ERTH656 -- Groundwater Modeling (also offered as CEE623)

Prerequisite: ERTH455 (or similar courses) or instructor consent
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Extra Readings: List of textbooks
http://www.bing.com/images/search?q=groundwater+modeling+textbooks&qpvt=groundwater+modeling+textbooks&FORM=IGRE

Classic textbooks

Course Content
This course emphasizes the practical aspects of modeling, where theory and development are reduced and model applications and limitations are stressed. Case studies are included in the course with hands-on modeling. Students will study the popular Groundwater Modeling Package (GMS; http://www.aquaveo.com/gms). Course synopsis is listed below.
- Math review
- Review of hydrogeological concepts
- Solution techniques
  - Analytical
  - Numerical
  - Finite difference method
  - Finite element method
  - Method of characteristics method
  - Random walk method
- Hands on model use
- Groundwater Modeling System (GMS)
  - MODFLOW
  - MODPATH
  - MT3DMS
  - SEAWAT
  - FEMWATER
- Case studies

ERTH Learning Objectives:
The Department of Earth Sciences has defined 4 and 5 learning objectives for the Masters and Ph.D. degree programs, respectively. For Masters, they are (1) Technical knowledge, (2) Scientific method, (3) Communicate geological knowledge, (4) Employability/Contributions Post-Graduation. For Ph.D., an additional SOL is required, i.e., (5) Expertise in a sub-discipline. This course directly incorporates content relevant to some of those:
- SLO1 - student will learn about the relevance of groundwater hydrology and modeling to the understanding and providing for human needs, and the impacts on society and planet Earth.
- SOL2 - graduates are able to examine construct scientific hypotheses and define and carry out analyses
Course Goals
This class is aimed at advancing the students' modeling skills, not only for the utilized software, but also for all hydrology related models. Modeling is an important expertise that enhances someone chances for working as either a researcher or a consultant.

Assessment and Grading
Tests and homework assignments are in the form of take-home projects. The final's grade will be based on a report in the form of a technical paper and may include oral presentation by each student.

- Assignments: 40%-50%
- Exams: 50%-60%

Class Format
Most lectures include hands-on model application. Each student will follow the instructor's steps as tutorials are presented and discussed. The aim after a few lectures students will be proficient enough to apply the methods without following the written instructions. It is helpful if students practice with the tutorials before the respective class. The students are given a temporary license to use the software on their own personal computers/laptops.

Class handouts/notes/assignments can be downloaded from
http://www.soest.hawaii.edu/GG/FACULTY/aly/GG655_handouts.html

GMS can be downloaded from http://www.aquaveo.com/downloads