

Test 2 Reflection:

- 1) How and why the test demonstrates your work toward one, or more, of the course learning objectives. Be specific on the course objectives you decide to mention.
 - In this exam, we are covering the following course objectives: Describe the nature of fluids and define different fluid properties such as viscosity and pressure (this is required in problem b, d, e, and g, primarily in Bernoulli's and calculated for pressure drops due to different manufacturing requirements), compute the pressure and the forces associated with it in a stagnate fluid (this is used in problem g when calculating for the pressure on the blind flange), apply the principles of conservation of energy and mass to fluid flow systems, compute friction losses in pipes (problem b and g require us to compute these forces to accurately represent the system to solve for the unknowns), identify and solve for specific industrial problems such as water hammer, drag, forces in pipes, and learn about different instruments (this is highlighted in problem e and d when solving for water hammer and how flow nozzles will affect the system properties), discuss buoyancy and determine stability (this is used in problem b and f to solve for the size of the log and if it is stable).
- 2) How your test compares against the available solution. State the mistakes you made and what you will do next time to avoid making same mistakes. Please point out exactly where you made the mistake, say why you made the mistake, and how you should have done it. If you were taking this test again, what advice would you give yourself to ensure that you had a successful test?
 - In problem a, I obtained the same answer, just rounded to the nearest tenth.
 - In problem b, I split the problem into two sections instead of solving it as one big system. This led me down a path that made the problem far more difficult than it needed to be. I had initially skipped problem b, so I did all my losses calculation in part g. When calculating, I forgot to multiply the k value of the gate by the friction factor, which gave me far too much of a loss and ultimately caused an exaggerated air pressure. I then used the equation provided in the lecture for a straight pipe and used incorrect values for pressure change. This gave me an exaggerated answer.
 - For forces in the x, all I needed to do was solve for pressure at 1 (what I did in part g) and use the Rx equation.
 - For forces in the y, my work was correct, I just added instead of subtracting which gave me an answer slightly off the provided.
 - In problem c, because I rounded to the nearest tenth in problem a, my answer was slightly different (0.003); however, as we discussed via text, I considered the bottom of the channel as the limiting factor and shrunk the size of the log to ensure success. I provided both the limit answer and an ideal answer based off real world application.

- In problem d, the only difference was I used the equation to solve for C and not the chart. This causes a slight difference in pressure change.
- As discussed via text, E and E not were swapped on the master solution provided and was incorrect, therefore, I cannot compare.
 - I was incorrect about cavitation. I assumed that a pressure change of that magnitude could cause a drop in the air tank that may cause evaporation, or the rebound effect of C could cause cavitation at the valve.
- In problem f, I used the same formula and process; however, when selecting a size for area, I chose a piece of wood that would perfectly lodge at the bottom of the channel (.1155m x .05m) which made my area different; however, this still falls within the problem set requirements.
- In problem g, the provided solutions did not account for the piezometric head and I cannot compare answers.
- If I was taking this exam again, I would suggest always striving to find a simple way to structure problems to solve in a sensible way. I would also suggest moving through the problems slowly to ensure simple mistakes are not made given they can cause problems throughout the test.

3) What your grade should be. Base it on the writing rubric provided in the test and the correctness of your solution. What are the strengths and weaknesses of your test?

- I think I would earn an A. I feel that I utilized the notes provided in class and was reasonably close on most of my solutions (some rounding and graph interpretation differences.) My biggest weakness was solving for the forces. I did not keep the problem solving process simple, and wound up confusing myself. My biggest strength was using the methods provided by the instructor, paying attention to detail, and thinking about the problems abstractly before immediately trying to solve.

4) Discuss the following:

a. What issues did you encounter in completing the test? How did you troubleshoot them?

- Learning from the first exam, I broke my effort into chunks. However, the first iteration of the exam I forgot a Δ^2 on one of the variables and incorrectly calculated the problem. I then continued with this incorrect calculation throughout the rest of the problems. It wasn't until two days later that something didn't seem right, and after checking my work, I found the error. This forced me to redo the entire test and due to long hours of staring at the screen / notebook, made it easy for me to make dumb mistakes, which made the process even longer. I forced myself to slow down, break each problem into chunks and do sensible calculations.

b. What steps did you take to complete the whole test? Would you change something?

- Taking multiple days to revisit work and check over calculations saved me on this exam. I caught a catastrophic error that would have made almost all my answers incorrect. This is something I will continue to do.

c. What new concepts have you learned?

- Understanding how multiple components interact with each other and what a sensible design / solution looks like.
- I now have a deep understanding of what different flow rates look like outside of a pipe. It makes you realize how much water is moving in something like Niagara Falls or a significant dam.

d. Where you think engineers use those concepts (provide specific examples)?

- The first concept applies to almost every aspect of engineering. Knowing how multiple systems will interact and what problems may arise helps steer away from potential problems and allows for innovation.
- Knowing what different flow rates look like in different types of systems helps engineers build a replica of what a solution might look like in their head before doing it for real. This is something I could see any civil / mechanical engineer apply.

e. Where do you think you will be using everything you learned?

- I will use these concepts when I am in United States Navy Test Pilot School next year.

f. Do you think what you learn is important for your professional career?

- Yes, teaching yourself how to problem solve and not give up are two of the most fundamental skills one can have. This exam is a great opportunity to expand those skillsets and test your ability to adapt.

g. How, when, where and why you might use this information or skill in the future?

- Calculating pressure drops from nozzles, designing channel flow, and design work are all things I will apply in the United States military.

h. Have you been able to apply concepts you have learned in the course to what you do at work or in other courses?

- Yes, in this exam, I used both fluid mechanics and thermodynamic concepts to picture the problem sets at a fundamental level..

i. What areas did you feel you were most successful, or improved the most?

- I think my ability to break the exam into components and apply principle theory to structure the problem in an effective manner was above average in this exam.

- j. How do you see this course's content intersecting with your field or career?
- I think the technical aspects are relevant to flight test engineering given the flow of air is how an airplane fly. I also think the mindset required to do well in this class is essential in problem solving everywhere.
- k. How much time did you spend on the test? How was the time organized? What would you do differently? Why?
- I spent ~12 hours on the exam. Having to recalculate the entire thing added a significant amount of time. Ensuring you copy given data and formulas correctly throughout the problem is essential in saving time and avoiding costly mistakes.

Self Grade:

WRITING RUBRIC (Applied to the whole test, not to particular problems)

1. Purpose	0.5/10.0
2. Drawings	1.0/10.0
3. Sources	1.0/10.0
4. Design considerations	1.0/10.0
5. Data and variables	0.5/10.0
6. Procedure	2.0/10.0
7. Calculations	2.0/10.0
8. Summary	0.5/10.0
9. Materials	0.5/10.0
10. Analysis	1.0/10.0
TOTAL	10.0/10.0

PROBLEM 1)

- | | |
|------------------------------|-----|
| 1. Open channel depth (y) | |
| a. Correct equation | 1/2 |
| b. Area and Hydraulic radius | 1/2 |
| 2. Pipe-elbow forces | |

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|---|-------|
| a. Free body diagram and correct forces | 1/3 |
| b. Force in x | .3/3* |
| c. Force in y (weight) | .8/3 |
| 3. Largest wood log | |
| a. Size | 1/2 |
| b. Stable? | 1/2 |
| 4. Flow-nozzle flowmeter pressure drop | |
| a. Right equation and A1/A2 | 1/2 |
| b. C value | 1/2 |
| 5. Water hammer pressure increase | |
| a. Wave velocity (units?) | 1/2 |
| b. Pressure increase | 1/2 |
| 6. Drag force on a stuck log | |
| a. Correct area | 1/3 |
| b. Correct velocity | 1/3 |
| c. How Cd was obtained? | 1/3 |
| 7. Force on the flange | |
| a. Magnitude | 1/2 |
| b. Location | 1/2 |
| 8. Final actual values of the results | .8/1 |

FINAL GRADE:

$$10.0 + (80/8) * (2/2 + 2.1/3 + 2/2 + 2/2 + 2/2 + 3/3 + 2/2 + .8/1) = 85/90$$