

Foundations of Water Science and Engineering

CEE 73
Summer

Location: **Y2E2 111**; Time: **Monday/Wednesday 11:00 – 12:50 PM**

Instructors:

Sandy Robertson
Office: Y2E2 153
Office Hours: TBA
sandrob@stanford.edu

Derek Fong
Office: Y2E2 169
Office Hours: TBA
dfong@stanford.edu

Allison Pieja
Office: TBA
Office Hours: TBA
apieja@stanford.edu

Course Description:

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

Pure water is colorless, tasteless and odorless. Water is the only substance that occurs at ordinary temperatures in all three states of matter: solid, gas and liquid. 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 will provide a multidisciplinary introduction to our planet's most precious and vital resource. This course will explore water from molecular to global cycle scales. We will identify key scientific and engineering concepts and relate them to sustainability, management and socioeconomic issues, considering the impact on populations and the environment.

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 for the interdisciplinary nature of water science and engineering
3. Begin to understand the basic physics, chemistry and biology associated with water science and engineering
4. Build skills pertinent to researching and evaluating scientific and technical literature regarding water issues
5. Develop effective communication skills
6. Begin an education about important water issues in the U.S. and around the world

Course Schedule: The class meets on Monday and Wednesday, 11:00am – 12:50pm. See Table 1 for the schedule

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

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#anclp5>

Ch 1 – Basic Considerations in Hydrobiology

Ch 4 – Basic Aquatic Ecosystems

Ch 5 – Microorganisms 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**