

1. A 3 m diameter roller gate retains water on both sides of a spillway crest as shown in Figure 1. Determine (i) the magnitude, direction and location of the resultant hydrostatic thrust acting on the gate per unit length, and (ii) the horizontal water thrust on the spillway per unit length. (25%)

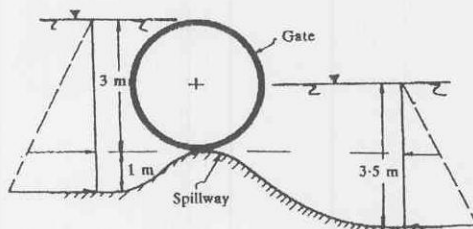


Figure.1

2. A 50 mm diameter vertical water pipeline discharges water through a constriction of 250 mm diameter as shown in Figure 2. The pressure difference between the normal and constricted sections of the pipe is measured by an inverted U-tube. Determine (i) the difference in pressure between these two sections when the discharge through the system is 600 l/s, and (ii) the manometer deflection, h , if the inverted U-tube contains air. (25%)
3. When a plane liquid jet strikes an inclined flat plate, it splits into two streams of equal speed but unequal thickness as shown in Figure 3. For frictionless flow there can be no tangential force on the plate surface. (i) Use this assumption to develop an expression for h_2/h as a function of plate angle, θ . (ii) Plot your results and comment on the limiting cases, $\theta = 0^\circ$ and $\theta = 90^\circ$. (25%)
4. A 1:64 scale model of a proposed dam is used to predict prototype flow conditions. If the design flood discharge over the spillway is $20,000 \text{ m}^3/\text{s}$, (i) what water flow rate should be established in the model to simulate this flow? (ii) If a velocity of 1.5 m/s is measured at a point in the model, what is the velocity at a corresponding point in the prototype? (25%)

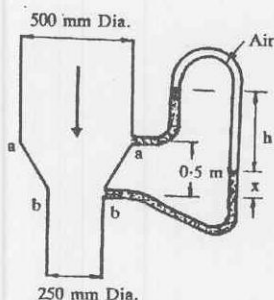


Figure.2

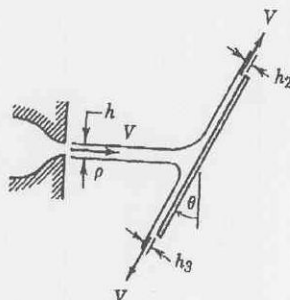


Figure.3