

EAS 435: Groundwater Hydrology

Spring 2014, 3 Credits

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Office Hours: 1:30 – 2:30 TR or by appointment

Teaching Assistant: Heather Robinson, O'Neil Hall 102, robinsonhk@slu.edu

Office Hours: 12:00 – 1:00 MW or by appointment

Meeting Times and Place: 11:00 – 12:15 TR, O'Neil 206

Website: Blackboard (<http://blackboard.slu.edu>)

Course Description: Introduction to principles that govern the flow and geochemistry of water in shallow and deep groundwater systems. Basic equations of fluid flow, dynamics, and the characteristics of groundwater. Examination of the connection between surface water and groundwater, the relationship between groundwater and geology, anthropogenic impacts on groundwater systems, and efforts to remediate damaged systems. Prerequisites: EAS 101, EAS 102, EAS 242, and MATH 142 or permission of instructor.

Textbook: No assigned textbook. All required course readings will be posted online.

Suggested Readings: *On reserve in the library

**Groundwater* by Freeze and Cherry

**Applied Hydrogeology* by Fetter

**Physical and Chemical Hydrogeology* by Domenico and Schwartz

Introduction to Hydrogeology by Deming

Applied Chemical Hydrogeology by Kehew

Environmental Hydrology by Ward and Trimble

The Geochemistry of Natural Waters by Drever

Resources of the Earth by Craig, Vaughan, and Skinner

Course Responsibilities and Grading Policies: Course grades will be determined based on three exams, a research paper and presentation, homework and in-class activities, and a field trip report. Due dates for all assignments are noted below.

Exams: 60%

Three exams will be given (20% each). Exams will focus on the most current material and readings but students must be able to recall information from throughout the course to be successful on the 2nd and 3rd exams. If you miss an exam and provide me with an acceptable, written excuse, I may choose to schedule an oral or written make-up exam or assign 30% to each of the other two exams.

Paper and Presentation: 20%

Students will prepare a term paper that critically reviews a topic in groundwater hydrology and present their findings during in-class presentations. A handout covering specific details, including topics of this assignment, will be made available early in the semester.

Homework/In-Class Activities: 16%

Problem sets and in-class activities will be assigned throughout the course. Late assignments will be accepted until the graded assignment is returned in class. A penalty of -10% per day (including weekends and holidays) will be enforced. Late homework must be turned in to the instructor or TA in person unless other arrangements have been made. No homework will be accepted on weekends or university holidays. Under certain circumstances, and only with approval from the instructor, short extensions may be granted. In-class activities are generally unannounced, so it is the student's responsibility to attend class to participate in these assignments.

Field Trip: 4%

This course will have one required field trip. The field trip date is March 29 to take advantage of the warmer weather in the spring. The trip will depart at 9 AM and return in the late afternoon. Students will be required to provide written summaries of field trip activities and answer essay questions pertaining to the field trip. Details will be provided in the class before the trip. Contact Dr. Hasenmueller well in advance if you have a conflict.

Grading: Final grades will be determined by the instructor. However, students are guaranteed the following minimum letter grade (+/- grades will be given):

- A: 90 – 100%
- B: 80 – 90%
- C: 70 – 80%
- D: 60 – 70%
- F: < 60%

Academic Integrity and Honesty: The University is a community of learning, whose effectiveness requires an environment of mutual trust and integrity. Academic integrity is violated by any dishonesty such as soliciting, receiving, or providing any unauthorized assistance in the completion of work submitted toward academic credit. While not all forms of academic dishonesty can be listed here, examples include copying from another student, copying from a book or class notes during a closed book exam, submitting materials authored by or revised by another person as the student's own work, copying a passage or text directly from a published source without appropriately citing or recognizing that source, taking a test or doing an assignment or other academic work for another student, securing or supplying in advance a copy of an examination or quiz without the knowledge or consent of the instructor, sharing or receiving the questions from an online quiz with another student, taking an on-line quiz with the help of another student, and colluding with another student or students to engage in academic dishonesty.

All clear violations of academic integrity will be met with appropriate sanctions. In this course, academic dishonesty on an assignment will result in an automatic grade of 0 for that assignment and a report of academic dishonesty sent to the Academic Honesty Committee of the College of Arts and Sciences. In the case of Class B violations, the Academic Honesty Committee may impose a larger sanction including, but not limited to, assignment of a failing grade in the course, disciplinary probation, suspension, and dismissal from the University.

Students should refer to the following SLU website for more information about Class A and B violations and the procedures following a report of academic dishonesty:
<http://www.slu.edu/x12657.xml>

Academic Support: In recognition that people learn in a variety of ways and that learning is influenced by multiple factors (e.g., prior experience, study skills, learning disability), resources to support student success are available on campus. Students who think they might benefit from these resources can find out more about:

- Course-level support (e.g., faculty member, departmental resources, etc.) by asking your course instructor.
- University-level support (e.g., tutoring/writing services, Disability Services) by visiting the Student Success Center (BSC 331) or by going to <http://www.slu.edu/success>.

Students who believe that, due to a disability, they could benefit from academic accommodations are encouraged to contact Disability Services at 314-977-3484 or visit the Student Success Center. Confidentiality will be observed in all inquiries.

Course instructors support student accommodation requests when an approved letter from Disability Services has been received and when students discuss these accommodations with the instructor after receipt of the approved letter.

Schedule: Listed below is a *tentative* schedule. The instructor reserves the right to modify the order and topics as necessary. Changes to the schedule will be announced in class, and it is the students' responsibility to attend class or make other necessary arrangements to keep abreast of the situation. All readings are from handouts posted online, and specific readings will be announced in class.

Week	Dates	Lecture Topics	Assignments/Exams
1	Jan. 14, 16	Introduction and Overview of the Water Cycle	
2	Jan. 21, 23	Precipitation and Evapotranspiration	HW #1 (out 1/21)
3	Jan. 28, 30	Infiltration, Soil Water, and Water Balance	
4	Feb. 4, 6	Groundwater-Surface Water Interactions, Stream Discharge, Hydrographs, and Hydrograph Separations	HW #1 (due 2/6)
5	Feb. 11, 13	Groundwater Resources	Exam #1 (2/13)
6	Feb. 18, 20	Porosity, Permeability, Hydraulic Conductivity, and Darcy's Law	Paper Topic (due 2/18) HW #2 (out 2/20)
7	Feb. 25, 27	Darcy's Law and Hydraulic Head	
8	Mar. 4, 6	Confined and Unconfined Aquifers	HW #2 (due 3/6)
9	Mar. 11, 13	Spring Break: No Class	
10	Mar. 18, 20	Groundwater Flow: Topographic Flow, Potentiometric Surface, and Flow Nets	Paper Abstract (due 3/18) HW #3 (out 3/20)
11	Mar. 25, 27	Well Hydraulics and Drawdown	Exam #2 (3/25) Field Trip (3/29 9AM)
12	Apr. 1, 3	Isotope Hydrology and Groundwater Geochemistry	
13	Apr. 8, 10	Geothermal Systems, Karst Hydrology, and Subsidence	HW #3 (due 4/10)
14	Apr. 15, 17	Anthropogenic Impacts, No Class (4/17)	Paper Due (4/15)
15	Apr. 22, 24	Paper Presentations	
16	Apr. 29, May 1	Anthropogenic Impacts (cont'd), Engineering of Groundwater Systems, and Remediation Efforts	Exam #3 (5/1)