CE 473/573 Groundwater
Fall 2011

Course information

Instructor: Prof. Chris Rehmann
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Office: 482B Town Engineering Building
294-1203

Goals: To apply fundamental principles governing movement of water and contaminants in groundwater systems to solve problems of groundwater resource evaluation and groundwater contamination, to develop thinking skills, to communicate effectively and function on teams

Prerequisites: Elementary fluid mechanics and water resources engineering, calculus

Topics (not necessarily in this order):

1. Basics of groundwater
   1.1. Physical properties of aquifers
       1.1.1. Porous media
       1.1.2. Darcy’s law
       1.1.3. Aquifers and groundwater geology
   1.2. Framework for groundwater flow
       1.2.1. Conservation of mass
       1.2.2. Equations of groundwater flow
       1.2.3. Confined and unconfined aquifers

2. Groundwater flow
   2.1. Streamlines, equipotentials, and flow nets
   2.2. Elementary solutions for confined and unconfined flow
   2.3. Wells
       2.3.1. Steady flow
       2.3.2. Unsteady flow & pump tests
   2.4. Superposition
   2.5. Flow in the unsaturated zone

3. Groundwater contamination
   3.1. Sources of contamination
   3.2. Physical, chemical, and biological processes
   3.3. Transport equations
   3.4. Behavior of non-reactive and reactive contaminants

4. Groundwater modeling
   4.1. Introduction to finite-difference models
   4.2. Models of groundwater flow
   4.3. Models of contaminant transport
   4.4. Available models
Recommended textbooks


Requirements and policies:

For CE 573, the grade will be based on homework (100%), two midterm exams (15 and 20%), writing assignments (20%), and a final exam (30%). For CE 473, the grade will be based on homework (100%), two midterm exams (20 and 25%), and a final exam (35%); if undergraduates complete the writing assignments for CE 573, then their grades will be computed from the highest possible combination. The midterm exams will be Friday September 30 (subject to change) and Friday November 4. Optional exercises will be given to reinforce lecture material; as incentive, individuals or teams may submit the exercises for extra credit (~5%). The homework will be done in teams of three or four students that the instructor will assign; students may form ‘meta-teams’, or teams of teams, to discuss homework. Your team will have the following responsibilities in completing homework:

1. Designate a coordinator, recorder, and one or two checkers for each homework. Rotate these roles for every homework.
2. Agree on meeting times and the individual work to be done before the meetings.
3. Do the required individual preparation.
4. Meet and work. The coordinator keeps everyone on task and makes sure everyone is involved. The recorder prepares the final solution, and the checkers check the solution and ensure that everyone understands the solution and strategy.
5. Submit the assignment and review the returned homework.

Late homework without a valid excuse given in advance of the deadline will be penalized 40%. Homework that fails to rotate the recorder will be penalized 25%. To facilitate group work and promote individual accountability, students will periodically rate everyone’s effort (not academic ability), and the ratings will be factored into the individual grades. Students will also be asked to comment on group functioning throughout the term. The groups will be reshuffled if a majority of students would like to.

Students in CE 573 will complete a few exercises to practices skills that will help in graduate school. In particular, you will critique and write reviews of literature (i.e., journal articles), generate and critique plots, discuss elements of an effective journal article, etc.

For students with a disability

If you have a disability and require accommodations, please contact the instructor early in the semester so that your learning needs may be appropriately met. You will need to provide documentation of your disability to the Disability Resources office, located on the main floor of the Student Services Building, Room 1076, 515-294-7220.