Test 3 Reflection

My work on test 3 demonstrated my work toward two of the course objectives. "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.)". Problem one on the test demonstrated this because required that I identify and calculate the drag on the two sections of the vertical pole in order to calculate the moment at the base of the pole due to the 80 mile per hour wind. Problem 2 demonstrated this because it required me to identify the problem, calculate the fluid depth of an open channel for a specified volume flow rate, and to determine if the flow was sub-critical or super-critical. Problem 3 demonstrated my work to this objective because it required that I use my knowledge of the orifice plate flow meter to calculate the liquid height of a mercury manometer for a specified flow rate. Problem 4 demonstrates my work to this objective because it required me to identify and solve the force on the curved section of pipe due to the fluid flow from the large tank. Problem 5 on the test required that I identify and solve the pressure increase when the valve closed due to water hammer. "Apply the principles of conservation of energy (Bernoulli's equation) and mass to fluid flow systems". Problem 4 demonstrated my work to this objective because it required me to apply Bernoulli's equation a couple times to find the volume flow rate, velocities, and pressure in the curved section of pipe in order to calculate the forces in the pipe.

My test is very similar to the available solution. There are only a few differences. On problem 1, I needed to find the coefficient of drag (Cd) on each section of pipe. To do this, I first calculated Reynold's number for each section and then Cd for each from figure 17.4 from the textbook. I calculated Reynold's number correctly but read the Cd differently than the available solution. For the lower section of the pipe, I read the Cd to be 0.9 whereas the available solution uses a Cd of 1. For the upper section of the pipe, I read Cd to be 0.95, whereas the available solution uses 1.1. This meant that the moment that I calculated at the base was less than the available solution I calculated M=92.545 lb*ft and the test solution is M=105.32 lb*ft. I wouldn't really say this is a mistake because there is some discrepancy when reading graphs like this because it's not really possible to read an exact value. In the future, I may need to be more careful when reading these figures and try to be more accurate by drawing lines on the figure.

PROBLEM 1)

Moment with respect to A	1/5 out of 1/5
Correct distances	1/5 out of 1/5
Correct Cd using Re and forces	2/5 out of 2/5
Results	1/5 out of 1/5
TOTAL	5/5 out of 5/5

PROBLEM 2)

Correct Q equations (look at constant)	1/6 out of 1/6
Correct A and Hydraulic radius R	1/6 out of 1/6
Solving by iteration	2/6 out of 2/6
Is it critical?	1/6 out of 1/6
Results	1/6 out of 1/6

TOTAL	6/6 out of 6/6

PROBLEM 3)

Correct eq for Q for nozzle	1/5 out of 1/5
Use Re to get C	1/5 out of 1/5
Solving by “h”	2/5 out of 2/5
Results	1/5 out of 1/5
TOTAL	5/5 out of 5/5

PROBLEM 4)

Compute pressures using Bernoulli’s	1/7 out of 1/7
Compute height with length	1/7 out of 1/7
Appropriate control volume?	1/7 out of 1/7
Rx (be careful with velocity direction)	1/7 out of 1/7
Ry (be careful with velocity direction)	1/7 out of 1/7
Compute Q with Bernoulli’s	1/7 out of 1/7
Results	1/7 out of 1/7
TOTAL	7/7 out of 7/7

PROBLEM 5)

Correct C (be careful with units)	2/4 out of 2/4
deltaP	1/4 out of 1/4
Results	1/4 out of 1/4
TOTAL	4/4 out of 4/4

FINAL GRADE:

(90/5)*(5/5 + 6/6 + 5/5 + 7/7 + 4/4) = 90

I would say my strengths on this test were calculating the force of drag on objects, calculating depth for open channels, finding the fluid height of manometer attached to an orifice plate flow meter, the forces in pipes, and pressure increase due to water hammer. If there are any weaknesses to take from this, it would be my ability to read graphs accurately.

Whenever I encounter something in a question that I am not sure of, I try to go to the textbook first to see if I can find information that will help me, find a similar problem from the book, or a problem from homework. If this does not work, then I ask questions. The steps I take on the test is to work on one question at a time. I do this so that I don't worry about what the next question is asking. This way I can focus on the question I am solving. For each question, I first read the problem, write the purpose, create a drawing, write the source, write the design considerations, write down the data and variable the problem provides and look up any variables that I need from the textbook, write the procedure so that I know the process to solve it when I get to the calculations, do the calculations, write the summary, write the materials, reflect on the problem and write the analysis. After I finished a problem, I go back and read the question once more to ensure that I have answered what it is asking. I also go back and repeat the calculations to ensure I haven't made any calculation errors. I repeat this process for each question. I wouldn't change anything about it honestly, it worked very well for me. The new concepts I have learned from this unit are how to calculate flow rates in network pipeline systems, how to calculate open channel flow, the many different devices for flow measurement and how they work, how lift and drag occur and their effect on objects, how water hammer and cavitation occur, and impulse theorem and how to find the forces in pipes.

If an engineer were in charge of designing a network pipeline system for a new neighborhood being developed, they would need to use the Hardy Cross method in order to determine the pipe size required to supply the water and what the flow rate would be in each pipe. An engineer would need the concepts of open channel flow to design dams, water irrigation channels, or storm drains. An engineer would need the concepts of the different flow meters such as the venturi meter or flow nozzle to measure the flow rate of a horizontal pipeline or the pilot tube to measure the velocity. This could be important for an application which required a specific flow rate such as supplying fluids to a production line. Automotive engineers use the concepts of lift and drag. Automotive engineers want to ensure the design doesn't have too much drag which would affect fuel economy and don't want lift because it could cause the car to be unstable. Aerospace engineers want to design aircraft that have low drag and sufficient lift so that aircraft can takeoff and carry a load. An engineer would definitely use the concepts of water hammer and cavitation to avoid damage to the system or pumps when designing a new system to ensure the pressure doesn't become too low before a pump which would cause cavitation and could damage the pump or piping. Also, stopping the pump too fast could cause water hammer that could damage the pump or piping. An engineer would use the impulse theorem when designing new piping systems. The pipeline would need adequate support so that it doesn’t break due to the weight of the fluid in or at the forces on the elbows.

In the future if I am hired to design a network pipeline system in a factory, I will need the Hardy Cross technique to help me choose the proper pipe sizes and calculate the flow through each pipe. I don’t know when I will need this specific skill but can see where it would be useful. Also, if I were hired for this task and I wanted to actually measure the flow rate in the pipes, I would need knowledge of venturi, nozzle, or orifice plate flow meters in order to read the manometer to know what the flow rate is. I can see where there may be cases where a machine or process would require a specific flow rate and I may need to use the flow meter and valve to achieve that value. In this system, it would be very possible to have a pump and I would want to ensure that the pump has sufficient fluid head so that it doesn’t cavitate due to too much pressure drop that could damage the pump over time. If I happen to get into the aerospace industry, I will need the concepts of lift and drag to help me design aircraft which have sufficient lift that is greater than the weight of the aircraft and the cargo to ensure that I can take off and be stable. It would also need to have low drag so that it can go fast and help with fuel economy. I would need the impulse theorem if I were turbine such as for steam powered generators. I would need the impulse theorem to allow to design the blades and calculate the work produce when the blades are coupled to a shaft of a generator. I haven’t been able to apply these concepts yet, although I am confident that they will in my career. I feel like I improved the most with the impulse theorem. When I first encountered it, I felt like it was going to be very hard and that I wouldn’t understand it. However, after looking through the slides, watching the videos, doing homework problems, and completing number 4 on the test, I feel confident in my ability to solve these problems involving the force of fluids acting on objects or pipes. I don’t know what my field or career is going to be yet, but I am very sure that what I have learned in this unit and in previous ones will be used in my future.

I spent approximately 10-15 hours on this test. I could have completed it faster, but I don’t want to rush because that is when I will make mistakes. I start early enough on test so that I don’t run out of time and have adequate time to spend on each. My time was organized by working on each problem individually. I do one problem, take a break to and go back to complete another. This is probably why it takes me longer, but it helps me to concentrate when I come back. I wouldn’t do this differently because it works for me.