

GEOL 621: Contaminant Hydrogeology

Syllabus, Spring 2012

Instructor:

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

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

Text:

Fetter, C. W., *Contaminant Hydrogeology*, Second Edition, Prentice-Hall Publishing Company, Upper Saddle River, NJ, 500 p.

Pre-requisite:

GEOL 410: Hydrogeology or permission from the instructor

Lecture:

MWF 10:20-11:10 a.m. Halbouty 174.

Office Hours:

Monday 3:00-5:00PM

Course Grading:

There are only one exam (Final) and a series of assignments. The final exam is comprehensive.

- homework: 50% ;
- final exam: 50% ;

Assignments can be accepted late within one week of the due day but the grade will be reduced 25% for that assignment. Assignments CANNOT be accepted one week after the due day.

Midterm and Final Exam Schedules:

Final: 3:00-5:00pm, Friday, May 4, 2012.

Course Outline:

1. Introduction to Contaminant Hydrology, Environmental Law, and Challenges
 - Classification of groundwater contamination (organic, inorganic)
 - Emerging groundwater contamination problems
 - Environmental laws that are related to contaminant hydrology
2. Fundamentals of Contaminant and Mass Transport

GEOL 621: Contaminant Hydrogeology

- 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
 - 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
 - Stochastic method and scale-dependent transport
 - Fractional Advection-Dispersion Equation (FADE)
 5. Numerical Solutions of Advection-Dispersion Equation
 - Numerical dispersion and oscillation problems
 - Upstream finite difference method
 - Method of Characteristic (MOC)
 - Advanced methods
 6. Laboratory and Field Methods
 - Laboratory column test
 - Field measurement of contaminant transport
 - Monitoring of DNAPL, LNAPL in the field
 7. DNAPL, LNAPL, and Multiphase Transport
 - Fundamentals of multiphase flow and transport
 - DNAPL and NAPL transport
 8. Transport in the Vadose Zone and Gas Transport
 - Transport in the vadose zone
 - Gas transport problem
 9. Other Topics
 - Remediation technology
 - Stream-aquifer interaction and stream depletion
 - CO₂ sequestration

References:

Bear, J. 1972. *Dynamics of fluids in porous media*. Elsevier, New York.

Zheng, C., and G. D. Bennett, 2002, [*Applied Contaminant Transport Modeling Second Edition*](#), Wiley, New York, 621 pp.

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