CE 3305 Engineering Fluid Mechanics
Exercise Set 3
Summer 2015 – GERMANY

1. (Problem 2.37 pg 57) Figure 1 is a schematic of a cylinder falling inside a pipe that is filled with oil. The annular space between the cylinder and the pipe is lubricated with an oil film that has viscosity μ.

   a) Derive a formula for the steady rate of descent of a cylinder with weight W, diameter d, and length l sliding inside a vertical smooth pipe that has inside diameter D. Assume the cylinder remain concentric with the pipe as it falls.

   b) Use the general formula you develop to estimate the rate of descent for a cylinder 100 millimeters in diameter that slides inside a 100.5 millimeter inside diameter pipe. The cylinder is 200 millimeters long and weighs 15 Newtons. The lubricant is SAE 20W oil at 10^{o}C.

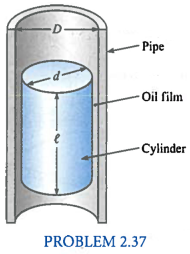
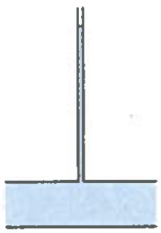


Figure 1: Falling cylinder in an oil-filled pipe

2. (Problem 2.61 pg 59) Figure 2 is a schematic of two glass plates spaced 1 millimeter apart. Calculate the maximum capillary rise of water between the two plates.



PROBLEM 2.61

Figure 2: Parallel plates immersed in water