

ERTH455 -- Hydrogeology

Prerequisite: MATH 242 or MATH 252A, or consent

4.000 Credit hours; 3.000 Lecture hours; 3.000 Lab hours

Schedule Types: Laboratory, Lecture. **However, due to the COVID-19 epidemic, all meetings will be online (see the note below regarding class format*).**

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Textbook: Fetter, C. W. Applied Hydrogeology, 2018, Waveland Press, Inc., 4th edition (Paperback) ISBN-13: 9781478637097; ISBN-10: 1478637099.

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?

EARTH Learning Objectives

The Department of Earth Sciences 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. **However, due to the COVID-19 epidemic, all meetings will be online. Labs will be discussed and sets of data provided for analyses. Of course, these are not as rewarding as real hands on, but some benefits are still there. Field trips will be replaced by lectures by guest speakers, hopefully including virtual trips. The class also shows three movies dealing with environmental issues.**

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

Title IX:

The University of Hawai'i is committed to providing a learning, working and living environment that promotes personal integrity, civility, and mutual respect and is free of all forms of sex discrimination and gender-based violence, including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence, and stalking. If you or someone you know is experiencing any of these, the University has staff and resources on your campus to support and assist you. Staff can also direct you to resources that are in the community. Here are some of your options:

As members of the University faculty, your instructors are required to immediately report any incident of potential sex discrimination or gender-based violence to the campus Title IX Coordinator. Although the Title IX Coordinator and your instructors cannot guarantee confidentiality, you will still have options about how your case will be handled. Our goal is to make sure you are aware of the range of options available to you and have access to the resources and support you need.

If you wish to remain ANONYMOUS, speak with someone CONFIDENTIALLY, or would like to receive information and support in a CONFIDENTIAL setting, use the confidential resources available here:
<http://www.manoa.hawaii.edu/titleix/resources.html#confidential>

If you wish to directly REPORT an incident of sex discrimination or gender-based violence including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence or stalking as well as receive information and support, contact: Dee Uwono, Title IX Coordinator (808) 956-2299
t9uhm@hawaii.edu.