

**Florida International University**  
**CWR 3201 Fluid Mechanics, Fall 2022**  
**Mid-term # 2**

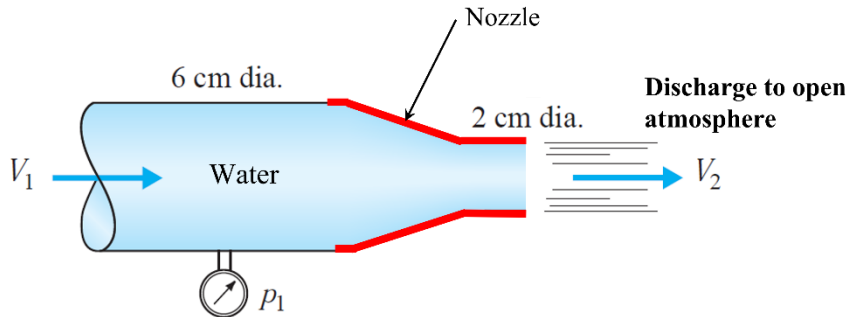
**Instructor:** Arturo S. Leon, Ph.D., P.E., D.WRE

**Student Name:** \_\_\_\_\_ **Panther ID:** \_\_\_\_\_

✓ You will have 1 h 15 minutes to complete the exam. The exam is closed book and closed notes.

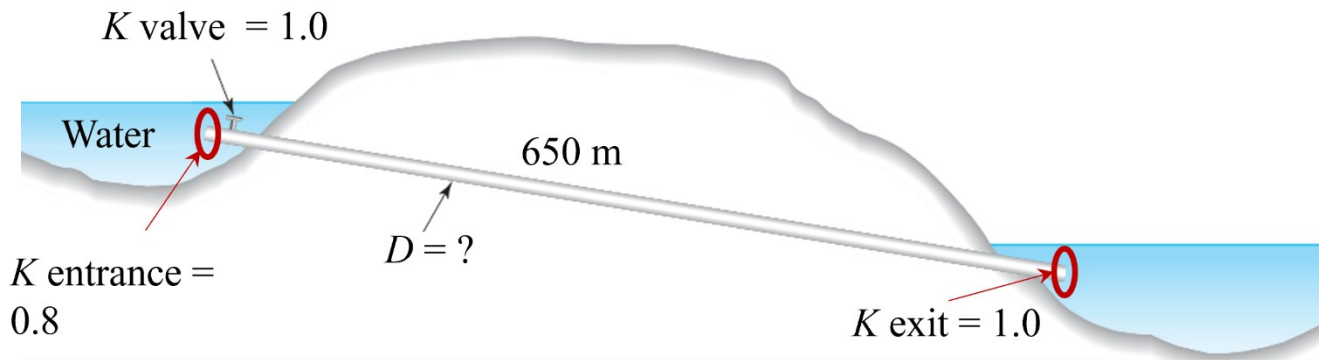
Only one page (front and back) with handwritten equations are allowed

1. **(35 points)** The water flow discharge in the figure below is  $0.1 \text{ m}^3/\text{s}$ . Determine the force the water exerts on the nozzle. Neglect all head losses.





2. (30 points) For the pipeline below, the friction factor  $f$  is 0.028, the reservoirs elevation difference is 200 m, and the flow rate through the pipe is  $2 \text{ m}^3/\text{s}$ . Determine the pipe diameter ( $D$ ).





3. (35 points) The **205-mm**-diameter pump represented in the figure below is used to move water between two reservoirs through a pipeline with the following characteristics:  $D = 150$  mm,  $L = 100$  m,  $f = 0.024$ ,  $\Sigma K = 2.0$ . Determine the actual discharge and pump head when a **single pump** (205-mm outer diameter of impeller) is used. The elevation difference between the reservoirs is 30 m ( $z_2 - z_1 = 30$  m).

