Saurabh Rawat

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- December 2018

M.Tech III Semester

COURSE CODE: 15M1WCE311 MAX. MARKS: 35

COURSE NAME: ENVIRONMENTAL GEOTECHNICS

COURSE CREDITS: 3 MAX. TIME: 2Hrs

Note: *All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means. Complementary error functions values are given in Table 1*

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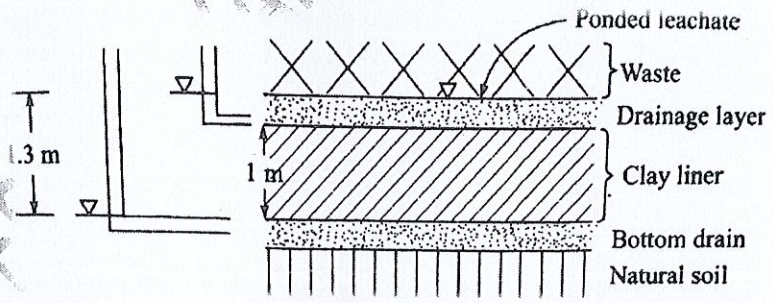
[1] Derive the advection and dispersion equation for contaminate transport and fate modeling. **[6]**

[2] What is sorption? Stating the significance of partitioning coefficient (K_d), explain how K_d is determined in laboratory? **[5]**

[3] Compute the total mass flux of Chloride ions for flow through a horizontal clay liner shown in figure below. Concentration of Chloride in the leachate is 1500 x 10^3 mg/m^3. The Chloride concentration beneath the liner is 200 x 10^3 mg/m^3. Permeability of clay is 10^{-9} m/s and the Effective Diffusion Coefficient is 0.5 x 10^{-9} m^2/s for Chloride ions that is a non – reactive contaminant. Porosity of clay is 0.4. Assume one dimensional steady flow condition exists for advective and diffusive flow. Dispersion may be neglected. **[8]**



[4] A one – dimensional column test was conducted on a soil sample. Deoinized water is flushed through the column to saturate the sample. The chloride solution (D_0 for Cl^- = 20.3 x 10^{-10} m^2/s) at a concentration of 1000 mg/L was passed through the column. The length of the column was 0.5 m. The seepage velocity was 0.0005 m/s. The concentration of the effluent at 400s is 66.8 mg/L. Taking tortuosity coefficient (τ) = 0.5; assuming D_L^* = 1.0 x 10^{-5} m^2/s and D_L^* = 5.5 x 10^{-5} m^2/s, determine which assumption of D_L^* value is correct and why? Also determine the corresponding correct value of longitudinal dispersivity for the soil in the column. **[8]**

[5] A 3 - ft – thick cut off wall is used to contain groundwater contaminated with benzene at a concentration of 1000 mg/L inside the wall as shown in figure below. Assume that $K = 1 \times 10^{-7}$ cm/s, $D^* = 1 \times 10^{-5}$ cm^2/s, $n_e = 0.4$, $\rho_d = 1.2$ g/cm^3 and $K_d = 3.0$ cm^3/g. Calculate breakthrough contaminant concentration for a period of 5 years and distance 3 ft using approximate advection – diffusion transport method with sorption effects. [8]

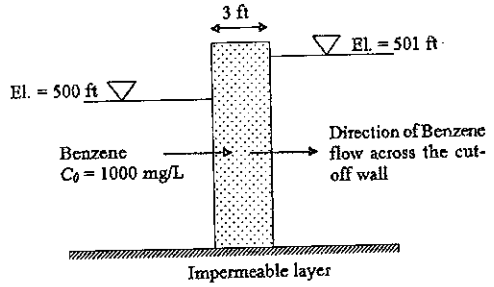


Table 1: Error and complementary error function values

u	erf (u)	erfc (u)
0.00	0.0	1.0
0.05	0.0563720	0.9436280
0.10	0.1124629	0.8875371
0.15	0.1679960	0.8320040
0.20	0.2227026	0.7772974
0.25	0.2763264	0.7236736
0.30	0.3286268	0.6713732
0.35	0.3793821	0.6206179
0.40	0.4283924	0.5716076
0.45	0.4754817	0.5245183
0.50	0.5204999	0.4795001
0.55	0.5633234	0.4366766
0.60	0.6038561	0.3961439
0.65	0.6420293	0.3579707
0.70	0.6778012	0.3221988
0.75	0.7111554	0.2888446
0.80	0.7421008	0.2578992
0.85	0.7706679	0.2293321
0.90	0.7969081	0.2030919
0.95	0.8208907	0.1791093
1.00	0.8427007	0.1572993
1.10	0.8802050	0.1197950
1.20	0.9103140	0.0896860
1.30	0.9340079	0.0659921
1.40	0.9522851	0.0477149
1.50	0.9661051	0.0338949
1.60	0.9763484	0.0236516
1.70	0.9837905	0.0162095
1.80	0.9890905	0.0109095
1.90	0.9927904	0.0072096
2.00	0.9953223	0.0046777
2.10	0.9970205	0.0029795
2.20	0.9981372	0.0018628
2.30	0.9988568	0.0011432
2.40	0.9993115	0.0006885
2.50	0.9995930	0.0004070
2.60	0.9997640	0.0002360
2.70	0.9998657	0.0001343
2.80	0.9999250	0.0000750
2.90	0.9999589	0.0000411
3.00	0.9999779	0.0000221