CE 5349 – Design of Filtration and Membrane Desalination Proc.– Fall 2016

The University of Texas at El Paso
Civil Engineering
Lecture: Tue/Thur 4:30-5:50pm, UGLC 334
CRN: 18396
Prerequisites: CE 4342

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Required Text: MWH (2012) Water Treatment: Principles and Design, 3rd Ed.
Supplemental Texts:
Lawler and Benjamin (2013) Water Quality Engineering: Physical and Chemical Treatment Processes; Davis (2010) Water & Wastewater Engineering;
AWWA (2011) Water Quality & Treatment, 6th Ed., Edzwald (ed), McGraw Hill

Description and Objectives

This course involves a study of theory and preliminary design of pretreatment, process, and posttreatment for membrane filtration and desalination systems. The objectives of this course are to develop:

1. design background required to solve problems dealing with water quality, water treatment, and water regulation.
2. the ability to work in teams on complex design problems.
3. an awareness of the environment in which we, as a society, live and the significance of the local, state, national and global problems that face the engineering community.
4. preliminary design of membrane filtration (microfiltration or ultrafiltration) systems for drinking water treatment
5. preliminary design of membrane desalination (reverse osmosis, nanofiltration, or electrodialysis) systems for drinking water treatment

Expectations

Participation: More than simply attending class, you are invited to *think,* and *participate* in the lectures and discussions. I encourage you to be curious and inquisitive during lectures and discussions.
Preparedness: I recommend that you bring the textbook, a personal course notebook, a pen or pencil, a calculator, completed homework assignments, and questions from the homework and assigned reading.
Punctuality: You are expected to be on time to class, laboratory exercises, and plant tours. Assignments submitted late will receive half credit.
Ethics: In engineering, personal integrity is of utmost importance, especially in the assessment and reporting of environmental conditions. Also, in most cases, it is necessary to work in teams to develop and design optimal solutions to problems and challenges, and it is essential that each team member contribute to the productivity of the team. In this course, I strongly recommend that you complete homework assignments in teams; in many cases, you will help each other through the solution of difficult problems. My goal for the homework is for you to develop proficiency in the basic application and calculations in design. Thus, every student is accountable for *understanding* the concepts, analysis, and solution. My goal for the projects is for you to have opportunity to apply this theory in a deeper and more meaningful way than homework. Each student is accountable for understanding and *contributing* (equitably) to the team projects. Any student committing plagiarism (*e.g.*, copying another's work without understanding) or any other form of academic dishonesty will be reported to the Dean of Students for disciplinary action (which may include expulsion from the University). For a concise summary of engineering ethics, I have provided here the Fundamental Canons within the Code of Ethics of the American Society of Civil Engineers (ASCE):

1. *Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development3 in the performance of their professional duties.*
2. *Engineers shall perform services only in areas of their competence.*
3. *Engineers shall issue public statements only in an objective and truthful manner.*
4. *Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.*
5. *Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.*
6. *Engineers shall act in such a manner as to uphold and enhance the honor, integrity, and dignity of the engineering profession and shall act with zero-tolerance for bribery, fraud, and corruption.*
7. *Engineers shall continue their professional development throughout their careers, and shall provide opportunities for the professional development of those engineers under their supervision.*

Evaluation

Assessment of your performance in this course will be determined by class attendance and participation, homework quizzes, and exams. (No makeup exams will be offered.) The total course average will be computed by the following:

Evaluation	Contribution (%)
Homeworks & Quizzes	20
Midterm Exams	40
Project 1	12
Project 1 Peer Eval.	8
Project 2	12
Project 2 Peer Eval.	8
Total	100

The final course grade will be determined according to the following:

Average (%)	Grade
≥ 90	A
80-89	B
70-79	C
60-69	D
< 60	F

I reserve the right to modify or augment this grading scheme for the sake of improving the educational effectiveness of this course.

Topics Covered

The topics covered in this course are:

1. Water Quality
2. Granular Media Filtration (e.g., rapid sand filtration)
3. Membrane Filtration (e.g., MF and UF) - Design Project 1
4. Membrane Desalination Systems (e.g., RO, NF, and ED) – Design Project 2

Special Accommodations

The University of Texas at El Paso provides, upon request, appropriate academic accommodation for students with disabilities. For more information, contact the Center for Accommodations and Support Services (http://sa.utep.edu/cass/).

Tentative Course Schedule

Class	Day	Date		Topics	Reading Assignment
1	T	AUG	23	Documentary: *Last Call at the Oasis* (2011)	
2	R		25	Water quality: Phys., Chem., & Microbio.	Chapter 1-3
3	T		30	Water treatment overview	Chapter 4
4	R	SEP	1	Granular Media Filtration	Chapter 11.1-5
5	T		6	Granular Media Filtration	Chapter 11.6-8
6	R		8	*Drinking Water Treatment Plant Tour*	-
7	T		13	Membrane Filtration	Chapter 12.1-5
8	R		15	Membrane Filtration	Chapter 12.6-7
9	T		20	Membrane Filtration	Chapter 12.8
10	R		22	*Ultrafiltration pilot tour*	
11	T		27	Project Group Meeting	
12	R		29	Project Group Meeting	
13	T	OCT	4	Membrane Desalination	Chapter 17.1-4
14	R		6	Membrane Desalination	Chapter 17.5
15	T		11	Membrane Desalination	Chapter 17.6
16	R		13	Design Project 1 - Presentations	Project Reports Due
17	T		18	Membrane Desalination	Chapter 17.7
18	R		20	EXAM 1	Chapters 1-4, 11-12
19	T		25	*Desalination Plant Tour*	*Kay Bailey Hutchison (KBH) Plant*
20	R		27	Membrane Desalination	Commercial Software: Tbl. 17-5
21	T	NOV	1	Seawater versus Inland Desalination	
22	R		3	Electrodialysis design	-
23	T		8	Residuals (concentrate) Management	Chapter 21
24	R		10	Concntrt.. Enhanc. Recovery RO (CERRO)	-
25	T		15	Electrodialysis Metathesis	-
26	R		17	Project Group Meeting	
27	T		22	EXAM 2	Chapters 17, 21
-	R		24	*Thanksgiving Holiday (no classes)*	
28	T		29	Project Group Meeting	
29	R	DEC	1	Project Group Meeting	Project 2 Reports Due
30	T		6	Design Project 2 – Presentations	4:00pm-6:45pm