University of Colorado Denver
Department of Civil Engineering
CVEN-5333 Surface Water Hydrology

ASSIGNMENTS and ANSWERS
dcm 4/17/2023 ← *updated through HW#13*

week	notes	assignment
1		(see handout)
2		5th edition: 1.19, 1.21, 1.27, 2.28,[1] 2.29, 2.31, 2.34 6th edition: 1.19, 1.21, 1.27, 2.27,[1] 2.28, 2.30, 2.33
3		5th edition: 8.1, 8.3, 8.9, 2.35, 2.36 6th edition: 8.1, 8.3, 8.9, 2.34, 2.35
4		(see handout)
5		(see handout)
6	**1st midterm**	5th edition: 3.25, 3.29, 3.32 6th edition: 3.25, 3.28, 3.32
7		4.10, 4.11, 4.16, 4.18, M-2005 11.7.2, M-2005 11.7.3 5th edition, 4.16, $x = 0.15$. 6th edition, 4.16, $x = 0.1$
8		(see handout)
9		2.9, 2.10, 2.14, F-2002 1.7
10		5th edition, 2.7, 2.11, 2.15, 2.21, 2.24 6th edition, 2.7, 2.15, 2.16, 2.21, 2.24
11		(see handout)
12	**2nd midterm**	(see handout)
13		1.24, 6.4, 6.6, 6.12 (and handout)
14		(see handout)

Answers to Homework Problems
These partial answers will help determine whether you are on track. Some have been rounded.

Week 1 ← *Spring 2023*
1. 30% of liquid fresh water is groundwater.
2. 2% of discharge from land to ocean is groundwater.
3. 91% of ocean evaporation precipitates back into the ocean.
4. 61% of precipitation onto land evaporates back into the atmosphere.
5. The Sierra Nevada cast a rain shadow over Nevada (orographic warming/drying)
6. Lake Erie warms and moistens the air, triggering lake effect snow on Buffalo.

Week 1
1 16 cm
2(b)(ii) Sample A $T_d = 21^oC$
3 RH = 78%
4 (b) Florida, (c) 902 mb, (d) absorbed into extratropical cyclone in Pennsylvania

[1] This problem is optional for Spring 2023.

5	Answers will vary.
Week 2	
1.19(b)	3.041 in (you will need to round that)
1.21	i_{max} = 4.0 in/hr from 16:20-16:35
1.27	5th edition: (a) i = 10 cm/hr from 0-0.5 hr (b) P = 52.5 cm (c) Q_{peak} = 0.39 m^3/s
	6th edition: (a) i = 4 cm/hr from 0-0.5 hr (b) P = 38 cm (c) Q_{peak} = 0.40 m^3/s
2.27	0.24 in ← *5th edition 2.28*
2.28	E = 0.056 in on day 14 ← *5th edition 2.29*
2.30	f_o = 7.8 in/hr; f_c = 1.2 in/hr; k = 0.25 1/hr ← *5th edition 2.31*
2.33	(a) φ = 0.2 in/hr ← *5th edition 2.34*
Week 3	
8.1	$q = 1\times10^{-6}$ cm/s; $v_s = 5\times10^{-6}$ cm/s
8.3	Q = 100 m^3/d; z = 47.1 m *(Hint, assume aquifer is completely saturated.)*
8.9	T = 3.8 ft^2/s
2.34	when F = 1 cm, f = 2.9 cm/hr; when F = 8 cm, f = 1.0 cm/hr ← *5th edition 2.35*
2.35	silt loam, low n, saturation time 2.3 hr ← *5th edition 2.36*
Week 4	
1	63 cm
2(c)	134 cm of SWE remain at the end of April 5th
3	for temperature increase of 4ºC, V = 4.4×10^6 m^3, 64% snowmelt, peak April 25th
4	Answers will vary.
Week 5	
3.1	Time series indicates increased variability from 2000-2010.
3.2	(c) C_w = -0.277
3.3	(d) p = 0.00142
3.5	(a) Q_{100} = 38,000 cfs
3.6	(a) Q_{100} = 44,400 cfs
3.8	(a) Q_{100} = 41,300 cfs
3.11	*hint:* Sketch the normal PDF for each of the five questions.
3.24	(b) p = 22.2%
Week 6	
3.25	Answers will vary.
3.28	Answers will vary. ← *5th edition 3.29*
3.32	Answers in problem statement.
Week 7	
4.10	Q_p = 5.3 cfs; duration = 16.7 hr
4.11	Q = 35 cfs at 228 hr
4.16	5th edition: at 30 hr, I = 60 m^3/s, Q = 88 m^3/s
	6th edition: at 20 hr, I = 66 m^3/s, Q = 163 m^3/s
4.18	This is a "show that..." problem.
11.7.2[2]	(from Mays 2005) V = 10,123 ac-ft (do not use ΣQF_i column in Table 11.7.1)

[2] Mays (2005) Table 11.7.1. The cumulative volume for January 1966 should be 4,302 ac·ft, not 3,302 ac·ft as stated. This error propagates through the remainder of Table 11.7.1.

11.7.3 (from Mays 2005) V = 7,223 ac-ft

Week 8

4.23 at 4 km, Q_p = 28.96 m^3/s at 180 min

6.8 impervious A = 0.49 ac; t_c = 5.48 min

6.9 D = 18 in

6.19 peak 19.2 cfs

Week 9

2.9 (a) peak 340 cfs at 6 hours

2.10 (a) peak 1,560 cfs at 7 hours
(b) peak 750 cfs at 4 hours
(c) peak 1,160 cfs at 3 hours

2.14, 5th edition Hint, use the following chart to show Q_p = 142 m^3/s at 2.5 hours:

time [hr]	0-0.5	0.5-1	1-1.5	1.5-2
i [cm/hr]	1.0	1.25	2.5	1.0
f [cm/hr]	0.75	0.5	0.4	0.3

2.14, 6th edition Hint, use the following chart to show Q_p = 367 m^3/s at 4.0 hours:

time [hr]	0-0.5	0.5-1	1-1.5	1.5-2	2-2.5
i [cm/hr]	0.75	1.5	3.0	1.75	0.5
f [cm/hr]	0.25	0.2	0.2	0.1	0.1

Fitts (2002) 1.7 Q_{DRO} peaks at ±3.2 m^3/s at ~15 hr.

Week 10

2.7 5th edition, T_R = 4.73 hr; Q_p = 420 cfs
6th edition, T_R = 4.65 hr; Q_p = 406 cfs

2.11 5th edition, A = 310 acres; max(UH_3) = 62 cfs/in at 6 hr

2.15 5th and 6th editions, max(UH_{15}) = 125 cfs/in at 45 min

2.16 6th edition, max(UH_2) = 362.5 cfs/in at 4 hr

2.21 5th and 6th editions, T_R = 7.2 hr; Q_p = 670 cfs

2.24 5th and 6th editions, max(UH) = 1978 cfs/in at 9.7 hr

Week 11

1 Complete exercise.

2 Match example in text.

Week 12

Note error, Page 287, Example 6.A.1, last equation should be:

$$D_c = \frac{0.2 d^{-1}}{0.4 d^{-1}}(4.3 mg/L)\exp\left(-0.2 d^{-1} \times 61 km / 41 km d^{-1}\right) = 1.6 mg/L,$$

where the "-0.2 d^{-1}" is "-k_1", per equation (6.A.13).

Nazaroff and Alvarez-Cohen (2001) 6.12 Short essay.

Nazaroff and Alvarez-Cohen (2001) 6.55 k_1 = 0.17/d; BOD_o = 7.9 mg/L; D_c = 2.7 mg/L

Week 13

1.24 ~~(b) P = 8.16 in, (d) i_{max} = 4.4 in/hr between hours 3 and 4~~(c) 25± year storm

6.4	6 events when MIT = 3 hr
6.6	i_{max} = 3.67 in/hr at 12 hr using Table E6-4
6.12	maximum outflow 9.5 cfs at 90 minutes
extra	15-minute 10-year average intensity is 3.08 in/hr

Week 14

1	Complete exercise.
2	Essay question.