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

Fall 2007

Course Number	CE 569/669
Title	Groundwater Hydrology
Section	001
CRN(s)	10472/10478
Credits	4
Prerequisite(s)	Senior/graduate standing
Days/Time	TR 1000-1150
Location	Room 350, EB
Final Exam Day/Time	Tuesday, December 4, 1015-1205

Course Website	http://web.cecs.pdx.edu/~gjohnson/

Instructor	Gwynn R. Johnson, Ph.D.
Office	EB Room 202F
Phone	503-725-8710
E-mail	gjohnson@pdx.edu
Office Hours	Tuesday 12 to 1 p.m. and by appointment
Mailbox Location	CEE Office, EB Room 202U

Required Text or Other Materials:
Applied Hydrogeology, C.W. Fetter, Prentice Hall, 4th edition, 2001.

Recommended References/Optional Text/Supplemental Readings & Resources:
Groundwater, R. Allan Freeze and John A. Cherry, Prentice Hall, 1979.
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

Catalog Course Description (modified from Bulletin):
This course will introduce students to the basic principles of aqueous flow in the subsurface, emphasizing the importance of groundwater as a resource. Topics include: the hydrologic cycle, history of groundwater usage, aquifer classification and properties, Darcy's experiments and Law, hydraulic head and potential, porosity and permeability, transmissivity and storativity, heterogeneity and anisotropy, saturated vs. unsaturated subsurface flow, and hydraulics of pumping wells (drawdown, flow in confined and unconfined aquifers, nonequilibrium flow conditions, slug tests, and aquifer-test design). Prerequisite: senior/graduate standing.

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 subsurface systems (e.g., the vadose zone and aquifer systems).
2. Recognize soil porosity and hydraulic conductivity as a function of soil type and heterogeneity; describe tests performed to measure these soil properties.
3. Describe the difference between matric potential, hydraulic head, and pressure head; negative and positive pressure head.
4. Describe and assess the use of Darcy's Law, recognizing the major assumptions in the application of Darcy's Law to quantify water flow in porous media.
5. Describe and assess the use of the continuity equation to define fluid flow in the subsurface.
6. Estimate aquifer parameters (such as transmissivity and storativity) through the analysis of aquifer test data (e.g. pump tests and slug tests).

Course Grading

Assignment	**Points Assigned or % of Total Grade**
HOMEWORK	30
MIDTERM	30
FINAL	30
CLASS PROJECT (to be posted)	10
Graduate Level Students only	

Please Note: No make-up exams will be given. Your attendance during scheduled exam periods is required for you to receive a grade for that exam.

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) **Fall 2007**

Week No.	Week of:	Topic	Reading Assignment	Homework Assignment	HW Due Date
1	09/25 and 09/27	Syllabus, Introductions and course overview. Hydrologic cycle, Soil classifications and porosity, Darcy's Law.	Ch 1 Ch 3	Assignments will be announced in class and/or posted on our class website.	Generally due one week after they are assigned.
2	10/02 and 10/04	Darcy's Law: Assumptions and usage. Hydraulic conductivity (heterogeneity and anisotropy); Measuring hydraulic conductivity and porosity in the lab.	Ch 4.6 Ch 3		
3	10/09 and 10/11	Subsurface hydrology (vadose zone, capillary fringe, unconfined and confined aquifers). Fluid potential (total head, matric potential, and pressure head). Infiltration.	Ch 6		
4	10/16 and 10/18	Sedimentary vs. fractured flow (Cubic law). Equations of groundwater flow. Assessing subsurface water resources; Aquifer storage.	Ch 4 Ch 5		
5	10/23 **10/25**	Continued. **MIDTERM EXAM**			
6	10/30 and 11/01	Exam review. Water quality: Groundwater as drinking water. Aquifer testing: Design and analysis.	Ch 10 Ch 5		
7	11/06 and 11/08	Groundwater flow to wells. Radius of influence. Boundary conditions (e.g., impermeable or pumping well).			
8	11/13 and 11/15	Conceptual models for the analysis of aquifer systems.	Supplemental		
9	11/20 11/22	Continued. **Class Canceled - Holiday**			
10	11/27 and 11/29	Class presentations of course project			
	12/04	**Cumulative FINAL EXAM 1015 -1205**			

Ethics and Professionalism

As future professional engineers you should plan to take the FE Exam (see the Oregon State Board of Examiners for Engineering and Land Surveying at www.osbeels.org), and you should be familiar with the ASCE Code of Ethics (www.asce.org/inside/codeofethics.cfm), which includes the following:

Engineers shall act in such a manner as to uphold and enhance the honor, integrity and dignity of the engineering profession.

The PSU Student Conduct Code prohibits all forms of academic cheating, fraud, and dishonesty. Further details can be found in the PSU Bulletin. Allegations of academic dishonesty may be addressed by the instructor, and/or may be referred to the Office of Student Affairs for action. Acts of academic dishonesty may result a failing grade on the exam or assignment for which the dishonesty occurred, disciplinary probation, suspension or dismissal from the University. The students and the instructor will work together to establish optimal conditions for honorable academic work. Questions about academic honesty may be directed to the Office of Student Affairs (http://www.ess.pdx.edu/osa/).

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.): http://www.cee.pdx.edul
- 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.

Computer and E-mail Accounts

- If you haven't done so already, please go to the CadLab located in EB 325 to activate your engineering account. If you need help in using this account, please see the attendant or send an e-mail to support@cecs.pdx.edu
- If you choose not to check your CECS e-mail account regularly (yourname@cecs.pdx.edu) then please forward it to an e-mail account that you do check. Important information and announcements are delivered via this e-mail address.

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.

Student Groups and Professional Organizations

Participation in student and professional groups can be a valuable part of your education experience. Membership gives students opportunities to get to know fellow students better, meet and network with professionals, collaborate in solving real engineering problems, learn about internship or job possibilities, socialize and have fun. Consider becoming active with a student organization, such as the following:

- American Society of Civil Engineers Student Group (ASCE): http://www.asce.pdx.edu
- Institute of Transportation Engineers Student Chapter (ITE): http://www.its.pdx.edu/ite/

Most professional organizations have monthly meetings and encourage student participation by providing discounts for lunch and dinner meetings. These meetings provide opportunities to network with potential future employers, learn about scholarships, and increase your technical knowledge. Take a look at these organizations as a starting point:

- American Society of Civil Engineers (ASCE) Oregon Section: www.asceor.org
- Institute of Transportation Engineers (ITE) Oregon Section: www.oregonite.org
- Society of Women Engineers (SWE) Columbia River Section - http://www.swe-columbia-river.org
- Structural Engineers Association of Oregon (SEAO): www.seao.org