GEOL 621: Contaminant Hydrogeology

Syllabus, Spring 2015

Instructor:

Dr. Hongbin Zhan, Professor and Holder of Endowed Ray C. Fish Professorship in Geology
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Class Notes and Text:

Class notes are the primary study materials. If you can understand the class notes thoroughly, you can succeed in this class.

Pre-requisite:

GEOL 410: Hydrogeology or permission from the instructor

Lecture:

TR 5:15-6:30 p.m. Halbouty 174.

Office Hours:

Wednesday 3:00-5:00PM

Course Grading:

There are only one exam (take home) and a series of assignments.

- homework: 60%
- final exam: 40%

Numerical grades on homework assignments and final exam will be rounded at the first decimal place (e.g. 89.50%→90%, 89.49%→89%). Letter grades for individual assignments will be computed as follows: A=90-100%, B=80-89%, C=70-79%, D=60-69%, F <60%. No extra credit will be available.

A student with an official medical, religious, and university excused absence will not be counted as absent. Students should consult Student Rule 7 for attendance and excused absence.

Learning Outcomes and Course Outline:

1. Introduction to Contaminant Hydrology, Environmental Law, and Challenges
   - Classification of contamination, Emerging contamination problems, and Environmental laws that are related to contaminant hydrology

2. Fundamentals of Contaminant and Mass Transport
   - Role of advection in mass transport
   - Capture zone design, capture size, and capture time computation
   - Role of dispersion and diffusion
   - Role of adsorption, radioactive decay, and biodegradation, and other reaction

3. Analytical Solutions of Advection-Dispersion Equation
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- 1-D solutions with first, second, and third-type boundary conditions
- 2-D solutions and applications
- 3-D solutions and applications

4. Non-Fickian Contaminant Transport and Advanced Transport Theories
   - Concept of mobile-immobile approach
   - Colloid transport
   - Transport in a single fracture
   - Scale-dependent transport
   - Fractional Advection-Dispersion Equation (FADE)
   - Continuous Time Random Walk (CTRW)
   - Reactive transport theory

5. Numerical Solutions of Advection-Dispersion Equation
   - Numerical dispersion and oscillation problems
   - Upstream finite-difference method
   - Method of Characteristic (MOC)
   - CXTFIT software package practice

6. Laboratory and Field Methods
   - Laboratory column test
   - Field measurement of contaminant transport
   - Push-and-Pull method

7. DNAPL, LNAPL, and Multiphase Transport and Remediation
   - Fundamentals of multiphase flow and transport
   - DNAPL and NAPL transport
   - Simple flushing model
   - Vadose zone leachate model
   - Remediation technology

8. Advances Topics
   - CO₂ sequestration
   - Shale gas development related contaminant transport
   - Oil and Gas exploration related contaminant problem

References:


All students should pay attention to the following:

THE AMERICANS WITH DISABILITIES ACT (ADA): If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities in Room B118 of Cain Hall. The phone number is 845-1637.

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