

University of Colorado Denver
Department of Civil Engineering and Construction
CVEN-5335 Vadose Zone Hydrology

Fall 2026

Class: Mon/Wed 5:00-6:15 pm

Location: North Classroom 1521

Office Hours: Mon/Wed 3:30-4:45 pm

Instructor: David C. Mays, P.E., Ph.D.

Office: North Classroom 2014

E-mail: david.mays@ucdenver.edu

<http://engineering.ucdenver.edu/dmays/5335>

Catalog Description: Engineering analysis of the vadose zone, the unsaturated porous media linking the earth surface to groundwater. Darcy's law for flow. Richards equation for moisture content. The advection-dispersion equation for solutes. Analytical solutions and numerical modeling applied to infiltration, evaporation, drainage, and subsurface remediation. *Prerequisites:* Graduate standing. Proficiency in fluid mechanics, differential equations, and spreadsheet applications like Microsoft Excel.

Course Objectives: At the end of the semester, you should be able to:

1. Articulate the vadose zone's central role in water resources and environmental engineering.
2. Explain how water flow in porous media depends on gravity, pressure, and capillary effects.
3. Apply soil physics to water resources topics like infiltration, drainage, and field water balance.
4. Extend soil physics to environmental engineering topics like soil remediation.
5. Use the software package HYDRUS-1D for water flow and solute transport modeling.

Required Text: Tindall, J.A. and J.R. Kunkel (1999), *Unsaturated Zone Hydrology for Scientists and Engineers*, Prentice Hall, Upper Saddle River, New Jersey (ISBN 0-13-660713-6).¹

Week	Dates	Topic	Film/Reading Assignment ²
1	8/17, 8/19	Hydrologic Cycle	♦ P-2016, §2.6-2.7, §4.4-4.5, ☼ T-1969
2	8/24, 8/26	Saturated Flow	§4.2-4.3, §4.7, §6.3, §7.0-7.3, §7.5-7.10, ☼ T-1967
3	8/31, 9/2	Unsaturated Flow	§8.0-8.4
4	9/9	Evaporation	§9.0-9.1, §9.3-9.4, §9.7-9.8
5	9/14, 9/16	Flow Modeling	§13.0-13.1, ♦ SVS-2005 (§2.0-2.8, §7.0-7.4, §11.1)
6	9/21, 9/23	HYDRUS-1D (EXAM)	→ same as previous week
7	9/28, 9/30	Infiltration	§11.0-11.8
8	10/5, 10/7	Drainage	§14.0-14.5, ♦ R-1993
9	10/12, 10/14	Field Water	§12.0-12.3
10	10/19, 10/21	Solute Transport	§10.2-10.5, §10.8, §10.13, §10.15
11	10/26, 10/28	Solute Transport (EXAM)	♦ SVS-2005 (§3.0-3.4, §8.0-8.4)
12	11/2, 11/4	HYDRUS-1D for Solutes	→ same as previous week
13	11/9, 11/11	Soil Remediation	§15.0-15.2, Appendix 1
14	11/16, 11/18	Clay Effects	§2.1, §2.4, §7.4, §10.14, ♦ M-2007
15	11/30, 12/2	Summary and Review	→ none

Midterms: Monday 9/21/2026 (weeks 1-4), Monday 10/26/2026 (weeks 1-9).

Final Exam: To be scheduled during exam week (Monday 12/7/2026 to Friday 12/11/2026).

Grades: 10% homework, 20% 1st midterm, 30% 2nd midterm, 40% final exam.

¹ Free online. You may print up to eight chapters: http://wwwbrr.cr.usgs.gov/projects/GW_Unsat/Unsat_Zone_Book/.

² See the public website above for film ☼ and reading ♦ assignments: M-2007 is Mays (2007); P-2016 is Perlman (2016); R-1993 is Reisner (1993); SVS-2005 is Šimůnek et al. (2005); T-1967 is Taylor (1967); and T-1969 is Trefethen (1969).

Attendance

The education research literature and personal experience in this course have established a strong cause-and-effect relationship between attendance and learning. Accordingly, punctual attendance is required. While your letter grade is based entirely on your demonstrated ability, as stated above, students with more than five absences (*i.e.*, more than $5 \times 75 = 375$ minutes absent) will receive a grade of incomplete (I) that may prevent registration for subsequent courses. *If you must be absent, can you make it up?* Partially, as follows: (1) Borrow a classmate's notes. (2) Copy them by hand with your name in ink on each page. (3) Discuss the notes with your classmate, the teaching assistant (TA), or the instructor. (4) Arrange a meeting with the TA, show your handwritten notes, and summarize your discussion for $\frac{1}{2}$ attendance point. *If you are facing unusual circumstances, can you make special arrangements with the instructor?* Yes.

Homework

Homework will be assigned in class each Monday, or through Assignments and Answers on the course website, and will be due at the beginning of class on Wednesday of the following week. Engineering paper is encouraged. To clarify the presentation, accelerate the grading, and develop attention to detail, homework must comply with the following specifications:

1. Assignments must be submitted in hard copy, during class or office hours, professionally presented (no wrinkles or ragged edges), and stapled in the upper-left corner.
2. At the top of *each* page, print your name, class number, homework number, due date, and page of total (1 of 5, 2 of 5, etc.). If late, you must write the date submitted on the first page.
3. Draw a picture for *each* problem. Use a straight edge for straight lines.
4. Briefly restate *each* problem in your own words. Do not copy the problem statement verbatim.
5. State what you are going to calculate under the heading FIND.
6. State any relevant assumptions, including assumed precision of input numbers.
7. Write the units for all numbers, not just final results:
 - a. Use the same units (metric or US) as the problem.
 - b. Write 5 ft rather than 5' and 8 in rather than 8".
 - c. Units like psi are fine for results but otherwise write lb/in² to show the units cancel.
8. Write each result, with the correct number of significant digits, on its own line.

Homework will be checked for compliance specifications 1-8. If more than one specification is overlooked, homework will be returned and considered missing until resubmitted. Homework grades are A (100), B (85), C (75), D (65), F (50), and missing (50). For example, the average of B and C is 80%, and the average of C and D is 70%. There is a five-point bonus for A homework and a five-point penalty for F or missing homework.

Grading

- Life happens, so late homework is accepted—no questions asked—with a penalty of one letter grade per class.
- No credit for missed exams, except (a) when special arrangements have been made ahead of time, or (b) with documentation of an emergency.
- Unclaimed exams, assignments, and reports will be destroyed on or after 2/1/2027.
- Final grades, rounded to two decimal places, are $F < 60\%$, $60\% \leq D < 70\%$, $70\% \leq C < 80\%$, $80\% \leq B < 90\%$, and $A \geq 90\%$. Final grades will not include plus or minus designations.

Communication

The business of civil engineering happens by email, so I expect you to check your CU Denver email account each and every business day. Never hesitate to email me. It's easy! See the step-by-step guide below.³

Academic Integrity

Studying with others is useful and encouraged, but you must perform and present your own work, so copied solutions—from artificial intelligence (such as ChatGPT), from an online resource, from a tutor, from other students, or from any other source—violate the expectation for academic integrity stated in the *2026-2027 Academic Catalog*⁴ and our Student Honor Code, attached below. To avoid plagiarism, cite your sources using American Society of Civil Engineers format.⁵ Midterm and final exams will follow an Exam Policy to be distributed separately.

Mental Health

Is your mental health impacted by anxiety, depression, substance use, or loneliness? If so, you are not alone, and there is help available at CU Denver Medical and Mental Health Resources.⁶ You can visit their website below, email them at lynxwellness@ucdenver.edu, call them at 303-315-WELL (9355), or visit them in the Lola and Rob Salazar Student Wellness Center (1355 12th Street).

General

- We honor and acknowledge that we are in the traditional territories and ancestral homelands of the Cheyenne, Arapaho, and Ute nations.
- The University of Colorado Denver is committed to an educational environment that is inclusive and embodies the equality of opportunity. We are dedicated to the full participation of students with disabilities in the university environment. If you have a learning disability or need special accommodation, please register with Disability Resources and Services (DRS),⁷ who will evaluate your situation on a case-by-case basis. I will provide accommodation per your letter from DRS.
- Snow Closure Hotline 877-556-3637. Campus closed? Class on Zoom with video uploaded.
- Students are responsible for all material presented in class, readings, homework, and email.
- Syllabus subject to revision.

This semester's Academic Calendar and our Student Honor Code are attached below. If you have not done so already, please detach, sign, and return the Student Honor Code to me.

Welcome to the class!

³ <https://www.purdue.edu/advisors/students/professor.php>

⁴ <http://catalog.ucdenver.edu/>

⁵ <https://ascelibrary.org/author-center/books-style-guide#date-references>

⁶ <https://www.ucdenver.edu/wellness/services/basic-needs/medical-and-mental-health-resources>

⁷ <https://www.ucdenver.edu/offices/disability-resources-and-services>

[UCD Access \(Student Portal\)](#)
[Registrar Forms](#)
[Registration Information](#)
All deadlines are 11:59 PM MT unless otherwise indicated.

Main Session	Date	Important Notes
Registration begins for Fall Semester via UCDAccess	March 16- March 31, 2026	Check UCDAccess for your specific registration date and time assignment. For best course selection, register as soon as possible after your registration time assignment.
First day to apply for Fall Graduation via UCDAccess	March 16, 2026	
Open enrollment begins for Fall Semester via UCDAccess	April 1, 2026	
First day of Fall semester classes	August 17, 2026	
Last day to waitlist Fall classes using UCDAccess	August 23, 2026	
Last day to drop a Fall class without a \$100 drop charge	August 24, 2026	All waitlists will be eliminated today.
First day instructor approval may be required to add some Fall classes	August 24, 2026	If unable to enroll in UCDAccess because "Instructor Consent is Required", obtain instructor approval on a Schedule Adjustment Form.
Census Day	September 2, 2026	Deadline time is 5:00 PM MT.
Last Day to add Fall classes in UCDAccess	September 2, 2026	Deadline time is 5:00 PM MT.
Last day to add Fall classes with instructor consent on the Schedule Adjustment form	September 2, 2026	If unable to enroll in UCDAccess because "Instructor Consent is Required", obtain instructor approval on a Schedule Adjustment Form. Deadline time is 5:00 PM MT.
Full tuition will be charged for additional Fall classes added after this date	September 2, 2026	College Opportunity Fund will not apply nor will hours be deducted from eligible lifetime hours after this date. Deadline time is 5:00 PM MT.
Last day to drop Fall classes with a financial adjustment	September 2, 2026	Deadline time is 5:00 PM MT.
Fall classes dropped after this date will appear on your transcript with a grade of 'W'	September 2, 2026	Deadline time is 5:00 PM MT.
Last day to submit a Grade Forgiveness Opt-Out form for a Fall Semester class.	September 2, 2026	Refer to the Grade Forgiveness Opt-Out form for restrictions. Deadline time is 5:00 PM MT.
Last day to apply for Fall graduation via UCDAccess	September 2, 2026	Deadline time is 5:00 PM MT. After this, contact your advisor.
Labor Day Holiday	September 7, 2026	No classes. Campus closed.
Registration begins for Spring Semester via UCDAccess	Oct. 15, 2026 - Oct. 30, 2026	Check UCDAccess for your specific registration date and time assignment. For best course selection, register as soon as possible after your registration time assignment.
Open enrollment begins for Spring Semester via UCDAccess	November 2, 2026	
Last day to request No Credit or Pass/Fail grade for a Fall class	October 25, 2026	Graduate degree students can exercise the P+/P/F option for undergraduate courses only. Graduate students should consult their school or college regarding the P+/P/F option. A grade of P+/P/S will not be acceptable for graduate credit to satisfy any graduate education requirement.
Last day to withdraw from a Fall class via UCDAccess	October 25, 2026	
First day to withdraw from a Fall class with a Late Withdraw Petition form	October 26, 2026	
Fall Break	November 23 - 29, 2026	No classes. Campus open.
Thanksgiving Day	November 26, 2026	No classes. Campus closed.
Last day to withdraw from a Fall class with a Late Withdrawal Petition form	December 2, 2026	
Finals Week	December 7 - 12, 2026	
End of Fall semester - Commencement	December 12, 2026	
Final Fall Semester grades available on UCDAccess and transcripts (tentative)	December 17, 2026	
Winter Break	Dec. 25, 2026 - Jan. 1, 2027	No classes. Campus closed.
Fall degrees posted on UCDAccess and transcripts (tentative)	January 15, 2027	This is the date degrees will be recorded on the transcript; diplomas begin mailing approximately February 1st.



Student Honor Code

(Revised 12/1/2022)

The Honor Code outlined below is the College of Engineering, Design and Computing statement on academic integrity. The Code articulates the College's expectations of its students and faculty in establishing and maintaining the highest standards in academic work.

Honor Code Text

The Honor Code of the College of Engineering, Design and Computing is a statement of its students, individually and collectively:

- Students will not give or receive aid during examinations.
- Students will not use any prohibited electronic devices during examinations.
- Students will not give or receive unpermitted aid in class work, in the preparation of reports, or in any other work that is to be used by the instructor as the basis of grading.
- Students will uphold the spirit and letter of the Honor Code and they will take an active role to ensure that others uphold the Honor Code and if they observe violations of the Honor Code they must report violations to their Department Chair.
- The Faculty of the College will do its part to ensure its confidence in the honor of its students. Faculty must ensure that precautions are in place to prevent the forms of dishonesty mentioned above. Faculty will also avoid, as far as practical, academic procedures that create temptations to violate the Honor Code. Faculty alone has the right and obligation to set academic requirements. However, the students and faculty will work together to establish optimal conditions for honorable academic work.

Violations of the Honor Code

Examples of conduct that will be regarded as being in violation of the Honor Code include:

- Copying from another's examination paper or allowing another to copy from one's own paper.
- Plagiarism in any shape or form. Plagiarism is defined as the use, without giving reasonable and appropriate credit to or acknowledging the author or source, of another person's original work, whether such work is made up of code, formulas, ideas, language, research, strategies, writing or other form(s).
- Giving or receiving unpermitted aid either in person or via electronic devices.
- Engaging in unauthorized collaboration on academic assignments or examinations.
- Representing as one's own work the work of another.

Penalties for Violating the Honor Code

Most student disciplinary cases have involved Honor Code violations. Of these, most cases arise when a student submits another's work as his or her own, gives or receives unpermitted aid, or engages in unauthorized collaboration. If a violation occurs during a quiz or on a homework assignment, the student will receive a zero for that quiz or assignment. If a violation occurs on an examination or a final project that compromises at least 15% of the final grade, the student will receive a failing grade for the course. The standard penalty for a first offense may include suspension from the College of Engineering, Design and Computing for a severe infraction of the Honor Code. The penalty for a second violation will be expulsion from the College of Engineering, Design and Computing. An instructor who notices a violation should report it to the Department Chair. The Department Chair makes a confirming determination if a violation has occurred and writes a formal letter to the student describing the penalty that will be imposed.

It is the responsibility of the student to seek clarification from the instructor when in doubt about these guidelines.

By signing below, I affirm that I have read and understood the Student Honor code and will abide by its provisions.

Student Name (*printed*): _____

Student ID: _____

Student Signature: _____

Date: _____