BIRZEIT UNIVERSITY

Faculty of Engineering

Department of Mechanical Engineering

ENME335 Final Exam

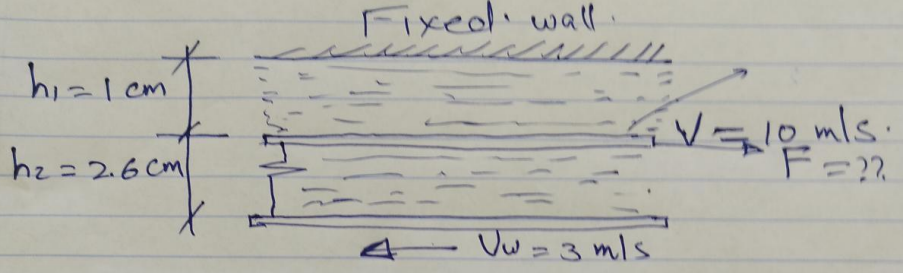
Dr. Sameh Abu Awad **February 11th ,2024.**

Q1: (20 Points) A flat plate with a squared shape of 40 cm each side, is pulled through an oil layer between two infinite plates as shown.

Assuming linear velocity profiles find the following

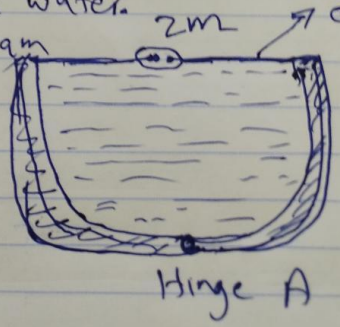
(a) The force acting on the plate

(b) The velocity profiles on each side of the plate. where does the velocity becomes zero? of the fluid.

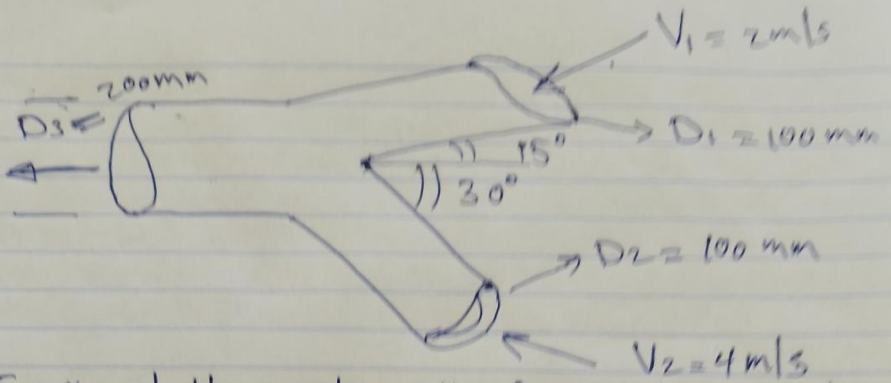


Q2: (20 points) A water tank has a semicircular shape and a radius of 1m. It consists of two symmetric parts hinged together at the bottom as shown. The two parts are held together by a cable, with the depth of the tank 3m. what is the tension in the cable when the tank is filled with water.

Draw the free body diagram

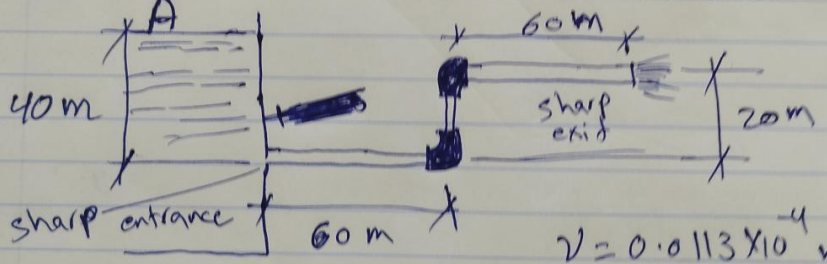


Q3: (20 points)



For the double nozzle in the figure above, find the resultant force acting on it, if it lies in a horizontal plane. Assume frictionless flow

Q4.: (20 points) A pipe system delivers water from a reservoir and discharges it as a free jet as shown. What is the flow rate of this system if diameter of the pipe is 200 mm and made of commercial steel.



$\nu = 0.0113 \times 10^{-4}\ m^2/s$

$\rho = 998\ kg/m^3$

Problem 5 (20 Points):

A centrifugal pump is to be designed to pump a fluid with density of 1226 kg/m3, with inner and outer radii of 100 and 180 mm, and impeller depth of b1=50mm, b2=30mm. The desired flow rate is 0.25 m3/s at a net head of 14.5 m when the impellers rotate at 1720 rpm. Calculate the blade angles β1 and β2 at the design point. What is the horsepower of this pump. Draw the velocity angles of the pump.