Water: An Introduction

CEE 73
Summer
Meets twice per week for 110 minutes

Instructors:

Sandy Robertson	Derek Fong	Allison Pieja
sandrob@stanford.edu	dfong@stanford.edu	apieja@stanford.edu

Course Description:

Without water, there is no life (as we know it). Its utilization and control has been a critical focus of human societies for thousands of years.

Pure water is colorless, tasteless and odorless. It is the only substance that occurs in all three states of matter: solid, gas and liquid, at ordinary temperatures. Water is essential in determining the quality of all living organism. It covers more than 70% of the earth, however only 1% of the earth's water is available for drinking. This team-taught class provides a multidisciplinary introduction to our planet's most precious and vital resource. We explore water from molecular to global scales. We identify key scientific and engineering concepts and relate them to sustainability, management and socioeconomics, considering both human and environmental impacts.

Course Objectives:
In this course, we hope that students will:

1. Develop a long term interest in water science and engineering
2. Gain an appreciation of the subject's interdisciplinary nature
3. Begin to understand the basic physics, chemistry and biology associated with water
4. Build skills pertinent to researching and evaluating scientific and technical literature
5. Develop effective communication skills
6. Begin an education about important water issues in the U.S. and around the world

Course Schedule: See Table 1

Course Units and Grading:
This lecture course is being offered for 3 units, for letter grade or credit/no credit. Your grade in this class will reflect your knowledge of the lecture material (3 homework problem sets) and a final project.

Your grade will be calculated as follows:
Homework (45%)
Final Project (45%)
Class Participation (10%)

Textbook: None—readings from several texts will be assigned/suggested. All readings should be available electronically through Stanford Libraries

Background Readings

Introduction

The Science of Water: Concepts and Applications. Spellman, Frank R., 2008
http://www.crcnetbase.com/isbn/9781420055450
Ch. 2—All about Water

Water Physics: Hydrology, Hydraulics, and Physical Oceanography

Brooks, et al. *Hydrology and Management of Watersheds*, 2012.
http://onlinelibrary.wiley.com/book/10.1002/9781118459751;jsessionid=58DF0274F5450370FA1BBD2F74E24434.d03t04
Ch 2: Hydrologic Cycle and the Water Budget

Spellman, *The Science of Water*, 2008.
http://www.crcnetbase.com/isbn/9781420055450
Ch3 – Hydraulics

Stewart, *Introduction to Physical Oceanography*, 2008.
http://oceanworld.tamu.edu/resources/ocng_textbook/PDF_files/book_pdf_files.html
Ch 5 – The oceanic heat budget
Ch 7 – Equations of Motion (Stewart)
Ch 9 – Response of the Upper Ocean to Winds
Ch10 – Geostrophic Currents

Water Properties/Aquatic Chemistry

Environmental Chemistry. Manahan, Stanley E. 2000
http://www.crcnetbase.com/isbn/9781439832769
Ch3—Fundamentals of Aquatic Chemistry

Key Concepts in Environmental Chemistry. Hanrahan, Grady, 2012
http://www.sciencedirect.com/science/book/9780123749932
Ch3—Aqueous Chemistry

The Science of Water: Concepts and Applications. Spellman, Frank R., 2008
http://www.crcnetbase.com/isbn/9781420055450
Ch. 4—Water Chemistry

NOTE: Ch28 in Manahan provides background material that may be useful for those with limited chemistry background or those who would like a refresher

Water Biology *(selections will be assigned prior to class)*

Spellman, *The Science of Water,* 2008
http://www.crcnetbase.com/isbn/9781420055450
Ch 5 – Water Biology
Ch 6 – Water Ecology

Gray, *Water Technology: An Introduction for Environmental Scientists and Engineers*, 3rd Edition, 2010
http://www.sciencedirect.com/science/book/9781856177054#ancp5
Ch 1 – Basic Considerations in Hydrobiology
Ch 4 – Basic Aquatic Ecosystems
Ch 5 – Microogranisms and Pollution Control
Ch 6 – Water Pollution
Ch 10 – Water Treatment and Distribution
Ch 12 – Pathogens and Their Removal
Ch 14 – Introduction to Wastewater Treatment

CEE73—Typical Schedule

Week	Date and Topic	HW	Project[1]	TA sessions
Week 1	Introduction			
	Hydrologic Cycle & Conservation Laws			Project Overview
Week 2	Conservation laws: flow in pipe systems and rivers.			
	Flow in pipes and rivers		**1st project discussion**	
Week 3	Motions in the Ocean			
	Water, solutes, terms & properties	PS #1 due	1 paragraph Topic Summary	Finding, Citing References
Week 4	Reactions & Equilibria			
	Acid/Base Chemistry		Proposed reference list	Using Tables, Figures
Week 5	Oxidation/reduction			
	Aquatic Ecology	PS #2 due		Writing an op-ed
Week 6	Aquatic Microbiology			
	Water Quality & Pollution		**Discuss refs, figs, tables**	
Week 7	Water Treatment & Case Studies			
	Synthesis	PS #3 due		
Week 8	Final Project Presentations			
	Final Project Presentations		Final Project due	

[1]**Bold font indicates requirement to meet with TA or one of instructors**--we will provide info on instructor/TA availability; plain font--hand in a document