CE 5364
Groundwater Transport Phenomena
Fall 2010

Class Meetings: Fridays 9:00—11:45, CA 5.

Instructor: Dr. Jeff Stovall
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Phone: 806-681-8275.
Office Hours: By appointment.

Text: *Ground Water Contamination*, 2nd ed., Bedient, Rifai, and Newell. Some computer manuals will be required at different times during the semester.

Course Website: www.blackboard.ttu.edu

Prerequisite: CE 4363/5363 Groundwater Hydrology

Course Purpose

The purpose of this advanced course is to enable the student to apply the hydrogeologic, hydrologic, and engineering principles to problems of groundwater and soil contamination investigation, simulation of the migration and fates of the contaminants, and pursue remediation alternatives.

Contribution of Course to Professional Component of the Curriculum

This course is one of the two groundwater courses in the MEnvE curriculum. This course builds on the water resources background begun in CE 4363 Groundwater Hydrology by emphasizing how groundwater flow participates in fate and transport of dissolved and liquid contaminants. These two courses complete the preparation of the students for most practical problems in groundwater quantity and quality. Individual projects are used in both courses to simulate the working environment in engineering practice.

Course Objectives

The student will be trained in the fundamental descriptions of the physical and chemical processes that which control the movement of contaminants in the subsurface. Analytical solutions and existing computer models will be presented to typify the available tools with corresponding limitations.

Course Schedule

Week	Date	Topics, **Events**, and *Reading Assignments*	Assignments	Due
1	8/27	Introduction (*Ch 1*), Flow Fundamentals (*Ch 2*), Contamination Sources (*Ch 4*), Anisotropy *Additional Reading: Groundwater Physics*	Homework 1	
2	9/3	Analytic Models	WhAEM Project	
3	9/10	Transport Mechanisms (*Ch 6*), Potential Flow Theory *Additional Reading: Advection and Dispersion*	Homework 2	Homework 1
4	9/17	Fate Processes (*Ch 7*), Modeling Attenuation (*Ch 8*), Attenuation and RBCA (*Ch 12*)	Homework 3	WhAEM Project
5	9/24	Risk Assessment, Natural Attenuation Models (BIOSCREEN/BIOCHLOR)	Homework 4	Homework 2
6	10/1	Numerical Models (*Ch 10*), MT3D Model *Additional Reading: Modeling Natural Attenuation*		Homework 3
7	10/8	**Exam 1**		
8	10/15	Site Investigations (*Ch 5*), Analysis of Groundwater Data/MAROS *Additional Reading: Groundwater Sampling and Data Analysis*	MT3D Project, Homework 5	Homework 4
9	10/22	Flow and Transport in the Unsaturated Zone (*Ch 9*)		
10	10/29	CHEMFLO Model	CHEMFLO Project	Homework 5
11	11/5	Non-Aqueous Phase Liquids (NAPLs) (*Ch 11*) *Additional Reading: LNAPL Distribution*	Homework 6	MT3D Project
12	11/12	NAPL Modeling (API Tools) *Additional Reading: NAPL in Fine-Grained Soils*	LDRM/LNAST Project	CHEMFLO Project
13	11/19	Remediation Alternatives (*Ch 13*), Model Optimization *Additional Reading: In Situ Bioremediation*		Homework 6
14	11/26	Thanksgiving		
15	12/3	Legal Protection (*Ch 14*), Final Exam Review		LDRM/LNAST Project

Exam 1: Week of 10/8.
Final Exam: To be announced.

Evaluation Process

Homework and Projects (50%) Homework assignments are due at the beginning of class unless otherwise stated.

- Several homework and project assignments will be distributed through the semester, weighted according to their relative scopes. After the graded homeworks are returned, the solutions will be posted.
- Use of spreadsheets is encouraged for repetitive tabular calculations and graphs, but sample calculations are required for full credit. Each student must submit his/her own spreadsheet.
- Late homework **will not be** accepted after solutions have been posted. A missed homework will be given a grade of zero.
- Homework must be submitted on (a) engineering paper (*for hand calculations*) with clearly defined problem statement, given information, required information, and solution sections, (b) plain computer paper when using computers. **Computer print-outs on engineering paper will not be accepted.**
- If you are unable to attend class the day a homework assignment is due you may email it to me by the end of the day. The file must be in final form, ready to be printed, including a cover sheet. Scanned pages are acceptable.
- Homework should be submitted on the **front** of a sheet only. **Start each problem on a new sheet of paper. Staple all homework pages together.**
- All solutions must have **correct units**.
- Because of the use of computers, copies of homework will receive a zero. It is your responsibility to delete completely any homework solutions that you have created on a lab machine when you are finished. **If someone turns in your solution you both will receive a zero on the assignment.**

Homework presentations should include:

1. A brief statement of the problem, information given, what is required, and a logical procedure leading to a solution.
2. Neatly drawn sketch with pertinent details such as dimensions, labels, and units.
3. Box, circle, or highlight the answer or principle conclusion.

Reading Quizzes (20%) Articles from the professional literature will be assigned throughout the semester to provide additional explanation or insight on key course topics. A short quiz on the assigned article will be given in class the following week.

Exams (2) (30%) Two exams will be given. The final exam will only cover the material after Exam 1. No make-up exams will be given for simple absence.

Grading Policy

90-100%	A
80-89%	B
70-79%	C
60-69%	D

Instructor reserves the right to adjust the grade distributions.

Calculators

Only NCEES-approved calculators will be permitted during tests and your test will be collected and your grade will be a zero if you are caught using a non-approved calculator. The approved calculators include the following:

- Hewlett Packard: HP 33s or HP 35s only.
- Casio: Any fx-115 model only.
- Texas Instruments: Any TI 30X or TI 36X models only.
- If you are unsure about your calculator, it is your responsibility to check with the instructor for approval.

Software

All software available in CE218/CE220 Computer Lab.
Modeling programs may be downloaded for free or provided by instructor.
Microsoft Excel 2007 available for download at www.eraider.ttu.edu for free.

Laptops/PDAs/MP3 Players/Cell Phones/etc.

If you have a laptop, you are encouraged to bring it to class to follow along with software demonstrations. The use of any electronic device, except an approved calculator, is not permitted during exams. Your exam will be collected and your grade will be a zero if you are caught using a non-approved electronic device. The use of phones and MP3 players is not permitted during class.

Attendance

Attendance is not a component of the course grade; however, attending class is recommended. Please let the instructor know if you miss a class for academically related extracurricular activities before the day you will be absence. A student who intends to observe a religious holy day (as defined by OP 34.19) should make that intention known to the instructor prior to the absence in order to receive accommodations prescribed by OP 34.19.

Class Conduct

Students are expected to treat each other and the instructor respectfully. All students are expected to observe appropriate personal hygiene practices.

Academic Misconduct *(as per OP 34.12)*

If the faculty member determines according to Part II B 2 of the *Student Handbook* that academic dishonesty has occurred and assigns a grade of **F** for the course, the grade of **F** will stand as a final grade, notwithstanding a subsequent withdrawal from the course by the student. The faculty member shall notify the registrar of the intention to assign a grade of **F** for the course, in addition to the notifications of the department chairperson and the student's academic dean, as provided in Part II B 2 of the *Student Handbook*. The student will have the right to appeal the receipt of a failing grade in a course through the established grade appeal procedure, as outlined in OP 34.03, Student Grade Appeals. The student may not appeal a failing grade given for a class assignment.

Military Personnel Ordered to Active Duty *(as per OP 34.13)*

Please see instructor.

Disability Policy *(as per OP 34.22)*

Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, you may contact the Student Disability Services office at 335 West Hall or 806-742-2405.

