CIVE1400, Fluid Mechanics

Marked Problem Sheet

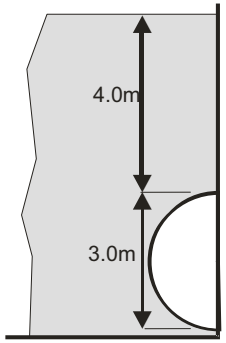
Dr P.A Sleigh
P.A.Sleigh@leeds.ac.uk

This work must be submitted via the print room by 4.00pm
Tuesday 24th April 2007
No marks will be given for work submitted after this date.

You will receive the marked work complete with solutions by May 8th 2007.

Question 1.

(a) For the circular gate shown in figure 1, submerged in water, what is the minimum weight (per unit length) of the gate so that it does not float.



(b) The face of a dam is vertical to a depth of 10m below the water surface then slopes at 35° to the vertical. If the depth of water is 20m what is the resultant force per metre acting on the whole face?

(c) Water flows in a circular pipe which reduces in diameter from 500mm at point A to 300mm at point B. Then pipe then splits into two branches of diameters 0.25m and 0.2m discharging at C and D respectively. If the velocity at A and D is 1.0m/s, what is the discharge at C and D and the velocity at B and C?

(d) If point A is 10m higher than point B and the pressure at A is $10kN/m^2$, what is the pressure at point B?

[12 Marks]

Question 2.

The maximum depth of water in a reservoir is maintained by a V-notch weir, as shown in figure 1. When the water exceeds its optimum depth, the excess discharges via the weir into a spillway.

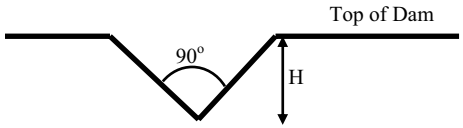


Figure 1. Notch weir geometry.

Experience has shown that under storm conditions this weir is not adequate to cope with the excess flow and needs to be modified.

(a) If the maximum discharge, above which water will start to flow over the dam, is 25000 m^3/hr, determine the height of the weir if its discharge coefficient is 0.9.

(b) The first proposed new design is to increase the angle of the notch to 120°. Determine the maximum hourly discharge over this weir if the height of the weir remains the same and the discharge coefficient is 0.85.

(c) A second proposed design is to replace the notch weir with a rectangular weir of width 200cm and the same height as the original weir. Determine the maximum discharge over this weir if Cd = 0.85.

(d) The new weir design must allow a peak flow at least 40% greater than the original weir design. Using this criterion, which of the two weirs would you chose?

[8 Marks]

Question 3.

A pipe which is carrying water turns through 180° in the horizontal plane, at the same time it reduces diameter from 0.5m at the entrance to the bend to 0.3m at the exit. The water is measured as flowing at the rate of 500 litres/s with a pressure at the entrance of 1.45 bar.

Neglecting any loss is head for friction, calculate the force exerted by the water on the bend, and its direction of application.

[10 Marks]