CEE 3430 Engineering Hydrology
Spring 2014

General Information

CEE 3430 Engineering Hydrology
Mon, Wed, Fri 2:00-2:50 pm
ENGR 203

Instructor

David Tarboton
Office: ENGR 230. Tel: 435 797 3172
Email: dtarb@usu.edu
Office Hours: Mon 3-4 pm, Fri 11 am – 12 noon in ENGR 230. Also I am generally available to answer questions immediately following lecture. You may send me email any time to ask a question or request a meeting outside these times. You may also access my calendar online (http://www.google.com/calendar/embed?src=david.tarboton@gmail.com) to see my availability.

Teaching assistant

Madeline Merck, madeline.merck@aggiemail.usu.edu

Class web page: http://www.engineering.usu.edu/dtarb/cee3430/ (This will be updated regularly during the course)

Catalog Information

Provides a basic understanding of engineering hydrology through the hydrologic cycle, watershed characteristics, atmospheric water, rainfall-runoff processes, infiltration and evaporation, stream flow analysis, groundwater flow, and related designs. 3 Credits, Spring Semester

Prerequisite: CEE 3500 Fluid Mechanics.

Texts

Mays, L. W., (2011), Ground and Surface Water Hydrology, John Wiley & Sons, 704 p. (We will only use Chapters 1-4 and 7-9 from this book. These chapters are available as a Wiley Custom Book for this class).

Hydrologic Modeling System HEC-HMS Users Manual. Available online at http://www.hec.usace.army.mil/software/hec-hms/documentation/HEC-HMS_Users_Manual_3.5.pdf

Topics:

1. Hydrology, Climate Change and Sustainability. Mays Ch 1.
2. Occurrence of Groundwater. Mays Ch 2.1-2.5, 2.8.
3. Groundwater Movement. Mays Ch 3.
4. Well hydraulics. Mays Ch 4.1-4.2, 4.4-4.5.
5. Surface Hydrologic Processes. Mays Ch 7.
6. Surface Runoff. Mays Ch 8.1-8.8. HEC Hydrologic Modeling System computer model
7. Reservoir and Streamflow Routing. Mays Ch 9.1-9.3. HEC HMS

Learning Objectives

Upon successful completion of the course you should be able to **apply the principles of hydrology to solve engineering hydrology design problems involving hydrologic modeling and analysis.** This means that specifically you should be able to:

A. Identify and describe the processes and quantities involved in the hydrologic cycle. (Mays Ch 1)
B. Quantify the components of the water balance of a watershed. (Mays Ch 1)
C. Quantify the hydrologic properties of groundwater (Mays Ch 2)
D. Quantify the flow of groundwater and evaluate the impacts of well pumping on groundwater flow and properties. (Mays Ch 3, 4)
E. Quantify the variability of precipitation, calculate area average precipitation and determine design storm amounts (Mays Ch 7)
F. Calculate hydrologic losses due to evaporation and infiltration. (Mays Ch 7)
G. Calculate hydrographs based on streamflow and precipitation measurements, watershed attributes and unit hydrograph theory. (Mays Ch 8)
H. Formulate problems and prepare inputs to use hydrologic engineering software (computer models) for analysis and design. Summarize and synthesize outputs from these computer models. (Mays Ch 8, HEC HMS documentation)
I. Use reservoir and river routing methods to determine the hydrograph output from a reservoir or river reach given the hydrograph input (Mays Ch 9)

Assessment of ABET Outcomes Addressed in this course

Outcome	**Learning Objective**
(a) an ability to apply knowledge of mathematics, science, and engineering principles to civil engineering problems.	B,C,D,F,G,H
(b) an ability to design and conduct experiments, as well as to analyze and interpret data.	
(c) an ability to design a system, component, or process to meet desired goals in civil engineering applications.	H,I
(d) an ability to function on multi-disciplinary teams.	
(e) an ability to identify, formulate, and solve engineering problems.	H,I,
(f) an understanding of professional and ethical responsibility.	
(g) an ability to communicate effectively.	
(h) a broad education necessary to understand the impact of engineering solutions in a global and societal context.	
(i) a recognition of the need for, and an ability to engage in life-long learning.	
(j) a knowledge of contemporary issues in civil engineering.	A,D
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	D,H

Tests

There will be two in class tests and a final exam on the dates indicated in the schedule. Tests and the Final Exam will be a combination of a closed book portion testing knowledge of definitions and basic principles that I expect you to remember and an open book portion where reference to the text and other material will be necessary for solution of the problems. The use of

programmable calculators is permitted. (I recognize that there is a gray area between what is a calculator, smart phone, computer, iPad etc. For tests you may not use a notebook or laptop computer, but may use one of the other devices as a calculator as long as its use is limited to calculation, not information retrieval from the internet or saved documents and not for communication. If you do not have a paper copy of the textbook you may need to print paper copies of the parts of it you think you may need to refer to during the test.).

The final exam will be comprehensive and cover all aspects of the class. This is because I believe that there is pedagogical value in the learning that comes from reviewing all material at the end of the semester and it allows assessment of synthesis and evaluation levels of learning through questions that require drawing knowledge from different sections of the course.

Homework

There will be homework assignments due every week except test and spring break weeks. Homework up to 1 week late, or the time a solution set is provided, whichever is sooner, will be accepted with 20% grade deduction. There will be a 50% deduction for homework received more than 1 week late or after a solution set has been provided. Homework is due at close of business on the due date. You may hand it in at class (preferable), or drop off/slip under my campus office door (ENGR 230) and as long as it is there when I arrive the next day it will be deemed on time.

You should submit homework solutions as neatly handwritten or computer printed as appropriate for the problem. Homework should be neatly assembled, stapled and presented in an orderly fashion. Computer output (text, code or graphics) that is handed in does not need to be high print quality, but should be concise and carefully and fully labeled (by hand if easiest). There must be explanatory text accompanying computer printouts or graphs. Hand in enough (**and only enough**) to document precisely and concisely what you have done and how you obtained your solutions. Graphical output is favored over reams of printed numbers. You should use computers that you have access to (ENGR PC lab or your own computer) and programmable calculators, as appropriate to complete homework assignments.

Homework should be each student's individual work. I recognize and support the learning value of working together to figure things out, and cross checking of solutions, but this should not extend to copying.

iClickers

I will use iClickers to make the class more interactive so please bring your clicker if you have one. Clickers will not be used for quizzes or grading so if you do not have one, do not worry.

Grading

1. Grades will be based on a weighted average of results as follows:
   Homework. 20%
   Test 1: 25%
   Test 2: 25%
   Final: 30%.

2. Letter grades will be assigned as follows:
   A = 95 – 100%
   A- = 90 – 95%

B+ = 87 – 90%
B = 83 – 87%
B- = 80 – 83%
C+ = 77 – 80%
C = 73 – 77%
C- = 70 – 73%
D+ = 65 – 70%
D = 60 – 65%
F < 60%

These thresholds may be adjusted downwards (in the students favor) at my discretion, but will not be adjusted upwards. I may also adjust a student's letter grade upward if there are indications that such adjustment is warranted (e.g. an improving trend in grades following a poor start).

3. Incomplete grades will not be given except under extenuating circumstances as allowed for by University policy. Incomplete grades will not be given for poor performance.

4. Make up exams will only be given in cases of severe personal hardship or illness.

Expectations of Students

- Be prepared for class. Read text material in advance.
- Be on-time to class and ready to learn / participate when class starts.
- Turn off or keep silent all electronic devices (phones, pagers, PDAs, music players, etc.) that may make a noise or otherwise distract other students or me.
- Participate and contribute to class discussions.
- Be respectful of and listen to other's points of view during discussions.
- Turn in all work on time in the required formats
- Uphold academic integrity. See http://www.usu.edu/studentservices/studentcode/article6.cfm.
- Bring questions and concerns forward either during class, office hours, or by email.

Expectations of the Instructor

- Be on-time to class and prepared to give lectures and/or facilitate discussions.
- Respect the value of student's time.
- Strive to optimize the learning experience value of all assignments and activities.
- Facilitate an environment of inclusivity and non-discrimination.
- Determine grades impartially based on the substance and content of the work submitted.
- Respond to student email within 1 business day.
- Return graded work back to students within 1 week from when submitted.
- Address student concerns promptly. (I appreciate all forms of feedback and will not hold negative feedback against you. I prefer to know about a problem and attempt to fix it, than let it fester).

Disabilities

Students with ADA-documented physical, sensory, emotional or medical impairments may be eligible for reasonable accommodations. Veterans may also be eligible for services. All accommodations are coordinated through the Disability Resource Center (DRC) in Room 101 of the University Inn, (435)797-2444 voice, (435)797-0740 TTY, or toll free at 1-800-259-2966.

Please contact the DRC as early in the semester as possible. Alternate format materials (Braille, large print or digital) are available with advance notice.

If you are a veteran or have a disability that requires accommodation, please contact the DRC using the contact information above or the instructor so that the necessary arrangements can be made.

CEE 3430 Engineering Hydrology Schedule **(SUBJECT TO CHANGE)**				
Date		Topic	Readings*	Assignments due
6-Jan	Mo	Introduction to Hydrology (Peralta)	1.1-1.4	
8-Jan	We	The Hydrologic Budget and Hydrologic Data (Peralta)	1.5-1.7	
10-Jan	Fri	Groundwater and rock/soil properties	2.1-2.2	
13-Jan	Mo	Groundwater vertical distribution	2.3-2.5	HW1
15-Jan	We	Groundwater storage	2.8	
17-Jan	Fri	Groundwater movement and Darcy's law	3.1-3.2	
20-Jan	Mo	**No Class - Human Rights Day**		
22-Jan	We	Determining hydraulic conductivity	3.3	HW2
24-Jan	Fri	Groundwater flow	3.4-3.6	
27-Jan	Mo	Unsaturated flow	3.7	
29-Jan	We	Steady flow in confined aquifers	4.1	HW3
31-Jan	Fri	Steady flow in unconfined aquifers	4.1	
3-Feb	Mo	Steady radial flow to a well.	4.2	
5-Feb	We	Radial flow to well in unconfined aquifer	4.2	
7-Feb	Fri	Review		HW4
10-Feb	Mo	**Test 1**		
12-Feb	We	Introduction to surface water hydrology	7.1	
14-Feb	Fri	Precipitation	7.2.1-7.2.3	
17-Feb	Mo	**No Class - Presidents Day**		
18-Feb	Tu	Design storms	7.2.4-7.2.5	
19-Feb	We	Evaporation	7.3	
21-Feb	Fri	Methods for calculating infiltration	7.4.1-7.4.3	HW5
24-Feb	Mo	Infiltration continued	7.4.1-7.4.3	
26-Feb	We	Surface runoff and hydrograph components.	8.1-8.2	
28-Feb	Fri	The unit hydrograph approach	8.3	
3-Mar	Mo	Synthetic unit hydrographs	8.4	
5-Mar	We	S hydrographs	8.5	
7-Mar	Fri	NRCS Rainfall Runoff Calculations	8.6-8.7	HW6
10-Mar	Mo	**No Class - Spring Break**		
12-Mar	We			
14-Mar	Fri			
17-Mar	Mo	Unit Hydrograph Examples and Problem Solving		
19-Mar	We	Hydrologic Data		
21-Mar	Fri	Streamflow measurement		
24-Mar	Mo	NRCS Dimensionless Unit Hydrograph	8.8	
26-Mar	We	Review		HW7
28-Mar	Fri	**Test 2**		
31-Mar	Mo	Reservoir routing.	9.1-9.2	
2-Apr	We	No Class - Spring Runoff Conference		
4-Apr	Fri	River Routing	9.3	
7-Apr	Mo	Modeling using HEC-HMS 1		HW8
9-Apr	We	Modeling using HEC-HMS 2		
11-Apr	Fri	Modeling using HEC-HMS 3		
14-Apr	Mo	Problem solving case study - Great Salt Lake Hydrology		HW9
16-Apr	We	Problem solving case study - Great Salt Lake Hydrology		
18-Apr	Fri	Problem solving case study - Great Salt Lake Hydrology		
21-Apr	Mo	Review		HW10
23-Apr	We	Review		
25-Apr	Fri	Review		
28-Apr	Mo	**Final Exam. 1:30-3:20 pm**		

Notes

*Readings refer to sections in Mays, L. W., (2011), Ground and Surface Water Hydrology, John Wiley & Sons, 704 p.