ITU

CIVIL ENGINEERING FACULTY HYDRAULICS DIVISION

HYDROLOGY

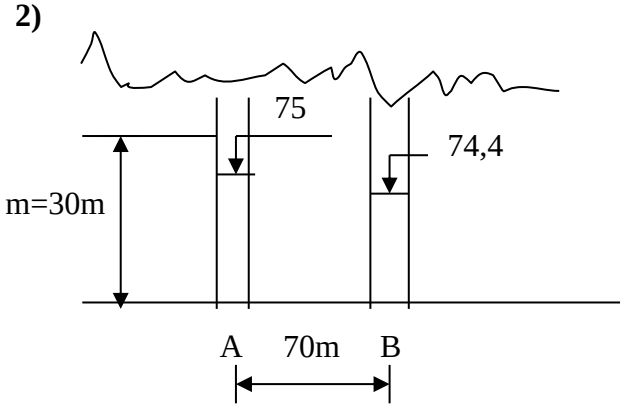
Solutions-5 Groundwater

1) L= 25cm A= 80cm^2 Q= 0,16cm^3/s H= 10mm

V= K I Q/A = K I

K= $\frac{QL}{AH} = \frac{0,16*25}{80*1} = 0,05 cm/s$

2)



a) $I = \frac{\Delta H}{\Delta L} = \frac{75-74,4}{70} = 0,0086$ Groundwater flow A $\Rightarrow$ B

b) $V_g = \frac{L}{T} = \frac{70*100}{3,67*3600} = 0,53 cm/s$

$V_f = V_g * p = 0,53*0,13 = 0,069$ cm/s

c) Hydraulic conductivity; K= $\frac{V_f}{I} = \frac{0,069}{0,0086} = 8,02 cm/s$

d) The transmissibility of the soil; T=m*K = 30*100*8,02 = 24060 cm^2/s

e) Specific Permeability; $k = \frac{\mu}{\gamma} K = \frac{134*10^{-6}}{10^3} * 8,02 * 10^{-2}$

k= 134*8,02*10^{-11}

k= 1,07*10^{-8} m^2

K$\Rightarrow$ related to the fluid and soil properties

k$\Rightarrow$ related to only soil properties

3)

a) $Q = \frac{2{,}72mK(S_1 - S_2)}{\log(r_2 / r_1)}$

Hydraulic conductivity; $K = \frac{Q * \log(r_2 / r_1)}{2{,}72 * m(S_1 - S_2)} = \frac{0{,}03 * \log(50/20)}{2{,}72 * 40 * (3{,}2 - 1{,}9)} = 8{,}43 * 10^{-5} m/s$

The transmissibility of the soil; $T = m*K = 40*8{,}43*10^{-5} = 3{,}37*10^{-3} m^2/s$

b) $K = \frac{Q * \log(r_2 / r_0)}{2{,}72 * m(S_0 - S_2)}$

$K (S_0\text{-}S_2)\ 2{,}72m = Q \log(r_2/r_0)$

$S_0 = \frac{Q \log(r_2 / r_0)}{K * 2{,}72 * m} + S_2 = \frac{0{,}03 \log(50/0{,}4)}{8{,}43 * 10^{-5} * 2{,}72 * 40} = 6{,}85m$

4) For pressurized aquifers:

$Q=0.07 m^3/s$ $m=8m.$ $r_1=55m$ $r_2=115m$ $h_1=12.6m$ $h_2=14m$

$Q = 2\pi mK \frac{(h_2 - h_1)}{\ln \frac{r_2}{r_1}} \Rightarrow K = \frac{0.07}{2\pi * 8} . \frac{\ln(115/55)}{(14 - 12.6)} = 7.34 * 10^{-4} m/s. = 0.073 cm/s.$