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MET 330

Test 2 Reflection

11/4/2021

Test #2 Reflection

1)

In this test we touch on a pile of the course objectives. This test was built to make use of a lot of the things we have learned in the class so far this semester. In part one we start out by using the properties of open channel flow by figuring out the flow rate it would take for the lazy river to maintain its depth of water. On the second part of the first question we were tasked with finding the drag force a 5-year-old would feel while standing in the lazy river which applies solving for very specific industrial problems from the syllabus. Part 3 of question one completely covers what buoyancy and stability are and how to calculate for them and how to understand what stability really is. On the last part in part 1 we compute pressure and forces that were associated with a "stagnant fluid while finding the force on the floor and the walls of the lazy river.

In part 2 of the test we revisited the problem that we completed on exam one to fully finish the design of the piping system between the two tanks. In the first part we have to calculate the forces that the piping is feeling from the moving fluid inside of them so that a civil engineer can take the calculations and correctly support the tube. Part 2 of this question we had to place a flow-nozzle in the system and find the pressure drop across it. Part 3 was to find the amount of force the pipe would see due to water hammer and then calculate the minimum thickness the pipe could be to withstand the force and compare it to what was specified to see if our pipe has a sufficient wall thickness. We then had to determine the lowest pressure in the system which was 40 psi and find the vapor pressure of ethyl alcohol to determine if the vapor pressure would ever exceed the lowest pressure causing cavitaion. This problem brought up a lot of fluid dynamics inside of pipes, computing pressure and forces on the pipes due to the flowing fluid and solving for very specific industrial problems in water hammer and cavitation.

2)

When talking about problem number one I would say that from the beginning of the problem I was on the right track. It was very difficult in this section to grade for correctness because of the amount of variable that were decided by the test taker. In part 1 I was very confident with my process for sizing the lazy river to the specified requirements as well as with my calculations needed for the flow rate of the system. I used the correct equation and got a reasonable number. In part 2 I did most of the calculating correct but seemed to stumble a bit when I used a different area for the cylinder (lateral surface area) when I should have just multiplied diameter by height like in the solution other than that I think everything else was spot on for part 2. In part 3 I assumed the tube to have a height of 7.88" which was significantly smaller than the tube used in the solution. Although that was different I used the correct equation to find the depth of immersion from displaced volume and found I of a cylinder and MB to eventually find that ycg was less than ymc meaning the tube was stable with 250 lbs on it. In part 4 of

question 1 we had to find the forces on the bottom of the lazy river and I did not use volume to compute the equation only area which caused my numbers to be off from the numbers provided in the solution. In the same part I used the equation to find the forces on the walls correctly and stated where that reaction force would be on the wall at 2/3 down from the surface which came out to .67 ft from the bottom of the lazy river.

When talking about problem number 2 I believe I did my free body diagram correctly and placed the reaction forces in the correct places but for Rx I failed to multiply by the area and ended up dividing by the area which made my numbers different from the solution. For Ry I did not use volume to find the weight of the fluid instead I just multiplied gamma by the lengths of the pipes which caused my numbers to come out differently than the solution. In part 2 I started out doing everything correctly until it came down to doing A1/A2. This is what messed up the equation that I correctly used and gave me a different number than the solution. In part 3 I used the correct equation but did not correctly convert everything to metric and that threw off the number I also did not supply units on the C value. I did use the delta P and Pmax equations correctly but did not have the correct C value so the answers were not correct. All in all I am not upset with how I did on this test as a whole. I wish I would have completed more problems outside of the homework in order to have a larger understanding of everything and maybe that would have helped but overall I think I used all of the correct tools that were supplied to me I just didn't work with them in the manner I should have.

Writing Rubric:

1. Purpose: .5/10
    a. In this section I stated clearly what the objective of the problem and the given numbers for the problem.
2. Drawings: 1.0/10.0
    a. In this section I clearly draw out the system needed for the problem and label all measurements and needed values.
3. Sources: .5/10.0
    a. I should have placed the sources I used to find the heights and weights of the children.
4. Design Considerations: 1.0/10.0
    a. I used more design considerations that what were place on the solution but I feel that they also apply.
5. Data & Variables: 0.5/10.0
    a. I clearly stated all of the given variables and found variables in this section in an organized manner.
6. Procedure: 2.0/10.0
    a. I described the procedure that was needed to solve the problems in clear concise steps that can be easily followed.
7. Calculations: 2.0/10.0
    a. For the calculations I show the work neatly and in an organized manner.
8. Summary: 0.5/10.0
    a. I thoroughly describe the design of the system and the way in which it works according to the calculations.
9. Materials: 0.5/10.0
    a. I stated all of the different materials that were used in the solving of the problem.
10. Analysis: 1.0/10.0
    a. In my analysis I discuss my findings and how both systems work according to the problem at hand.

Total : 9.5/10

Flow in the Open channel:

a. Lazy River Dimensions: 1/28
b. Correct Equation: 1/28
c. Area and Hydraulic Radius: 1/28
d. Correct Results: 1/28

Total : 4/28

Drag force on the child:

a. Correct Equation to Use: 1/28
b. Correct Area and Velocity: 1/28
c. How Cd was obtained?: 1/28
d. Correct Results: 1/28

Total : 4/28

Lazy river tube floating - stability:

a. Realize Fb=W and solve for distance into water: 1/28
b. Compute metacenter location: 1/28
c. Realize metacenter will always be above cg: 1/28
d. Correct Results: 1/28

Total : 4/28

Force on the channel walls and floor per 1-m length:

a. Vertical force (weight) & location: .5/28
b. Horizontal force magnitude: 1/28
c. Horizontal force location: 1/28
d. Correct Results?: .5/28

Total : 3/28

Pipe- elbow Forces:

a. Free body diagram and correct forces: 1/28
b. Force in x – solve for Rx: 1/28
c. Force in y (weight) – solve for Ry: 1/28
d. Correct Results: 0/28

Total : 3/28

Flow-nozzle flowmeter pressure drop:

a. Right equation and A1/A2: .5/28
b. C value: 1/28
c. Correct Results?: .5/28

Total : 2/28

Water hammer pressure increase and cavitation:

a. Wave velocity (units?): .5/28
b. Pressure increase and Pmax: 1/28
c. Pipe thickness: 1/28
d. Lowest pressure & compare to sat pressure (cavit): 1/28
e. Correct Results?: .5/28

Total : 4/28

Overall Total: 9.5+(80)(24/28)= 78.07

During the test I only encountered one issue and it was on the first part of the second problem when I had to reach out to the professor to get an idea of where to even begin with solving the problem. Other than that, I think the test went smooth just took a lot of time to complete and consult the book when I needed some guidance. I would not change how I completed the test, but I do wish I would have realized that I needed to cite the sources of the websites I used to find data for certain parts of the test. I have learned what it takes to design a lazy river and how you can use fluid mechanics to not only make it work but also find ways to make it safe, and how to find information to submit to another engineer to solve their part of the problem. I think that engineers use what we learned in the test all the time in water parks and the design of water attractions all over the world. The applications of finding forces on the tubes and pressure drops across flow meters are also used every day in plants across the globe to design new plumbing systems, supply line systems, or even sewer systems, not to mention in countless other situations. I think that everything I learned will be harder to apply in my everyday career because of my mechanical engineering job but I do think that if I ever want a career change this test would apply to a career more than anything I have ever learned. I absolutely think what we learned in preparation for this test will be important for my career because fluids are everywhere whether it be hydraulics or air in most manufacturing facilities. I have not been able to apply what I learned for this test to my everyday career, but I see where it may come in handy in the design phase of some systems in the future. I feel I was most successful on this test in applying the equations and taking the correct steps to solve the problems but applying wrong numbers and not using cohesive units across a problem was my Achilles heel. I think this course could directly intersect with my field if we ever must redesign some of our air powered or hydraulic powered systems. I spent about 8 hours throughout my workday on this test. I worked it start to finish and only stumbled on one section. A thing I would change would be I wish I would have read the chapter a few times to engrain some more of the information into my brain.