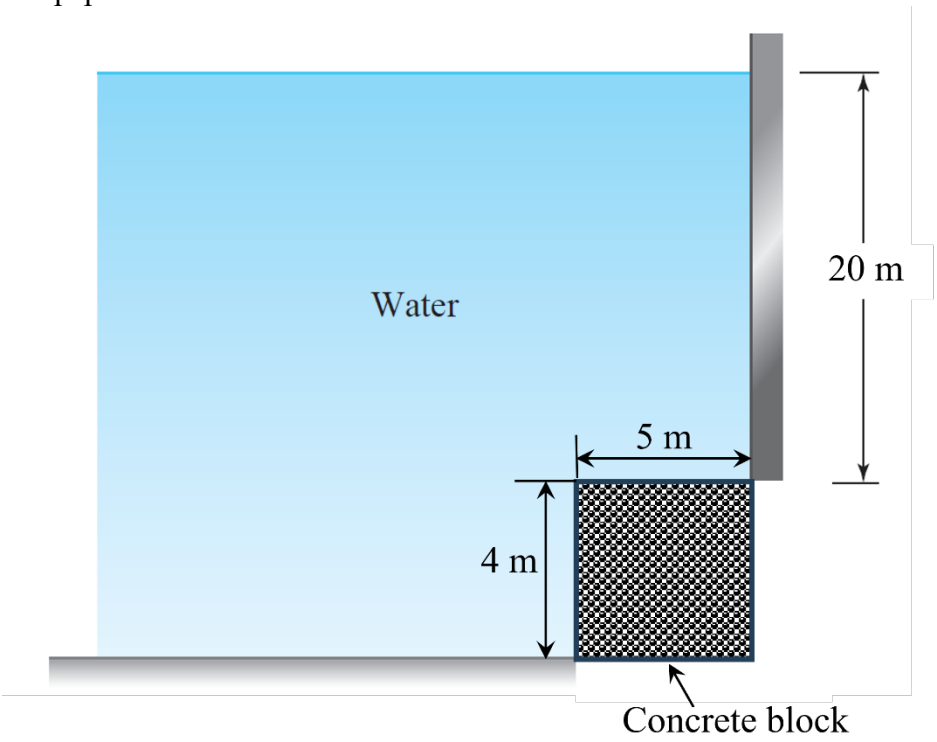
Florida International University
CWR 3201 Fluid Mechanics, Fall 2023
Final Exam

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

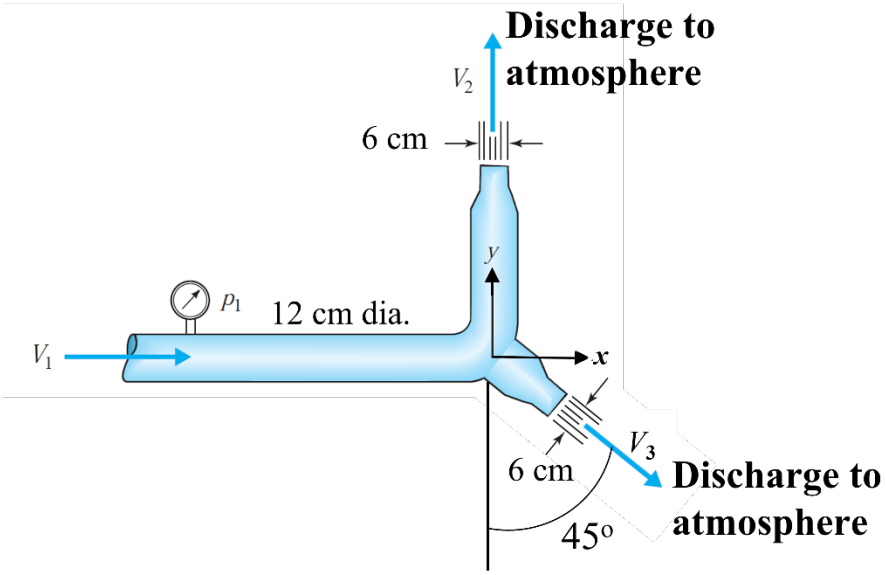
Student Name: _____ **Panther ID:** _____

- ✓ You will have 2 hours to complete the exam. The exam is closed book and closed notes
- ✓ Only two pages with handwritten equations are allowed (no photocopies or artificially reduced text will be allowed)
- ✓ No cell phones or any type of communication device will be allowed.

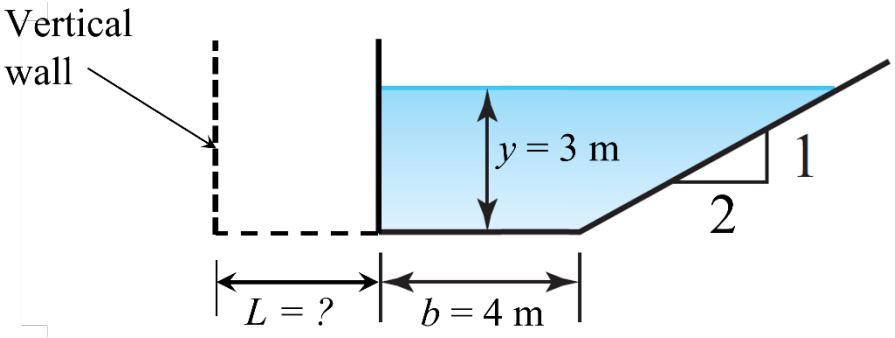
1. **(25 points)** Determine the magnitude of the horizontal and vertical components of the hydrostatic force acting on the concrete block in the figure below. The concrete block has a width of 6 m perpendicular to the plane of the paper.



2. **(25 points)** Determine the force in the "x direction ($\boldsymbol{F_x}$) of the water on the **horizontal** bifurcation shown in the figure below if the pressure P_1 is 225 kPa. **Neglect head losses**.



3. **(25 points)**. The canal shown below is to be widened by "*L*" so that the initial water flow discharge can be doubled. Determine the additional width "*L*" if all other parameters (i.e., flow depth, bottom slope and surface material) are to remain the same.



4. **(25 points)** The **260**-mm-outer impeller diameter pump represented in the figure below is used to move **water** in a piping system. The pipeline has the following characteristics: $D = 150$ mm, $L = 65$ m, $f = 0.022$, $\Sigma K = 2.6$. Determine the actual flow discharge (m^3/s) and pump head (m) when **four pumps in series** (**260** mm-impeller diameter pump) are used. The elevation difference between the reservoirs is 280 m ($z_2 - z_1 = 280$ m).