Civil & Environmental Engineering
Engineering Building, Suite 200
www.cee.pdx.edu
503-725-4282

Portland State UNIVERSITY

Winter 2012

Course Number	CE 571 / 671
Title	Subsurface Contaminant Transport
Section	001
CRN(s)	44392 / 44391
Credits	4
Prerequisite(s)	Subsurface Hydrology CE 569 or equivalent
Days/Time	MW 2:00 - 3:50 pm
Location	Room 310, Engineering Building
Final Exam Day/Time	Wednesday, March 21, 12:30 pm
Mailbox Location	CEE Office, EB 202U

Course Website	http://web.cecs.pdx.edu/~gjohnson/Transport12.html
Instructor	G. R. Johnson, Ph.D.
Office	EB 202F
Phone	503-725-8710
E-mail	gjohnson@pdx.edu
Office Hours	Open door, Tuesdays (9:30 – 3:30)

Required Text or Other Materials:
Contaminant Hydrogeology, Fetter, ISBN 978-1-57766-583-0. Cost New $68.95

Recommended References/Optional Text/Supplemental Readings & Resources:
Groundwater Hydraulics and Pollutant Transport, Charbeneau, Prentice Hall, 2000
Hydrology, Rafael L. Bras, Addison-Wesley Publishing, 1990
Physical Hydrology, S.L. Dingman, Macmillan College Publishing, 1994
Physical and Chemical Hydrogeology, P.A. Domenico and F.W. Schwartz, Wiley, 1990
Applied Hydrogeology, C.W. Fetter, Macmillan College Publishing, 1994

Course Description:
This course will introduce students to the principles associated with the transport and fate of contaminants in subsurface systems. We will discuss the many factors and processes influencing contaminant transport and will emphasize the impact of these processes on contaminant fate in the environment.

Course Objectives and Goals:

After completing this course, students should demonstrate the ability to:
1. Students will have a good command of the vocabulary (nomenclature) used in the literature to describe solute transport through subsurface systems

2. Mathematically describe physical and chemical processes contributing to the overall transport and fate of solutes through porous media (e.g., mechanical-mixing phenomena, diffusive solute flux, and solute retardation)

3. Recognize factors contributing to nonideal solute transport through porous media while describing ideal solute transport

4. Estimate the relative degree of dispersion while assessing the relative degree of nonideality exhibited in transport studies through porous media

5. Assess the applicability of using Fick's first law to describe a solute's dispersive flux in porous media

6. Describe the processes contributing to dispersion at various scales of interest (i.e., microscale, macroscale, and megascale) for transport studies through porous media

7. Describe sorption and desorption processes as they contribute to nonideal transport through porous media

Course Requirements

Attendance is not mandatory in this course. However, you are **solely** responsible for the lecture material, homework assignments as announced, as well as any other announcements delivered in class. To clarify, you do not need my approval to miss class for any reason. It is your choice to attend or not attend this class. It is also your sole responsibility to learn the material covered during every one of our meetings.

All written responses in this course shall be in your own words. ***As per PSU policy, acts of academic dishonesty will result in a failing grade on the exam or assignment for which the dishonesty occurred, disciplinary probation, suspension or dismissal from the University.***

Assignment	**% of Total Grade**
HOMEWORK **(See notes and requirements below)**	30
MIDTERM EXAM **Attendance is mandatory**	30
FINAL EXAM **Attendance is mandatory**	30
Class Participation and Professional Conduct	10

NOTE: Absolutely **no make-up exams** will be given. You must be in attendance for all exams to receive credit.

NOTE: Each assignment is due at the **beginning** of class (strictly enforced). **Absolutely No Late Homework** will be accepted.

Homework Requirements

In the event an assignment requires submission of graphics, **hand-drawn graphics will not be accepted,** unless otherwise noted by me.

All assignments shall be done in the absence of all forms of academic cheating, fraud, and dishonesty. Allegations of academic dishonesty will be directly addressed by me, your professor, and I reserve the right to refer any and all such actions to the Office of Student Affairs for action. Acts of academic dishonesty will result in a failing grade (specifically, zero credit) on the exam or assignment for which the dishonesty occurred.

Acts of academic dishonesty, including the submission of copied work, will result in a failing grade (i.e., a zero score) for ALL students involved on the exam or assignment for which the dishonesty occurred. Furthermore, as with PSU policy, disciplinary probation, suspension or dismissal from the University may result.

Incompletes: A grade of "I" is granted by the instructor *only* with prior approval and consent. Criteria are outlined in the PSU Bulletin.

Course Schedule (Tentative) – Subsurface Contaminant Transport W12

Course Topics

Week 1. Syllabus, Introductions and Course Overview.
Subsurface Heterogeneities and Dispersion. (Chapter 2)

January 16th Holiday. All Classes Canceled

Week 2. Basic Solute Transport Equation. Advection. (Chapters 1 & 2)
Spatial and Temporal Data: Lagrangian and Eulerian approaches.
Analysis of Solute Transport Distribution Behavior. (Chapter 2)

Week 3. Solute Transport: Physically Heterogeneous Media, (Chapters 2 & 4)
Variably-Saturated Media. (Chapter 4)
Advection/Dispersion and Fick's Law. (Chapter 2)

Week 4. Microscale Diffusion and Dispersion.
Solute Transport: Structured media. (Chapters 2 & 4)

Week 5. Continued.

February 13th Midterm Exam

Week 6. Mathematically Representing Solute Transport (Chapter 4)
Field-scale Transport of Reactive Solutes
Case Study: (Chapter 3)

Week 7. Continued
Unsaturated Systems and Transient Flow (Chapter 4)

Week 8. Solute Transport: Sorption, Retardation, Nonlinear Sorption,
Kinetic Sorption (Chapter 3)

Week 9. Solute Transport: Instantaneous vs. Rate-limited (Chapter 3)
Mathematically: One-site, Two-site, and Ln-PDF

Week 10. Continued.

Wednesday, March 21 Comprehensive Final Exam, 12:30 pm

Resources

As a PSU student, you have numerous resources at your disposal. Please take advantage of them while you are here. A small sample is listed below:

- CE Website (includes program info, job listings, etc.)
- Career Center: http://www.career.pdx.edu/
- Center for Student Health & Counseling: http://www.shac.pdx.edu/
- The Writing Center: http://www.writingcenter.pdx.edu/
- PSU Disability Resource Center: 435 Smith Memorial Union

Note: The PSU Disability Resource Center is available to help students with academic accommodations. If you are a student who has need for test-taking, note-taking or other assistance, please visit the DRC and notify the instructor at the beginning of the term.

Introduction to Library and Literature Research

With the advent of the Internet it is very tempting to think that all necessary resources for a term project will be available in full text after typing in a few words at Google.com. This is not the case. You will often need to go to the library, use real library search tools and access real books and articles contained in refereed/archival journals.

Be sure to make use of the Vikat library catalog. Go to the PSU library home page at http://www.lib.pdx.edu/. Also available on the library home page are Full Text Electronic Journals: http://www.lib.pdx.edu/~bvws/bytitle.html, and a list of on-line Databases: http://www.lib.pdx.edu/resources/databases/databases.html. Try EI Compendex (http://www.ei.org/ev2/ev2.home) and Lexis-Nexis. Note that access to these databases is free for PSU students, but you must be using a computer on campus or via a dial-in service. See http://www.lib.pdx.edu/services/distance/proxyserver.html for instructions on how to gain off-campus access using a proxy server.

Campus Safety

The University considers student safety paramount. The Campus Public Safety Office is open 24 hours a day to assist with personal safety, crime prevention and security escort services. Call 503-725-4407 for more information. **For Campus emergencies call 503-725-4404**.

Classroom Rules and Behavior Expectations

The classroom is a professional space and professional conduct is expected. Please silence your cell phone and refrain from text messaging during class and exam times. Treat your fellow students and the instructor with respect and please use appropriate language at all times. Additional rules may be added at the instructor's discretion.