

COE-C2003 Basic course on fluid mechanics, S2021

Round 1: Introduction and fluid at rest (return at the latest by Thu 23.9. at 13:00 o'clock)

Each problem (1-4) will be assessed on a scale of 0-3. Remember to explain the different stages in the solution. More detailed information can be found from MyCourses. In the Matlab problem, each sub problem will give 0.5 points (total points are 3).

1. You are pulling a plate (size 0.3m x 3m) with a constant velocity of $u = 2 \frac{m}{s} \cdot 1.y$, where 'y' is the last digit of your student number (If it is e.g. 5, then $y = 5$, and the multiplier is 1.5. If it is e.g. zero, then $y = 0$, the multiplier is 1.0). The plate is on an oil film. Below the oil film, there is another, non-moving, plate. The molecular viscosity of the oil is $\mu = 0.38 \text{ kg/ms}$.
 - a. Calculate the velocity gradient du/dy (=rate of shearing strain $\dot{\gamma}$) when the oil film thickness is 1mm. What if the film thickness is 0.5mm.
 - b. Calculate the shearing stress in the a) problem
 - c. Calculate the force needed in both cases.
2. An U-manometer has oil, mercury, and water as shown in the Fig. 1. What is the pressure difference between the pipes A and B with the given dimensions? The oil density is 800 kg/m^3 , the mercury density is 13000 kg/m^3 , and the water density is 1000 kg/m^3 .

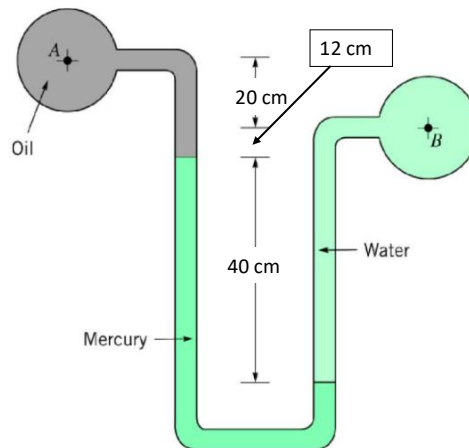


Fig. 1. Problem 2 (Young et al., 2012)

3. A large, open tank has water. The tank is connected to a 1.1 m high, rectangular shaped, pipe (Fig. 2). The rectangular shaped plug is used to seal the pipe. Determine the magnitude, direction, and location of the force of the water on the plug.

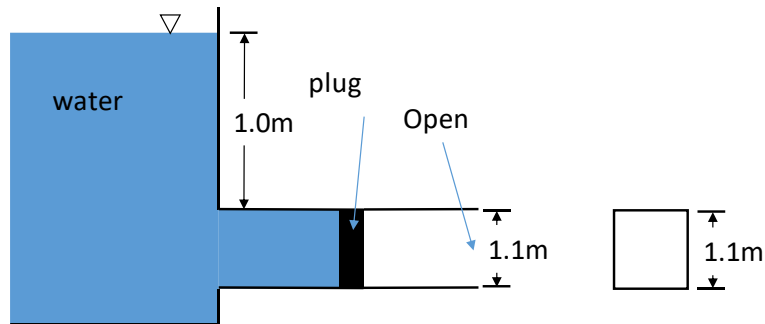


Fig. 2. Problem 3.

4. Lets start with Matlab. It is recommended to start the learning process by looking at e.g. Youtube videos suggested during the lecture. **It is recommended to start the problem by creating a new script (top menu left, New → script). When all the below points are ready, you can print it to pdf (print menu, print-to-pdf).**
 - a. Define in Matlab 1x6 size vectors a and b which both have the same integer numbers (e.g. 1,2,3,4,5,6). The 1st number of the vectors a and b is the last number of your student id (e.g. 9,10,11,12,13,14, where the number 9 would be the last number of your student id).
 - b. Multiply the vectors (syntax `[a*b]`). Explain briefly why you get an error.
 - c. Multiply the vectors with the syntax `[a.*b]`. Explain briefly why the result is different from the point b).
 - d. Make the vector b vertical. Multiply now the vectors a and b `[a*b]`. Show the result.
 - e. Show two additional ways (in addition to a)) to define the vectors.
 - f. Explain briefly what does the %-sign mean in Matlab. What does a semicolon mean at the end of a line ?