid in manometer is oil of sp. gr. 0.8. For the manometer readings shown in the *Fig, 1[SEE NEXT PAGE]*. Determine the difference of pressure head between A and B. (CO-1,L-3) [5]

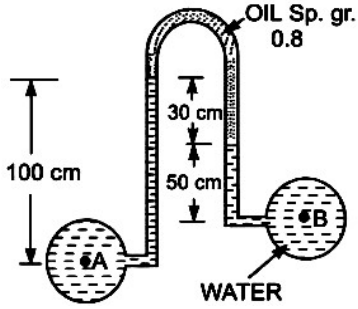

Figure 1(Q-1(c))

Q.2(a) Distinguish between stream line , streak line and path line in a fluid flow. (CO-2,L-2) [2]

Q.2(b) Prove the Bernoulli's theorem for fluid flow. Also state the assumptions being made. (CO-2,L-2) [3]

Q.2(c) A tapered horizontal pipe with inlet diameter of 25 cm, carries oil of sp. gr. 0.9 at a velocity of 3 m/s. The diameter of the outlet section is 20 cm. Determine the velocity of oil at the outlet section and also flow rate of oil through this tapered pipe. (CO-2,L-3) [5]

Q.3(a) Distinguish between major and minor losses in pipes. (CO-3,L-1) [2]

Q.3(b) What is a boundary layer? How a boundary layer gets separated from the boundary and what are the standard ways to control the separation. (CO-3,L-2) [3]

Q.3(c) A horizontal pipe line 40 m long is connected to a tank at one end and discharges freely into the atmosphere at the other end. The lengths of the segments and corresponding diameters are shown in *Fig-2[SEE NEXT PAGE]* . Given d1 = 0.15 m, d2 = 0.3 m. The height of the water level in the tank is 8 m above centerline of the pipe. Take friction factor f = 0.01. Considering all the losses of head which occur, determine the rate of flow. Also draw the hydraulic gradient line and total energy line for this hydraulic circuit. (CO-3,L-3) [5]

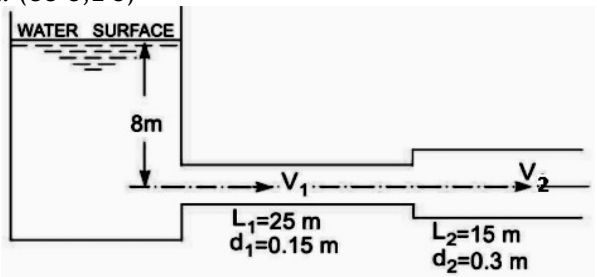

Figure 2(Q-3(c)

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Q.4(a)	Classify various types of hydro-turbines. (CO-4,L-1)	[2]
Q.4(b)	With a neat sketch explain the working of an inward flow reaction turbine. (CO-4,L-2)	[3]
Q.4(c)	Determine the power given by the jet of water to the runner of a Pelton wheel which is having tangential velocity as 20 m/s. The net head on the turbine is 50 m and discharge through the jet of water is 0.03 m^3/s. The blade angle at outlet with tangential direction(Φ) = 15 degrees. Take coefficient of velocity as 0.975. (CO-4,L-3)	[5]
Q.5(a)	Define the following terms for a centrifugal pump: (i) suction head, (ii) delivery head, (iii) static head, (iv) manomertic head. (CO-5,L-1)	[2]
Q.5(b)	With a neat sketch describe the principle of working of a reciprocating pump. (CO-5,L-2)	[3]
Q.5(c)	A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm. , which works against a total head of 40 m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set backwards at an angle of 40 degrees at outlet. If the outer diameter of the impeller is 500 mm and width is 50 mm, determine (i) vane angle at inlet, (ii) work done by the impeller on water per second, and (iii) manometric efficiency. (CO-5,L-3)	[5]

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