TD 603- Tutorial 5

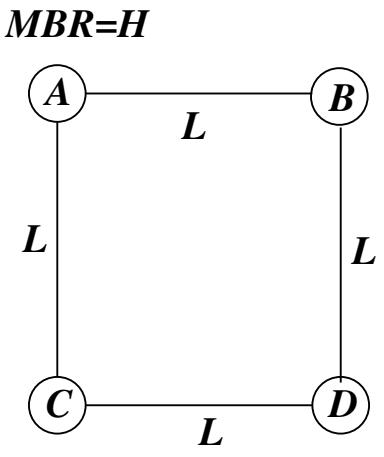
1. This is based on the salient features and yearly water use of Musai and Dolkhamb dams in Thane district as shown in class.
   (a) For Dolkhamb, estimate the average depth of the reservoir. For both reservoirs, what is the fraction of total rainfall in the catchment which gets stored?
   (b) Based on the formula of $Q = 1.6LH^{3/2}$ compute the maximum rainfall intensity for these two dams have been designed.
   (c) For Dolkhamb, look at the data in the water use for 2011. How much was irrigated land and how much water was used for that? How do you think is the "irrigation system performance" calculated. Verify your conjecture for all reservoirs.
   (d) Comment on the Dolkhamb reservoir as a possible source for drinking water supply.

2. A earthen dam is built in a channel of width 80m. The height of the dam is 8m and its crossection is rectangular of width 15m. The bulk density of dry earth is 1.6gm/cc while that of saturated earth is 2.2gm/cc.
   (a) What is the minimum coefficient of friction μ between the surface of the channel and the dam to ensure translational stability?
   (b) Compute the toppling torque per meter of length of the dam. What will be the angle of topple at the end of 1 second because of the toppling torque?
   (c) What will be the un-toppling torque once its begins to topple? What is the net force exerted by the rocktoe?

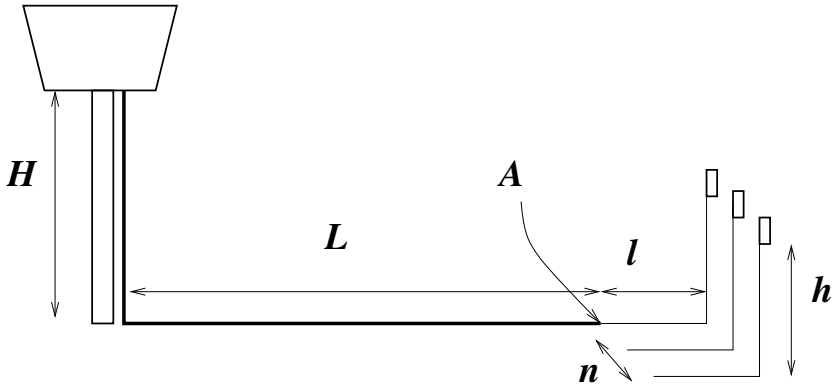
3. Suppose that the seat of the dam is 1m deep, i.e., the dam sits in a cavity of depth 1m and that the seepage drains are located at this depth. Suppose that the conductivity of the earth in the dam is 0.1m/day. Estimate the total volume of water seeping through the dam.

4. Gudwanwadi, of population 400, is to be served by a piped water supply scheme which will provide 40 liters per person per day. The supply is to come from a source 10km away from a tank which is about 20m above Gudwanwadi. The supply comes in a pipe with cross-section 20 sq.cm. The head-loss in this pipe is roughly 2m per km. per meter/sec of velocity of water through the pipe. If the water to Gudwanwadi is to be delivered in 6hrs, what is the head available at Gudwanwadi?

5. A network of four communities A-D are in a square with each side $L = 5km$. There is a pipe which has been laid of cross-section $75sq.cm.$. Each community requires water at about 30 cu.m./hour. The MBR is located at A at an elevation of $220m$. The elevations of A and D is $210m$ while that of B and C is $200m$. The resistance in the mains pipe is $\alpha = 0.4$ meters per kilometer per meters/sec, i.e., a drop of $0.4m$ over a length of 1km for a water velocity of $1m/s$.
   (a) Examine the head available at D if all water to D is routed through B.
   (b) Compare this with the case when D receives half of its water via B and the other half via C.



6. Let us consider a PWS on level ground with an overhead tank at height $H = 20m$. The mains runs for a distance $L = 10km$ to the distribution point A. From there, there are n individual connections, each at a distance $l = 300m$ and each with an overhead tank of capacity $1cu.m.$ at height $h = 5m$. The mains pipe has a diameter of 4 inches while the individual connections have pipes of diameter 0.5 inches. The resistance in the mains pipe is $\alpha = 0.5$ meters per kilometer per meters/sec, i.e., a drop of $0.5m$ over a length of 1km for a water velocity of $1m/s$. In the distribution pipes, this is $\beta = 2.5$.



(a) Assuming $n = 100$, how much time will it take to fill up all the household water tanks?

(b) If there was a limit on the velocity of water to $5m/s$ on the mains pipe and $3m/s$ on the distribution pipe, would this system be feasible?

(c) Suppose that 10 homes put a booster pump which reduced the effective head by 10m, how would water supply change for homes with and without a booster pump?

(d) Suppose that this scheme was to be extended to a 500 homes, what changes would you recommend?