Course: ***CIV_ENV 364- Environmental Engineering Applications II: Water***

Credits: 1 Unit credit; contact hours: 3 hrs lecture, 1 hr discussion

Instructor: George F. Wells

Texts: Davis, Mackenzie L. (2011) *Water and Wastewater Engineering: Design Principles and Practice.* McGraw-Hill, New York, NY.

Fishman, Charles. (2011) *The Big Thirst: The Secret Life and Turbulent Future of Water.* Free Press, New York, NY.

Description: This course is designed to provide students with an overview of the engineered water cycle, an underappreciated yet critically important foundation for modern society that is in need of both immense investments to shore up existing infrastructure and innovative solutions to emerging problems. The emphasis in this course is on urban water infrastructure in industrialized countries, but we will also touch on the enormous challenges presented by the lack of sanitation and drinking water in developing countries. We will cover fundamental principles as well as design and assessment methods for physical, chemical and biological treatment unit processes for drinking water treatment, wastewater ("used water") treatment and reuse, and water resource engineering. Regulatory drivers of water management will also be reviewed. Special attention will be paid to emerging issues, the energy-water nexus, and technological advances in the evolving engineered water cycle.

Prereqs: MECH_ENG 241 (Fluid Mechanics I) or equivalent and CIV_ENV 260 (Fundamentals of Environmental Engineering); CIV_ENV 340 recommended (Fluid Mechanics II)

Goals: By the end of this course, the successful student will be able to do the following:

Magnitude of the Problem

1. Explain current water resources issues and potential solutions
2. Identify typical and emerging water and wastewater contaminants
3. Describe the difficulties utilities face in eliminating combined sewer overflows

Regulations

4. Recognize what the regulations cover and where to find them
5. Indicate what performance characteristics are required
6. Interpret regulatory trends

The Major Technologies

7. Illustrate when and where they are used
8. Describe how the processes work and what performance can be achieved
9. Determine design parameters needed for conceptual design

Innovative Technologies

10. Describe new and emerging technologies
11. Illustrate where they can be used and why they are improvements over older methods
12. Interpret the logic involved and decision processes commonly used

Resources

13. Locate and apply important information resources, including major professional journals, institutional websites, and professional organizations

Relation of "course specific <u>goals</u>" to programmatic student learning <u>outcome</u> through

Course Assessment Table (CAT)

Course Goals[1]	Program/ ABET Outcome	Examples used for assessment	Assessment Outcome	Proposed Action
2,10	a	Midterm Qu. 5, Final Qu. 4	94%/70%	Increase difficulty of questions.
7	c	Midterm Qu. 2	90%/70%	
5,8,11	e	Midterm Qu. 6, 4, 7	87%/70%	
12,13	g	Project Oral Presentation, Project Report	93%/70%	Clarify expectations for group project. Change due date for oral presentation to 8th week of quarter, with report due at end of quarter so students get feedback from peers prior to report.
1, 4, 6	h	HW 1, Midterm Qu. 1, HW4 Qu. 2	93%/70%	
2	i	Participation (Discussion)	100%70%	
3	j	Final Qu. 1	100%/70%	Increase difficulty of questions. Add additional discussion and assessment questions about water reuse and coupling between food/ energy/ water.
9	k	Final Qu. 5	93%/70%	

[1] Included in syllabus under Objectives
[2] Class Average (%)/ Pass %

Course Outline:

Wk	Topic	Reading (Davis)
1	Water Quality Standards, Water Resources & Supply	Chp. 1.5, 2
2	Particles in water, coagulation/flocculation	Chp. 3
3	Hardness and softening processes	Chp. 4.1, 5, 6
4	Sedimentation, Filtration	Chp. 7 and 8
5	Disinfection, Review for Midterm	Chp. 10
6	Midterm, Wastewater Treatment Design Considerations	Chp. 12
7	Wastewater Microbiology	Chp. 15
8	Secondary Treatment: Activated Sludge	Chp. 16
9	Tertiary Treatment and Resource Recovery	Chp. 19 and 20
10	Final Project Presentations, Final Review	

Grade Distribution:

Homework	30%
Midterm	20%
Final	20%
Group Project	25%
Participation	5%

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