**Test 3 Reflections**
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**Learning Objectives**

The Unit 3 test focused on one learning objective:

- Identify and solve for different very specific industrial problems, such as, open-channel flow, cavitation, water hammer, drag, lift, forces in pipes, and learn about different instruments to measure fluid flow quantities (such as, pressure, fluid velocity, flow velocity, etc.)

This objective has a lot of goals within it. The problems on this test covered different aspects of this objective. Problem 1 looked at drag, Problem 2 investigated open channel flow, Problem 3 looked at measuring devices, Problem 4 focused on the forces created in pipes, and Problem 5 was about calculating the pressure effects of water hammers.

**Grading**

Problem 1:

For this problem, using the supplied grading rubric, I would grade it 5/5. The moment was calculated with respect to point A using the correct distances from the table, the Cd was found using the Reynolds number and figure 17.A, and the results were within a percent of the given answer for the pipe lengths I was assigned from the chart.

Problem 2:

Using the grading rubric, I would grade this problem 6/6. The same Q equation was used as in the results, the A and R values were setup correctly, iteration was used to find the final h value, Froude's number was used to check if the flow was critical, and though the results differ, it was because of an ambiguity in the question statement.

I set my iterative process up differently than the test answer does as I used the known values as one side of my equation and the unknowns which involved height as the other side. In the answer sheet, the height is singled out. This would allow a more automated iterative process, but was a more complicated calculation, so I opted for guessing my own h values and the simpler equation.

For the result, the one I reached is nearly 20% off, but that is because the value of Manning's number I chose, 0.013, does not match the one used on the answer sheet, which was 0.017. I also used table 14.1 to get the n value for the problem, but the problem statement says the channel is made of "cement" and does not specify whether it is rough, trowel finished, or float finished, which all have different n values. The answer sheet used the value for unfinished concrete while I chose the value for trowel finished concrete. Entering the n value used in the answer sheet into my Excel iteration file, I also reached a final answer of about 2.1 ft for the depth, which tells me my calculations were correct.

In the future, asking for clarification about the surface of the channel before turning in the test would have allowed me to reach a final answer that matched the answer sheet.

Problem 3:

Using the grading rubric for this problem, I would give it 5/5. The correct Q equation was used, the Reynold's number was used to find C, the result was reached by solving the Q equation for h, and the results were the same.

Looking over the calculations, the results for the Reynold's number differ slightly between my calculations and the answer sheet. This is due to my usage of the simplified Reynold's number equation that uses the velocity and kinematic viscosity of a liquid rather than the density and dynamic viscosity. The rounding errors that appear when converting flow rate into velocity make up for the minor difference between the Reynold's number on the answer sheet and the one that I calculated.

Problem 4:

For this problem, the score I would give is 2/6. I computed the pressure and the Q using Bernoulli's equation and the relationship between the 3 points marked on the diagram. I failed to calculate the height of the nozzle using the supplied length, both of my equations for Rx and Ry had faults, and the results were not like those given in the answer sheet.

For the height, I misunderstood the drawing and the use of the given lengths for the curved tube. The initial drawing gives an elevation of the nozzle, but not a length associated with the curved tube. Due to this, I assumed that the length was unimportant as the angle and the elevation were given and were the only values needed to solve all the equations necessary. If I were attempting this again, I would have asked the professor what the application of the tube length was, and either adjust the elevation of the nozzle or the angle of the nozzle to compensate for a longer tube length.

The Rx and Ry equations I used were close, but not setup correctly. I used the impulse theorem equation correctly, but for the Rx equation I applied the pressure from point 2 incorrectly, and used the area of the nozzle rather than the area of the tube when adding that value to my overall force in x. Those two errors created a much larger force in x in my answer than the one given in the answer sheet. For Ry, I neglected the weight of the fluid in the pipe, so my value was much smaller than the one on the answer sheet. While the problem statement said to neglect energy losses, it did not state to neglect the weight, and in a system as long as this one, the weight of the fluid was not negligible.

Due to the errors in my Ry and Rx equations, my results were also incorrect. They were calculated correctly, but because my inputs were wrong, they also were wrong.

Problem 5:

For this problem, I would score it 4/4. The correct C was calculated, including the units, the delta P value is correct, and the results match the calculations I performed.

Final Grade:

My final grade based on the scoring above would be 78/90. Misunderstanding Problem 4, along with mistakes applying the forces correctly led to major issues with that problem. I felt I understood the material in this module well, and that is demonstrated by my work on the other 4 problems on the test, but the errors on problem 4 dragged my grade down quite a bit.

**Discussion**

This test was largely successful for me. I felt I understood the concepts from the unit well and had applied them in my homework assignments with a clear understanding of the material. While doing the test, I felt confident in my approach and my calculations.

There were sections of the exam that I had questions about, but due to time crunch and a desire to complete the exam, I chose a course of action without consulting the professor and those choices lead to some mistakes. For Problem 2, picking a type of finish for the open channel led to a different answer than the one given. That ambiguity could have been cleared up with communication, and though I do not feel the answer I gave is wrong based on the problem statement, I was aware that there were three potential answers and instead of asking I picked one and used it.

For Problem 4, when I finished, I realized I had not used the assigned pipe length for any of the calculations I had done. I could have asked the professor for clarification about why that did not seem to impact the problem and discovered that the elevation for point 3 was dependent on the length. This was a simple mistake that could have been easily avoided and would have added a point to my score for that question. My misuse of the reaction equations was a greater mistake, as I am very familiar with how forces on systems should be applied and simply did not apply them correctly. A better drawn FBD would have helped me realize the mistake. Using the incorrect area in the final equation was also a poor mistake due to oversight.

I spent a total of 6 hours on this test, about an hour per problem except for Problem 4, which required a little more work than the others. I also went through that problem again after realized I had not used the pipe length to solve for the forces, assuming I had missed something in the problem statement or the equations. When I found that I had not, I moved on to Problem 5, assuming the pipe length was inconsequential as the height and angle numbers were already provided.