

GEOLOGY 445/545 – HYDROGEOLOGY
Winter, 2016

Class Hours: MTF 9:00-9:50 a.m. in Lind 103
Lab: T 2:00-4:50 p.m. in Lind 103

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Required Texts:

Applied Hydrogeology (Fourth Edition, 2001) by C.W. Fetter

Hydrogeology Laboratory Manual (Second Edition, 2003) by Keenan Lee, C.W. Fetter, and John E. McCray

Prerequisites:

GEOL 101 or 103 and MATH 154 or permission of instructor

Course Description:

Geology 445/545 is an advanced undergraduate/graduate level course dealing with hydrogeologic processes (involving both water and geologic materials). We will begin by discussing the entire hydrologic cycle and the water budgets of rivers, lakes, and watersheds. Then we will focus on properties of aquifers and how groundwater flows through them, with an emphasis on understanding the hydrogeology of the Ellensburg region.

Course Outcomes:

1. Dimensional analysis – Students can readily convert between unit systems and can evaluate a problem using the units of measurement as a guide for determining the units for the answer.
2. Properties of aquifers – Students know how to measure porosity, specific yield, specific retention, and hydraulic conductivity in the lab. Students can explain Darcy's Law.
3. Groundwater flow – Students understand how spatial variations in energy cause groundwater to flow. They can qualitatively describe what flow might be expected for a given geologic setting.
4. Regional hydrogeology – Students have a basic knowledge of the hydrogeology in the region around Ellensburg.
5. Mass balance – students are comfortable using mass balance calculations as a tool for approaching a wide variety of geologic problems involving water.
6. Computer skills – students know how to use spreadsheets and plot graphs using the computer. They can also use the internet as a resource for obtaining hydrologic information and have some familiarity with computer groundwater models.
7. GETSI – Students evaluate the utility of traditional versus geodetic data for quantifying water fluxes and storage and use these data to assess the California drought.

Required Elements:

Homeworks – A few assignments throughout the quarter. Late policy: 5% off for each weekday that homework is late.

GETSI module: Water Resources and Geodesy – This year, our class will pilot teaching material that has been developed through Geodesy Tools for Societal Issues (GETSI). The module we will be using focuses on groundwater and how GPS data can be used to understand groundwater fluctuations over time including groundwater declines due to excessive withdrawal. The module has four units and culminates in an assessment of the California Drought.

Lab Assignments – There is one three-hour lab session each week. The GETSI curriculum will often be incorporated into this part of the course. Two long lab reports will be assigned throughout the quarter. Several shorter lab write-ups will also be assigned. Due dates will be given at the time of the assignment. Late policy: 5% off for each weekday that report is late.

Field Trip – There is one mandatory field trip scheduled for Saturday February 20th to sites within the Yakima River basin. Tom Ring, a hydrogeologist with the Yakama Indian Nation, will help lead this trip. During the trip, graduate students will each make a short presentation on an assigned topic.

Exams – There will be two exams: one on Monday February 8th 9:00-9:50 a.m., covering all material taught through February 5th, and a final exam on Monday March 14th 10:00-12:00 a.m. The final exam will focus on material covered between February 9th and March 11th, but may also contain some comprehensive questions that involve material from the entire course.

Final Project – Students will work on a final project on a topic related to the California drought. Undergraduates can either work individually or in pairs. Graduate students must work alone.

Completion of the project will include a poster presentation during the last lab period.

Local hydrogeology presentations (graduate students) – Graduate students will be responsible for reading research papers on topics related to the hydrogeology around Ellensburg. They will then present syntheses of these papers to the rest of the class.

Grading:

Homeworks – 5%

GETSI assignments – 25%

Other Lab Assignments – 20%

Field Trip – 5%

Exams – midterm 15%, final 20%

Final Project – 10%

Graduate students – reduce all of the above except Homeworks and Field Trip by 1%,

Local hydrogeology presentations – 5%

Graduate students will also be given additional exam questions and will be graded with higher expectations on the lab reports and final project.

SYLLABUS

Week 1 – January 5, 8

Topics: Course overview, the importance of hydrogeology, hydrologic cycle, evaporation and precipitation, introduction to GETSI module

Reading: Fetter Chapter 1 and 2

Lab (January 5): Intro to lab – lab reports, significant figures, dimensional analysis, Mono Lake water budget (Lab 1) – *long lab report (with Lab 2)*

Week 2 – January 11, 12, 15

Topics: Runoff and streamflow, GETSI unit 1 (intro to the hydrologic cycle)

Reading: Fetter Chapter 2

Lab (January 12): Mono Lake water budget (2) – *long lab report (with Lab 1)*

Week 3 – January 19, 22 (January 18 – Martin Luther King Jr. Day)

Topics: , Properties of an aquifer, water storage in aquifers

Reading: Fetter Chapter 3

Lab (January 19): GETSI unit 2 (characterizing changes in groundwater storage)

Week 4 – January 25, 26, 29

Topics: Properties of an aquifer

Reading: Fetter Chapter 3

Lab (January 26): Porosity and Hydraulic Conductivity (Labs 6 and 7, modified)

Week 5 – February 1, 2, 5

Topics: Properties of an aquifer, Groundwater flow

Reading: Fetter Chapter 3

Lab (February 2): GETSI unit 3 (Groundwater withdrawal and fluctuations in the height of the Earth's surface)

Monday February 8th – Midterm

Week 6 – February 9, 12

Topics: Groundwater flow, flow to wells, local hydrogeology

Reading: Fetter Chapter 4 and 5

Lab (February 9): Local hydrogeology field trip

Week 7 – February 16, 19 (February 15 – Presidents' Day)

Topics: Groundwater flow to wells, water quality

Reading: Fetter Chapter 5 and 9

Lab (February 16): Water chemistry and water quality (Lab 5) – *long lab report*

Saturday February 20th – Field trip in Yakima River basin

Week 8 – February 22, 23, 26

Topics: Stable isotope hydrology, water quality

Reading: Fetter Chapter 9, 10

Lab (February 23): Aquifer testing III: Slug-Test Data Evaluation (Lab 11)

Week 9 – February 29, March 1, 4

Topics: Groundwater contamination

Reading: Fetter Chapter 10

Lab (March 1): GETSI unit 4 (Water balance approach to assessment of California drought)

Week 10 – March 7, 8, 11

Topics: Groundwater management, wrap up

Lab (March 8): GETSI wrap-up, Student poster presentations

Final Exam Monday March 14th 10:00-12:00 a.m.

Academic Honesty – Students are expected to be academically honest. Academic dishonesty is defined in the *Proscribed Conduct* section of the *Student Judicial Code* in the back of your academic catalog. Plagiarism is defined in this section as "the appropriation of any other person's work and the unacknowledged incorporation of that work in one's own work offered for credit" (CWU Undergraduate/Graduate Catalog, 2000-2001, p. 244). Plagiarism may range from an entire paper to a phrase within a sentence. When you are paraphrasing an idea that is not your own and is not common knowledge, you need to cite the source. Copying the work of other students on tests, exercises, or extra credit is another type of academic dishonesty. Academic dishonesty in any form will result in a failing grade. If one student copies the work of another student, then both students will receive a failing grade.

Students with Disabilities – Students who have special needs or disabilities that may affect their ability to access information or material presented in this course are encouraged to contact the instructors and/or Disability Support Services (963-2171) for disability-related educational accommodations.