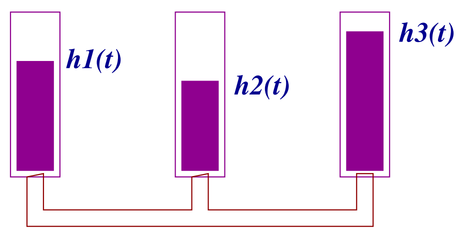
TD 609- Tutorial

1. Given the data in the lecture and an availability of 1000 cu.m. of water per person, prepare a food, energy and steel mix for each person of India.

2. A concrete drain of rectangular crosssection of breadth 1.5 is being designed to drain an area of 2 sq.km. The slope of the drain is about 1m for 400m. The drain must be designed for a peak rainfall of 50mm per hour. How high should the walls be?

3. Consider example 1 of lecture 5 of 3 tubes connected by two links of soil. Let the conductivity of the soil be K and the length of both sections be L and crossection of the cylinder and the tubes be L. Let the starting heads in the left, middle and right tube be H_1, H_2 and H_3 respectively. Compute $h_i(t)$, the heads in the tubes, as a function of time.



4. A forest is supposed to produce about 10000 kilos per hectare of harvestable biomass. Estimate the water requirement to produce this biomass. How much rainfall, at 10% infiltration, is adequate to sustain the forest?

5. Study the Papagni data-set and analyse how the secondary layers such as groundwater potential would have been constructed. See if the geomorphology or soil layers tell us about the presence of rivers and drains?

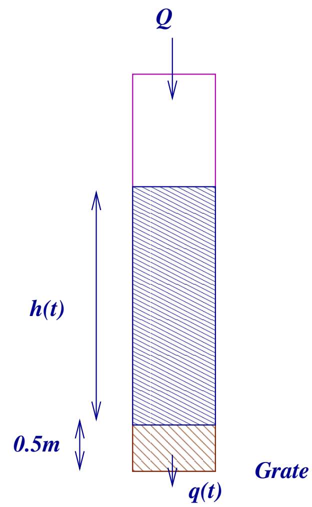
6. Consider the regional water systems lecture and study the KT bandhara used to irrigate farms. Suppose that there is a free-flowing river and a sequence of interventions happen in the following sequence:

   - 1955: A KT bandhara is built across the river which creates a lake in the river.
   - 1960: farmers start using the water in the reservoir and also well water for irrigating their farms.
   - 1970: Ghodegaon, a nearby large village, which used to depend on wells, starts using the lake water for their drinking water supply. The waste water flows back to the river.

   Use the above timeline and consider how you will construct a waterbalance. Argue for each stock and flow in the water and how it changes through the years.

7. A long cylinder has 0.5m of sand in the bottom, which is supported by a porous grid. A tap is opened which lets in water at Q liters/sec. The conductivity of the sand is $1m/d$. Compute the discharge $q(t)$ and the height of the water column $h(t)$ as a function of time.

   Based on this calculation, design a sand filter with the following specifications. The sand costs Rs. 25000 per cu.m. and water must pass through $0.5m$ to be judged as pure. The community has 300 people and each person needs about 5 liters per day. Design a suitable water filter.



8. Consider a set of 3 cells filled with sand of conductivity K and saturated with water, as shown in the figure below. Assuming that the cell on the left and right have heads H_1 and H_2 respectively and the middle cell receives q cu.m. per day, compute h, the head in the middle cell. For what value of q does h exceed H_1 and H_2?