Assignment 4

(Due: 20 November, 2017 by 17:00)

Q1. A rectangular channel 2.0 m wide is contracted to a width of 1.2 m. The discharge in the channel is 3 m^3/s, the slope is 0.0015 and n = 0.012.

a) Determine the depth of uniform flow in the main channel;

b) Neglect energy losses in the contraction and calculate the depth of flow through the contraction when the upstream depth (before the contraction) is equal to the normal depth determined in a);

c) Determine the width of the contraction to just cause the flow there to become critical (without choking).

Q2. A vertical sluice gate in a long rectangular channel 4 m wide has an opening of 0.9m and a coefficient of contraction of 0.6. At a discharge of 25 m^3/s, the depth of uniform flow (y_n) is 3.5 m.

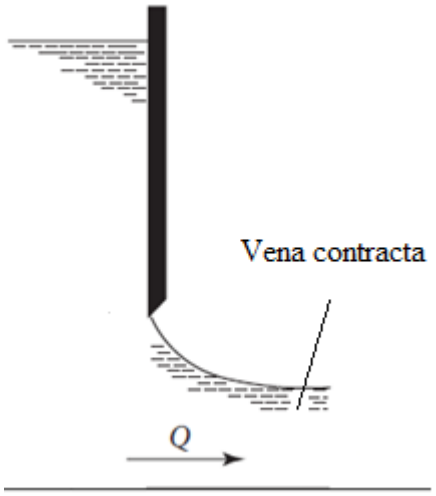
a) Verify that a hydraulic jump will occur downstream of the gate with a sequent depth equal to y_n and determine the initial depth of the jump;

b) Determine the depth upstream of the gate assuming α = 1.2;

c) If the gate is raised to give an opening of 1.5 m, determine whether or not a hydraulic jump will form downstream;

d) For the scenario described in c), calculate the depths immediately upstream of the gate and at the position of the vena contracta.

Hint: Assume no loss of energy through the sluice gate.



Q3. A 4 m-wide rectangular channel carries 25.0 m^3/s and has a Manning's roughness coefficient n = 0.015 and a bed slope of 0.001. A dam is placed across the channel raising the water depth to 4.0 m immediately upstream from the dam.

a) Calculate the depth of uniform flow and the critical depth in the channel;

b) Determine the channel and flow classification (e.g., M-2, S-1);

c) Use the direct step method with Δy **= 0.1m** to determine the water surface profile upstream of the dam. Show sample calculations.

d) Plot and label **the water surface profile** outlined in c) and show **channel bed**, and **the critical and normal depth lines** on the same plot.

e) Determine the distance upstream from the dam at which the depth becomes 0.3m higher than the normal depth.