GeoE 427 Groundwater Modeling, 2003

Instructors:
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Office Hours: F from 9:00-9:50
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Office Hours: M –F: 2:00 – 3:00PM

Classroom: Leonard 215 **Time:** M, W, and F at 9:00 a.m.

Texts (On reserve in the Geology Library):
Applied Groundwater Modeling (GB 1197.7.A53 1992) by Anderson and Woessner (A&W)
Introduction to Groundwater Modeling (TC 176.W36 1982) by Wang and Anderson (W&A)
A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model "MODFLOW" (I 19.15/5: bk. 6/chap. A1) by MacDonald and Harbaugh (M&H)
Processing MODFLOW: A Simulation System for Modeling Groundwater Flow and Pollution (1998) by Wen-Hsing Chiang and Wolfgang Kinzelbach

Course Summary: Fundamentals of numerical modeling applied to groundwater flow. Short programs using the finite difference method will be written to demonstrate groundwater movement and storage. Simulation of practical groundwater problems will be carried out using the USGS MODFLOW code. Engineers will do a design project and other students will do a scientific modeling project.

Grade: Based on the Following:

	Points
Homework (including "pop" quizzes)	200
Exams, 2 @ 100 points each	200
Final Exam: Project Presentation	75
Oral Defense	75
	550

Homework: For Korom's homework problems involving computer programming, late homework will lose 15% per week to a maximum of 50% off.

Syllabus 2003 (tentative)

Date	
Aug 27	Introduction. What is a model? (W&A 1.1, A&W 1)
29	Hydraulic head (W&A 1.2)
Sep 1	**Labor Day -- No classes**
3	Derivation of governing equations (W&A 1.2-1.3, A&W 2.1)
5	Governing equations and boundary conditions (W&A 1.3-1.4, A&W 4.1-4.2)
8	Toth's model
10	Approximating DEQs with algebraic expressions (W&A 2.1-2.3, A&W 2.2)
12	Solving Laplace's Equation with finite differences (W&A 2.1-2.3, A&W 2.2)
15	HW Review, Derived flow equation for confined flow of thickness b.
17	Introduction to FORTRAN
19	Introduction to FORTRAN
22	Solving Laplace's Equation with FORTRAN (W&A 2.4-2.5)
24	Solving Laplace's Equation with FORTRAN (W&A 2.4-2.5)
26	Solving Poisson's Eq. with finite differences: Confined (W&A 3.1-3.4)
29	Solving Poisson's Eq. with finite differences: Unconfined (W&A 3.5-3.6)
Oct 1	Solving Poisson's Eq. with finite differences: Mass balances (W&A 3.5-3.6)
3	Transient flow, explicit approximation, confined (W&A 4.1-4.2)
6	**Presidents' Day Holiday -- No classes**
8	Transient flow, implicit approximation, confined (W&A 4.3)
10	Crank-Nicolson method (W&A 4.3)
13	Transient flow, implicit approximation, unconfined (W&A 4.4)
15	Transient flow, implicit approximation, unconfined (W&A 4.4)
17	Catch-up and review
20	Modeling protocol (A&W 1.4)
22	**Exam 1** (W&A 1-6.4, A&W 1-2).
24	Conceptual Models (A&W 3.1)
27	Types of Models (A&W 3.2-3.4)
29	MODFLOW: Introduction (M&H1, M&H2 and Box 3.1 (A &W))
31	MODFLOW: Mathematics (M&H1, M&H2 and Box 3.1 (A &W))
Nov 3	MODFLOW: Equations and Time discretization M&H1, M&H2 and A&W 7.4)
5	Transient models and MODFLOW (M&H3 and A&W 7)
7	MODFLOW: Data input structure (MH3)
10	MODFLOW: layers and layers building (M&H4 and M&H5)
12	Source boundaries in MODFLOW (M&H5, 6, 7)
14	MODFLOW Packages: River, Drains, ET (Box 4.1: A&W 4.4)

17	Int. to Processing MODFLOW (PMWIN) (C&K 1, 2, 3)
19	**Exam 2** (Oct.20 – Nov. 14)
21	Your first groundwater Model with PMWIN (C&K 2)

Date	
Nov 24	Calibration of models (A&W 8)
26	Prediction (A&W 8.5)
28	**Thanksgiving -- No classes**
Dec 1	Sensitivity Analysis (A&W8.4)
3	Documentation and reporting of Modeling (A&W 9)
5	Postaudits (A7W 10)
8	Intro. to contaminant transport (Z&B 1)
10	Particle tracking theory (Z&B 5)
12	**Reading and Review Day -- No classes**
15	**Final Exam**, Monday at 8:00 a.m.