

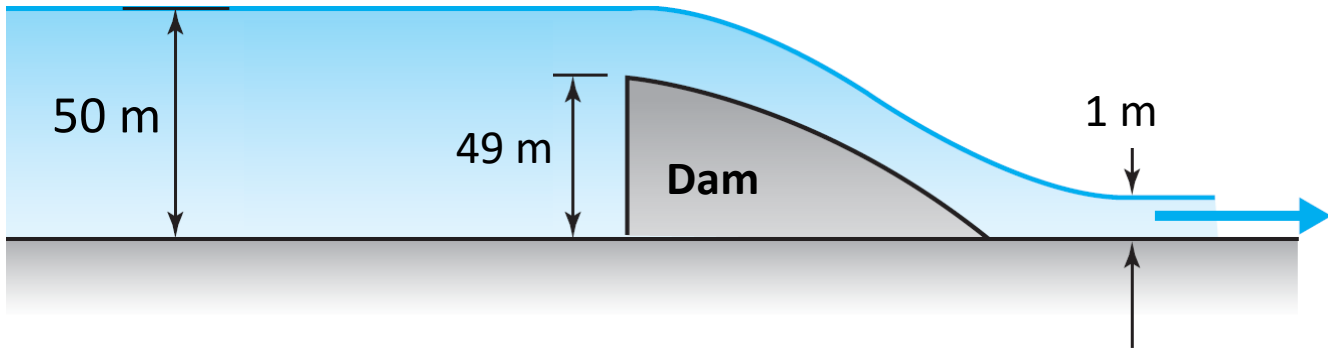
Florida International University
CWR 3201 Fluid Mechanics, Fall 2021
Mid-term # 2

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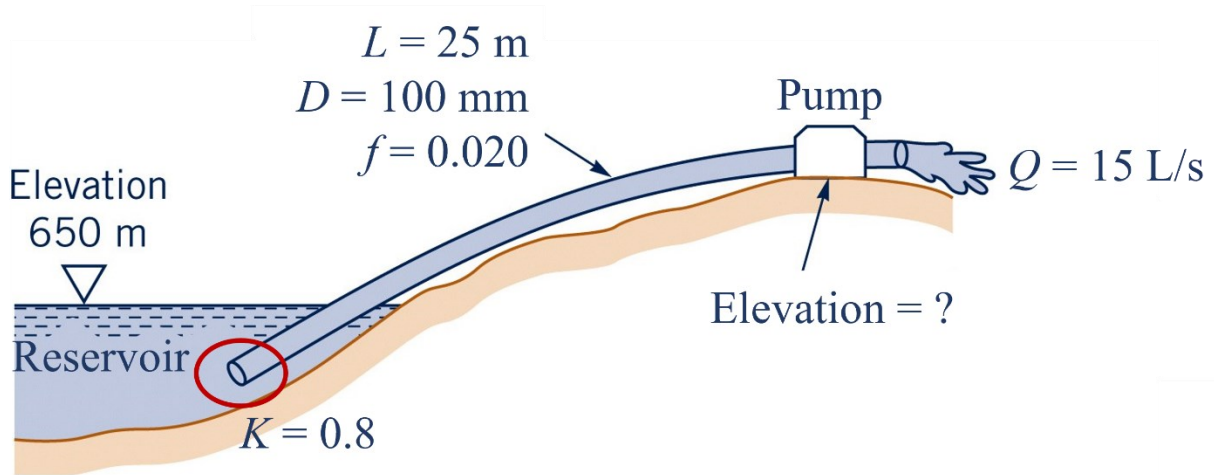
Student Name: _____ **Panther ID:** _____

✓ **You will have 50 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) Neglecting viscous effects** and assuming uniform velocity profiles, find the horizontal force component acting on the dam shown in the figure below. The river width is 100 m.



2. (30 points) The 25-m long, 100-mm diameter pipe with a friction factor of 0.020 is used to pump 30°C water from a reservoir as shown below. Determine the maximum elevation of the pump if the flow discharge is 15 L/s right before cavitation. Use $P_{\text{vapor}} (30^\circ\text{C}) = 4.24 \text{ kPa}$ (Absolute pressure), $P_{\text{atm}} = 101.3 \text{ kPa}$ (Absolute pressure), and water specific weight at 30°C, $\gamma = 9.768 \text{ kN/m}^3$. The pipe entrance local loss coefficient K is 0.8.



3. **(35 points)** Water is pumped between two reservoirs in a pipeline with the following characteristics:
 $D = 300$ mm, $L = 70$ m, $f = 0.025$, $\Sigma K = 2.5$. The radial-flow pump characteristic curve is approximated by the formula $H_P = 30 + 12.7Q - 110Q^2$, where H_P is in meters and Q is in m^3/s .

If $z_2 - z_1 = 50$ m, and the minimum required flow discharge is 150 L/s, determine the minimum number of pumps required to meet the minimum flow discharge. Would you use pumps in parallel or in series? Justify your answer.

