GG455 -- Hydrogeology

Class meets: TR 0130 - 0245 POST 708
W 0130 - 0420 POST 708
Prerequisite: MATH 242 or MATH 252A, or consent
4.000 Credit hours; 3.000 Lecture hours; 3.000 Lab hours
Schedule Types: Laboratory, Lecture
Instructor: Aly El-Kadi, POST 709, 956-6331, elkadi@hawaii.edu

Course Content
(3 Lec, 1 3-hr Lab) Occurrence, characteristics, movement, quality, development, and contamination of water in the Earth

Course synopsis
Introduction and Hydrologic Cycle
Math Review
Groundwater Occurrence
  • Saturated & unsaturated conditions
  • Pore pressure & tension
  • Aquifers
Groundwater Flow
  • Darcy's law
  • Hydraulic head & fluid potential
  • Heterogeneity & anisotropy
  • Equations of groundwater flow
  • Flow nets
  • Unsaturated groundwater flow
Groundwater Flow Applications
  • Analytic solutions to simple flow problems
  • Radial flow to wells
  • Departures from ideal conditions
  • Boundary effects
Introduction to Groundwater Models
Groundwater in Geologic Environments
  • Regional groundwater flow
  • Unconsolidated sediments
  • Sedimentary rocks
  • Igneous & metamorphic intrusive rocks
  • Volcanic rocks
Groundwater Development & Management in Hawaii
Groundwater Exploration
  • Geologic & hydrologic methods
  • Geophysical methods
Case Studies

Laboratory Exercises
1. Capillary rise, porosity, and specific yield laboratory determinations
2. Permeability determination using laboratory columns
3. Sandbox (pumping test) experiment
4. Tracer tests

Field Trips (change based on availability)
1. Well drilling site
2. Springs
3. Board of Water Supply (BWS) Beretania pump station and Halawa Shaft
4. BWS dike complex water development tunnel (Waihee shaft)
5. A clean-up site
6. Manoa landslide site
7. Others?

GG Learning Objectives
GG department has defined 5 learning objectives for the undergraduate degree program related to Relevance of Geology and Geophysics, Technical knowledge, Scientific method, Oral and written skills, and Evaluating Phenomena. This course directly incorporates content relevant to three of those:

- SLO1 - Throughout the course, students will learn about the relevance of hydrogeology to understanding and providing for human needs, and to impacts on society and planet Earth.
- SLO2 - Students will solve problems using real world data sets. Laboratory, field trips, and case studies emphasize and strengthen the link to the real world.
- SLO5 - In all assignments, students will evaluate, interpret, and summarize basic principles to explain complex phenomena at the interfaces of hydrology, physics, mathematics, geology, and soil science.

Course Goals
This class concerns the use of critical information and reasoning to understand hydrological, geological, and chemical processes and their interaction. We use quantitative and qualitative approaches to learn how the compositions of Earth materials constrain these processes. Relevant mathematical principles are covered. Laboratory, field trips, and computer simulations are used as efficient tools to supplement the lectures. This course helps many students towards their careers in environmental companies and government agencies.

Assessment and Grading
Coursework will include: (1) reading the textbook, (2) completing problem sets, (3) completing laboratory assignments and field trip reports, (4) mid-term exam, and (5) final exam.

Grades
- 33% Homework and lab/field reports
- 33% Midterm
- 33% Final

Class Format
The class includes lectures, laboratory applications, and field trips.

Class handouts/notes/assignments can be downloaded from:
http://www.soest.hawaii.edu/GG/FACULTY/aly/GG455_handouts.html