Assignment 5

The due date for submitting this assignment has passed.

As per our records, you have not submitted this assignment.

A beam having dimensions of 100 m and 489 m is to be filled with water to a depth of 7.0 cm in 1 hour. If the beam has a diameter of 2.0 cm is used for the filling, the water in the beam with the average velocity of 0.2 m/s. What would be required to fill the beam in the given time? Assume the flow to be steady, uniform and incompressible.

[Diagram of water flow through a beam]

Common data for Q.2 - 3.5

Calculate the friction force between two parallel plates a distance h apart. The width of each plate normal to the stream is w. The plates have a velocity V and causes the flow between these plates. Assume the flow to be steady. Consider the control volume (CV) as shown in the figure. The flow enters the control volume at section 1. As shown in the figure, the velocity varies linearly between the plates and is zero on the bottom and V at the top plate.

The volumetric flow rate at section 1, Q = wV h

The momentum flow rate, \( \rho V^2 (w + d_V) \) at section 1 =

5. What is the mean flow rate at entry of the nozzle in kg/s?

6. The average velocity of water at nozzle exit is m/s to

7. What is the net force (in N) required to keep the nozzle fixed with the house?

8. The oil is a stationary FOM. What is the viscosity of the oil?

As shown in the figure, a jet of oil strikes a moving (circular) blade that turns the oil jet by an angle 60° from 180°. The cross-sectional area of the jet is 100 cm² and its speed in the stationary frame of reference (FOM) is 20 m/s. The blade moves towards the nozzle at a speed of 10 m/s. The specific gravity of the oil is 8 and density of water is 960 kg/m³. Assume the flow to be steady, uniform and incompressible. Neglect any frictional forces. Determine the magnitude of force in N, that must be applied to maintain the blade speed constant.

1. (a) The axial vector normal to a surface is i. The velocity vector at the surface is in. What will be component of v normal to the surface? Note that \( \mathbf{v} \) represents the magnitude of vector v.

2. (b) The surface vector normal to a surface is j. The velocity vector at the surface is in. What will be component of v normal to the surface?