Test 1 Reflection Alexander Higgins MET 330 Fluid Mechanics Summer 2022

### **Learning Objectives**

The Unit 1 Test focused on the first 3 learning objectives for this course:

- Describe the nature of fluids and define different fluid properties such as viscosity and pressure
- Compute pressure and the forces (magnitude, location and direction) associated with it in a stagnant fluid
- Discuss what buoyancy is and determine object stability while floating or submerged in a fluid

Problem 1 and 2 on the test addressed the first two learning objectives with questions about how pressure is measured using fluid properties in a manometer and how pressure created by different fluids impact a physical system such as a hinged gate. Problem 3 is about buoyancy, and required knowledge regarding buoyancy equations, the relationship between center of gravity, center of buoyancy, and the metacenter, and the use of Excel spreadsheets to solve and graph those solutions.

## Grading

## Problem 1:

For problem 1, utilizing the grading rubric provided, it is a 6/6. The correct methods were employed for both states of the system to find the pressure at points A and B, the heights were changed effectively to reflect the 1-inch movement discussed in the problem statement, units were consistent throughout, the behavior of the section containing air was correctly applied, and the final answer matches the one provided in the results.

# Problem 2:

For problem 2, the score is a 6/7. The correct equations for fluid, gate, hinge and support force are used, with accurate adjustments made for the shifting of the force locations as the fluid levels change. The Excel spreadsheet works correctly and adjusting any of the given variables results in an answer that matches the one provided, with the caveat that the spreadsheet provided is mislabeled. In the Excel document provided as an answer for the test, the fluid labeled "f1" is shown on the illustration to be water, but it is paired with " $\gamma$ fluid1" which is labeled "oil". By reversing the height of the fluids in the spreadsheet I created, the answers match, but are negative to symbolize that the force is pushing to the left rather than to the right.

The point deducted from the score is due to the graph I created not matching the one on the answer key. I did not create separate plots to symbolize different levels of water (or oil, as the supplied spreadsheet uses) and only plotted 10 different levels of oil with the single depth of water. Due to this, the graph does not clearly represent how the force on the hinge changes and ends up looking like a linear relationship rather than the tapering one shown in the

provided graphs. I did not understand what was being asked for in the test prompt and should have asked for clarification before turning in my test. With more guidance about what the graph was meant to represent, I could have created something more useful. My calculations and setup were correct, but my implementation on the graph was not.

## Problem 3:

For problem 3, the score is 6/7. The correct equations were used to set up the Excel spreadsheet and were manipulated appropriately to create a spreadsheet which could dynamically work out the different buoyancy properties of a system with variable specific weights and dimensions, as well as the stability of the cylinder under those conditions.

Again, the lost point is related to a plot that does not match the one provided due to poor understanding on my part regarding what was being asked for. I created 3 separate plots, displaying the characteristics of cylinders with 3 different diameters and varying lengths. I failed to provide a plot for the stability of those systems on any of the graphs and created 3 separate graphs rather than one showing a direct comparison between the different cylinders in question. Asking for more guidance before turning in my test would have provided me with the information I needed to present my calculations more effectively.

Based on the scores above, my grade on this test would be 90.6% using the grading rubric provided. My calculations were correct, my formatting for the test document and sample calculations were clear and correct, and the calculations were performed correctly in my Excel spreadsheets. My plots were clearly not correct. In the future, asking more questions about necessary graphs, how to format them, and what information needs to be included in them should help me improve my scores.

#### Discussion

While completing this test, the biggest issues I faced surrounded the formatting I chose to use. There was no clear template for tests provided, and eventually I decided to follow the one used for all the example problems given in the modules. Once that was done, completing the test was straight forward.

While working on this test, I learned a lot about the use of Excel for solving problems. I am still in my first year back in college after a decade away, and I am still not proficient with Office programs. I enjoyed learning more about the functions Excel provides and have a new understanding for how useful it can be as a professional engineer. Most of my work so far has been focused on doing calculations by hand; completing this test within Office with digital illustrations has given me new tools that I look forward to using after I graduate.

Even with my limited school experience since starting college again, there is a lot of information that crosses over into other courses. So far, this class has used concepts that I learned in the two thermal courses I have taken, as well as some of the concepts from strength of materials and machines design. Every semester is building well on previous ones, and I am gaining more

understanding about how universally applied physics can be and what those concepts are used for in the real world.

I spent about 6 hours total on this test, approximately 2 hours per problem. Much of that time was spent formatting my final test documents to make sure the equations I made in Math Type were clear and that my Excel documents were easy to read and manipulate. The calculation portion of the problems took up maybe 1/3 of the time spent on each problem, as they were relatively straight forward problems. I feel much more confident with Excel and Math Type now, and with a test solution guide and example spreadsheets provided after the test to use as a template, I believe that the next test will be a more streamlined process with a clearer understanding of what is being asked of me.