TD 603: Water Resources
Groundwater Problem Set

1. Consider the set-up of page 4, Lecture 4, i.e., a horizontal column of soil of conductance K, length L and cross-section area A. Let then column on the left be of height h_1 and that on the right be h_2 with $h1 > h_2$. Let us start this system at time $t = 0$. Solve for $h_1(t)$ as a function of time.

2. Consider the thick-soil assumption and the lake recharge problem of page 8, Lecture 6. Verify if the variation in h is small for $L = 200m, q = 30mm/day$ and $m = 20m$ and $K = 1m/day$. Interpret $\partial h/\partial x$ at $x = 0$.

3. Solve the above problem when $q = ax + b$ for some constants a, b.

4. Consider the Dupuit scheme for the dam problem, as on page 9, i.e., heights H_1 and H_2 separated by a separation of L, and a rainfall q. For what $q = q_0$ is h so that $\partial h/\partial x = 0$ for $x = 0$. What happens when $q > q_0$.

5. Interpret the dam problem to solve the following problem. A contour trench of depth 1m and width 1m is dug on flat land. How much water does the trench recharge through out the monsoon?

6. Consider the above system but with a two-layer separation with thicknesses L_i and conductances K_i. Plot for h when $q = 0$.