Syllabus

ERTH 654

Groundwater Contamination

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Course description:

Principles of groundwater chemistry; chemical evolution in natural groundwater flow systems; sources of contamination; mass transport processes; hydrochemical behavior of contaminants. Pre: 455. 3.0 Credit hours

Time:

August 25 – Dec 10, 2020; Tuesday & Thursday 9:00 – 10:15 am in synchronous on-line mode; Zoom link will be provided

Instructors:

Henrietta Dulai, Office: POST 707*, e-mail: hdulaiov@hawaii.edu
Aly El-Kadi, Office POST 710*, e-mail: elkadi@hawaii.edu
Ken Rubin, Office POST 606E*, e-mail: krubin@hawaii.edu

*Virtual office hours ONLY: meetings can be arranged via e-mail

Resources:

Students need access to a computer and reliable internet. No textbook is required. Course resources (powerpoint slides, reading materials, video recording of the lectures) will be posted on Laulima under the "Resources" link on the course site. In addition, all homework assignments must be turned in electronically. To do this follow the "drop box" link to access your personal folder. To access the Laulima course web site use a web browser to visit the following address: https://laulima.hawaii.edu/portal.

Class student learning objectives:

At the end of the class the student should:
Be able to identify the most important controls on groundwater flow and solute transport.
Be able to mathematically describe groundwater flow and solute transport.
Be able to identify key controls of contaminant movement and resulting differences of different contaminant transport.
Recognize sources and behavior of most important contaminant groups.
Critically evaluate remediation approaches.

Grading:

The class will consist of lectures, readings, worksheets. Grades will be based on in-class activity (quizzes, polls and discussions on covered material 10%), completion of worksheets and a class project (30%), 3 take home exams (20% each).

List of topics and tentative schedule:

Week #	Days	Topic	Instructor
1	8/25 8/27	Class Intro & admin -zoom tutorial; Hydrology review - principles of hydrology	All; El-Kadi
2	9/1 9/3	Chemistry review and intro (pH, redox, advection-diffusion, dispersion, sorption-desorption, radioactive decay, colloids); Review of contaminant types and sources - state and national standards	Dulai Dulai / Rubin
3	9/8 9/10	Selected metals, colloids	Rubin
4	9/15 9/17	Selected organics: BTEX and other petroleum components (NAPLs/DNAPLs)	Rubin
5	9/22 9/24	Cleanup & Remediation	Rubin
6	 9/29 10/1	Selected radionuclides: Actinides Rn, Ra, and decay products	 Rubin Dulai
7	10/6 10/8	Nutrients & turbidity; sources, chemical and biological fate, transport and attenuation, source-tracking.	Dulai
8	10/13 10/15	Contaminants of emerging concern (pharmaceuticals, pesticides, household products) degradation pathways, persistence, sorption kinetics, environmental effects.	Dulai
9	10/20 10/22	Microbial groundwater contamination; Pathogens, types and source tracking.	Kirs (WRRC)
10	10/27 10/29	Wellhead protection; Safe Drinking Water Act, contamination examples from Hawaii (Red Hill, …)	Whittier (HDOH)
11		Nov 3 Holiday	

	11/5	Groundwater sampling and monitoring methodology	Dulai
12	11/10 11/12	Contamination modeling theory; numerical models dealing with conservative/reactive and density dependent cases.	El-Kadi
13	11/17 11/19	Hands on modeling	El-Kadi
14	11/24	Continue hands on modeling and example case studies Nov 26 Holiday	El-Kadi
15	12/1 12/3	Demonstrations; Contamination cleanup scenarios	El-Kadi
16	12/8 12/10	Demonstrations; Contamination cleanup scenarios	El-Kadi

Graduate Student Learning Outcomes as defined by the ES department:

For the M.S.

1. Acquire knowledge and skills that will enable her or him to advance the state of the Earth sciences and their application to societal problems.
2. Evaluate the hypotheses, methods, results and conclusions of published literature relevant to a chosen scientific problem.
3. Define an appropriate and tractable thesis objective, in consultation with his or her advisor.
4. Present and defend her or his scientific findings in front of a public audience.
5. Write a thesis which documents his or her contribution to the field.

For the PhD

1. Satisfy the SLOs for the M.S.
2. Comprehensively synthesize, evaluate, and interpret the fundamental knowledge in her or his sub-discipline.
3. Independently construct scientific hypotheses and design and carry out research to evaluate them.
4. Critically analyze and synthesize the results of their research, derive conclusions which advance the field, and be capable of writing a manuscript describing these in the peer-reviewed literature.

Disability Access:

If you have a disability and related access needs the Department will make every effort to assist and support you. For confidential services students are encouraged to contact the Office for St
udents with Disabilities (known as "Kokua") located on the ground floor (Room 013) of the Queen Lili'uokalani Center for Student Services:

KOKUA Program
2600 Campus Road
Honolulu, Hawaii 96822
Office hours 7:45 AM – 4:30 PM
Voice: 956-7511
Email: kokua@hawaii.edu
URL: www.hawaii.edu/kokua

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.