## Problem 10.002 - Froude and Reynolds Numbers Analysis

Water at 20°C flows in a 30-cm-wide rectangular channel at a depth of 10 cm and a flow rate of 95500 $cm^3/s$. For water, take $\rho$ = 998 $kg/m^3$ and $\mu$ = 0.001 kg/m-s.

Estimate (a) The Froude Number, (b) Reynolds number

## Problem 10.003 - Shallow-Water Wave Propagation Speed Analysis

Narragansett Bay is approximately 21 (statute) mi long and has an average depth of 42 ft. Tidal charts for the area indicate a time delay of 30 min between high tide at the mouth of the bay (Newport, Rhode Island) and its head (Providence, Rhode Island). Is this delay correlated with the propagation of a shallow-water tidal crest wave through the bay?

## Problem 10.016 - Volumetric Flow Rate Analysis (Open Channel Flow)

Water flows in a brickwork rectangular channel 2.6 m wide, on a slope of 5 m/km. For brickwork, take $n$ = 0.015.

(a). Find the flow rate when the normal depth is 50 cm. Round the final answer to two decimal places.

(b) If the normal depth remains 50 cm, find the channel width which will triple the flow rate. Round the final answer to two decimal places.

## Problem 10.030 - Flow Depth and Time Analysis (Open Channel Flow)

A clay tile V-shaped channel, with an included angle of 90°, is 1 km long and is laid out on a 1:400 slope. When running at a depth of 2 m, the upstream end is suddenly closed while the lower end continues to drain. Assuming quasi-steady normal discharge, find the time for the channel depth to drop to 28 cm. Round the final answer to the nearest whole number.

## Problem 10.031 - Slope of a Channel Analysis (Open Channel Flow)

An unfinished-concrete 6-ft-diameter sewer pipe flows half full. What is the appropriate slope to deliver 70000 gal/min of water in uniform flow? For unfinished concrete, take $n \approx 0.022$. Take $\pi$ = 22/7. Round the final answer to six decimal places.

## Problem 10.033 - Volumetric Flow Rate Analysis (Open Channel Flow)

Five sewer pipes, each a 2.3-m-diameter clay tile pipe running half full on a slope of 0.25°, empty into a single asphalt pipe, also laid out at 0.25°. If the large pipe is also to run half full, what should be its diameter? For clay tile, take $n$ = 0.014, and for asphalt, take n = 0.016. Take $\pi$ = 22/7. Round the final answer to two decimal places.

## Problem 10.051 - Critical Flow Analysis (Semicircular Channel)

An unfinished concrete duct, of diameter 3.7 m, is flowing half-full at 60 $m^3/s$. For unfinished concrete, take $n$ = 0.014. Take $\pi$ = 22/7.

a Determine the critical flow rate. Round the final answer to two decimal places.

b Is this a critical flow?

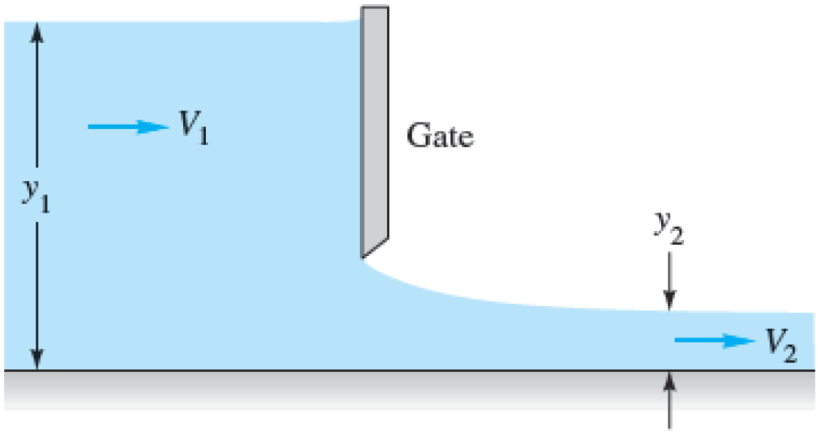
c Determine the Froude number. Round the final answer to two decimal places.

d Determine the critical slope. Round the final answer to four decimal places.

e If the flow is uniform, what is the slope of the duct? Round the final answer to four decimal places.

## Problem 10.073 - Flow Through a Sluice Gate Analysis

In the figure shown below, let $y_1$ = 6 ft and the gate width $b$ = 8 ft.




Find the gate opening H that would allow a free-discharge flow of 30000 gal/min. Round the final answer to two decimal places.