University of Colorado Denver
Department of Civil Engineering
CVEN-5334 Groundwater Hydrology

ASSIGNMENTS and ANSWERS
~~dcm 8/27/2019~~dcm 9/16/2019

Except as noted, all problem numbers refer to the 2nd edition of the textbook (Fitts 2013).
Brown text gives equivalent problem numbers for the 1st edition of the textbook (Fitts 2002).
The problem numbering convention follows: 1-7 means Chapter 1, Problem 7.

week	notes	assignment
1		1-7, 1-8, 1-9, 1-11, 1-12 *1-1, 1-2, 1-3, 1-6, 1-8* → For 1-11(a) and 1-12(a), *derive* equation with lecture Method #1.
2	Lab #1	2-3, 2-15, 2-17, 2-20, 2-21, 3-1, 3-4, 3-5 *2-2, 2-7, 2-9, 2-11, 2-12, 3-1, 3-3, 3-4*
3		(see handout)
4		7-16, 7-17, 7-18, 3-3, 3-6, 3-13, 3-14, 3-17 *6-11, 6-12, 6-13, 3-2, 3-5, 3-9, 3-10, 3-13*
5		6-1, ~~6-7,~~ 6-8, 6-12, 6-13, ~~6-16,~~ 6-18, 6-20, 6-21 *5-1, ~~5-2,~~ 5-3, 5-7, 5-8, ~~5-9,~~ 5-11, 5-12, 5-13*
6	**1st Midterm**	(see handout)
7		(see handout)
8	Lab #2	(see handout)
9		7-1, 7-2, 7-6, 7-10, 7-11 *6-1, 6-2, 6-5, 6-6, 6-7*
10		(see handout)
11	**2nd Midterm**	10-1, 10-2, 10-4, 10-11(a-c) *9-1, 9-2, 9-3, 9-7(a-c)* → Plus article summary on groundwater contamination (see HW#7)
12		(see handout)
13		(see handout)
14	Lab #3	(see handout)

Answers (not in "Back of Book")
These partial answers will help determine whether you are on track. Some have been rounded.

Week 1
1-12, minimum G = 5.36×10^4 m^3 in April, maximum G = 8.88×10^5 m^3 in November.

Week 2
2-3, at lake bottom, density $\rho = 1.0026$ g/cm^3
2-17, *hints*, (a) flow from high head to low head, (b) flow seeks path of least resistance
2-21, head at Well C is 476.69 m.
3-1, K = 2.8×10^{-3} cm/s

Week 4
7-18, Q = 210 ft^3/d ±20%
3-3, *hint*, think about the "no slip boundary condition" in fluid mechanics
3-14(a), T = 35 ft^2/d

Week 5
6-8, *hints*, (a) where is the sediment thickest? (b) where are the farms?
6-12, *hint*, compressive soil rapidly drains to sand above, but does not drain to sand below
~~6-16, maximum depth d = 10.9 ft~~
6-21, Δh = -1.7 m

Week 6
Problem 2(f), h_P = 118 m
Problem 2(g), v = 0.0015 m/d at 82° south of east

Week 7
7-20(c), x_{divide} = 42.8 ft

Week 8
9-8, the bottom row of the 10x10 h(x,y) grid is as follows [m]:

BC	1	2	3	4	5	6	7	8	9	10	BC
200	200.9	201.7	202.5	203.3	203.8	204.3	206.3	209.9	213.4	216.7	220

9-9, *hint*, use the default porosity of 0.25, and assume aquifer thickness *b* = 1.00 m.

Week 9
7-2, Q = 549 m^3/d
7-10, 1976 ft^2/d

Week 10
8-2, K_h = 3.5 m/d

Week 11
10-1, *hints*, (a) more salt, more TDS (b) more time, more TDS
10-2, *hint*, think about the water in relation to its surroundings
10-11(b), total cations 8.91 meq/L, total anions 9.20 meq/L

Week 12
11-11, PCE K_d = 0.56 L/kg with data from 0-350 d, and 0.97 L/kg with data from 350-650 d.
11-16(a), diffusive flux 0.66 $mg/m^2/d$
11-16(b), advective flux 4500 $mg/m^2/d$
11-17, macrodispersive flux 220 $mg/m^2/d$

Week 13
11-20(c), dh/dx = $-3.4x10^{-3}$
11-21, D_{mx} = 0.032 m^2/d, D_{my} = 0.0035 m^2/d, D_{mz} = 0.0021 m^2/d

Week 14
Problem 1(c), I_x/L_x = 0.1 and I_y/L_y = 0.2