

GEOL 719, Vadose Zone Hydrology

Schedule:

Section 1	T&Th	10:00 – 11:15am	LFG 202
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Course Description:

This course will provide a thorough introduction to vadose zone hydrologic processes, and their impact on issues of soil water movement, data analysis and monitoring. This subject area can be used to explain and solve environmental problems that span many areas of hydrology, plant science, and environmental science. It forms the underpinning of issues that include deep recharge of water, surface runoff, ecosystem development, and land restoration.

The course material will include a discussion of the physical properties of porous media (primarily soil) that can affect water status, such as particle size distribution, bulk density, and soil structure. We will then migrate to relationships of water energy, water content, and hydraulic conductivity in soil, and how these can be used to interpret flow direction, available water for plants, etc. We will look at methods of monitoring and measuring soil water parameters and how they can be used in the field to solve practical problems. Numerical modeling tools will be introduced.

Course Objectives:

- To understand how soil texture and structure affect water movement and storage in soil;
- To understand relationships between soil water pressure, water content and hydraulic conductivity;
- To understand basic techniques for monitoring soil water, storage, movement and characterizing soil hydraulic properties;
- To use this knowledge to be able to design monitoring systems, collect and evaluate data and to use these data for predicting water, heat and solute movement in soil

Broad Course Outline:

- Physical properties of porous media (primarily soil) that can affect water status
- Relationships of water energy, water content and hydraulic conductivity in soil
- Methods of measuring and monitoring soil water parameters
- Numerical modeling tools
- Laboratory and field demonstrations
- Data analysis

Class Notes (Provided) and Suggested Text Book:

- “Vadose Zone Hydrology/Environmental Soil Physics”, Lecture Notes by Dani Or, Markus Tuller and John Wraith (2015) – made available on <http://classes.dri.edu>
- “Environmental Soil Physics”, Daniel Hillel (1998) Academic Press, 771p.
*Note: Hillel’s “Intro to Environmental Soil Physics”, 2003 is also acceptable.

Moodle:

All course information including syllabus, class notes, homework assignments, journal articles, etc., will be posted on Moodle at: <http://classes.dri.edu>. Please go to the website and click on “Vadose Zone Hydrology,” then create an account so that you may access the course via the Moodle site. Please visit the Moodle frequently as the instructors will use Moodle for communication and providing updated course information.

Grades:

**subject to change!*

Assignments: 100 points (5 Assignments ~ 20 points each)

Projects: 200 points (25 points for the final Proposal; 75 points for the project presentation, and 100 points for the project report)

TOTAL: 300 points possible; grade based on % of 300

Final course grades will be assigned as follows:

A to A- = 100 - 90 %

B+ to B- = 89 - 80 %

C+ to C- = 79 - 70 %

D+ to D- = 69 - 60 %,

F = < 60 %

Project Suggestions - Analyzing Lysimeter Data:

In 2008, three large weighing lysimeters were constructed for the purpose of measuring vadose zone processes. Data have been collected since August 2008. Because of the close connection between this class and the lysimeter project, there is an opportunity to analyze lysimeter data as the final class project and answer some basic questions about the soil water status in the lysimeters. Data related to soil water parameters will include, but are not limited to, water content, matric potential, soil temperature, soil heat flux, CO₂ concentrations, etc. for specific depths and positions. Possible tasks/research questions, are listed below:

1. How deep does rainwater infiltrate into the soil? How fast does water evaporate from the soil?
2. What is the soil water storage as measured using different technologies? How do the technologies compare?
3. What is the wetting front velocity? Is it uniform or non-uniform across the surface?
4. Are particular instruments more or less sensitive to changes in water status?
5. etc.

Additional Information

Withdrawals:

Withdrawals from the course are possible through the date specified in this semester’s Catalog. Until then you may drop with no questions asked. After that date, withdrawals are not permitted for any reason.

Academic Misconduct:

Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility and professionalism. By choosing to join the UNLV community, students accept the expectations of the Student Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling in UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's function as an educational institution. An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another, from the Internet or any source, without proper citation of the sources. See the Student Academic Misconduct Policy (approved December 9, 2005) located at:

<https://www.unlv.edu/studentconduct/student-conduct>.

Copyright:

The University requires all members of the University Community to familiarize themselves **with** and to follow copyright and fair use requirements. **You are individually and solely responsible for violations of copyright and fair use laws. The university will neither protect nor defend you nor assume any responsibility for employee or student violations of fair use laws.** Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. Additional information can be found at: <http://www.unlv.edu/provost/copyright>.

Disability Resource Center (DRC):

The UNLV Disability Resource Center (SSC-A 143, <http://drc.unlv.edu/>, 702-895-0866) provides resources for students with disabilities. If you feel that you have a disability, please make an appointment with a Disabilities Specialist at the DRC to discuss what options may be available to you. If you are registered with the UNLV Disability Resource Center, bring your Academic Accommodation Plan from the DRC to the instructor during office hours so that you may work together to develop strategies for implementing the accommodations to meet both your needs and the requirements of the course. Any information you provide is private and will be treated as such. To maintain the confidentiality of your request, please do not approach the instructor in front of others to discuss your accommodation needs.

Religious Holidays Policy:

Any student missing class quizzes, examinations, or any other class or lab work because of observance of religious holidays shall be given an opportunity during that semester to make up missed work. The make-up will apply to the religious holiday absence only. It shall be the responsibility of the student to notify the instructor within the first 14 calendar days of the course for fall and spring courses (excepting modular courses), or within the first 7 calendar days of the course for summer and modular courses, of his or her intention to participate in religious holidays which do not fall on state holidays or periods of class recess. For additional information, please visit: <http://catalog.unlv.edu/content.php?catoid=6&navoid=531>.

Transparency in Learning and Teaching:

— The University encourages application of the transparency method of constructing assignments for student success. Please see these two links for further information:

<https://www.unlv.edu/provost/teachingandlearning>

<https://www.unlv.edu/provost/transparency>

Incomplete Grades:

The grade of I—Incomplete—can be granted when a student has satisfactorily completed three-fourths of course work for that semester/session but for reason(s) beyond the student's control, and acceptable to the instructor, cannot complete the last part of the course, and the instructor believes that the student can finish the course without repeating it. The incomplete work must be made up before the end of the following regular semester for undergraduate courses. Graduate students receiving "I" grades in 500-, 600-, or 700-level courses have up to one calendar year to complete the work, at the discretion of the instructor. If course requirements are not completed within the time indicated, a grade of F will be recorded and the GPA will be adjusted accordingly. Students who are fulfilling an Incomplete do not register for the course but make individual arrangements with the instructor who assigned the I grade.

Tutoring and Coaching:

The Academic Success Center (ASC) provides tutoring, academic success coaching and other academic assistance for all UNLV undergraduate students. For information regarding tutoring subjects, tutoring times, and other ASC programs and services, visit <http://www.unlv.edu/asc> or call 702-895-3177. The ASC building is located across from the Student Services Complex (SSC). Academic success coaching is located on the second floor of the SSC (ASC Coaching Spot). Drop-in tutoring is located on the second floor of the Lied Library and College of Engineering TEB second floor.

UNLV Writing Center:

One-on-one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-3-301. Although walk-in consultations are sometimes available, students with appointments will receive priority assistance. Appointments may be made in person or by calling 702-895-3908. The student's Rebel ID Card, a copy of the assignment (if possible), and two copies of any writing to be reviewed are requested for the consultation. More information can be found at: <http://writingcenter.unlv.edu/>.

Rebelmail:

By policy, faculty and staff should e-mail students' Rebelmail accounts only. Rebelmail is UNLV's official e-mail system for students. It is one of the primary ways students receive official university communication such as information about deadlines, major campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the university. Students' e-mail prefixes are listed on class rosters. The suffix is always @unlv.nevada.edu. **Emailing within WebCampus is acceptable.**

Library Resources:

Students may consult with a librarian on research needs. For this class, the subject librarian is https://www.library.unlv.edu/contact/librarians_by_subject. UNLV Libraries provides resources to support students' access to information. Discovery, access, and use of information are vital skills for academic work and for successful post-college life. Access library resources and ask questions at <https://www.library.unlv.edu/>.

Final Examinations:

The University requires that final exams given at the end of a course occur at the time and on the day specified in the final exam schedule. See the schedule at: <http://www.unlv.edu/registrar/calendars>.

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Course Schedule:

Note: Schedule can change either way depending on student input and other interesting subjects.

Week/Date		Topic	Instructor	Reading	Activity
1	1/19	Class introduction	ALL		
	1/21	Introduction to soils	MB/RS	Or & al. Section 1.1-1.5 and Rose's notes	
2	1/26	Introduction to soils	MB/RS	Or & al. Section 1.1-1.5 and Rose's notes	
	1/28	Soil solid phase	MB	Or & al. Section 1.1-1.5	<i>Homework #1 Due</i>
3	2/02	Soil liquid phase	MB	Or & al. Section 1.6	
	2/04	Soil physical properties - Lab demo	RS/JK	Rose's notes	
4	2/9	Energy state of soil water	MB	Or & al. Section 1.7	
	2/11	Water potential and its components	MB	Or & al. Sections 1.8-1.10	<i>Homework #2 Due</i>
5	2/16	Water potential and its components	MB	Or & al. Sections 1.8-1.10	
	2/18	Soil water characteristics	MB	Or & al. Section 1.11	
6	2/23	Water flow in saturated soils	MH/MB	Or & al. Sections 2.1-2.6	
	2/25	Water flow in unsaturated soils	MB/MH	Or & al. Sections 2.7-2.9	<i>Homework #3 Due</i>
7	3/01	Water flow in unsaturated soils	MB/MH	Or & al. Section 2.10	
	3/03	Infiltration	MB	Or & al. Sections 2.11, 2.12	
8	3/08	Evapotranspiration	MB	Or & al. Section 3	
	3/10	SEPHAS introduction/field trip	ALL		
9	3/15	Water flow and storage - Lab demo	RS/JK	Rose's notes	
	3/17	Hydrology	ALL		
10	3/22	Spring Break			No class
	3/24	Spring Break			No class
11	3/29	Soil gaseous phase and transport	MB/MH	Or & al. Section 6 Mark's notes	
	3/31	Thermal properties of soil	MH	Mark's notes Or & al. Section 4	<i>Proposal Due</i>

Week/Date		Topic	Instructor	Reading	Activity
12	4/05	Solute Transport	MH/MB	Mark's notes Or & al.5.1-5.4	
	4/07	HYDRUS-1D	MH/RS	Mark's notes	<i>Homework #4 due</i>
13	4/12	HYDRUS-1D	MH/RS	Mark's notes	
	4/14	HYDRUS-1D	MH/RS	Mark's notes	
14	4/19	HYDRUS-1D	MH/RS	Mark's notes	
	4/21	TBD	ALL		<i>Homework #5 due</i>
15	4/26	Projects	ALL		<i>Presentations</i>
	4/28	Projects	ALL		<i>Presentations</i>
16	5/03	Projects	ALL		<i>Presentations</i>
	5/05		ALL		
17	5/10 5/12	Finals week/Projects	ALL		<i>Presentations and Project Reports Due (5/12)</i>

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