CE 5345 – Advanced Physical-Chemical Water Treatment Processes

The University of Texas at El Paso
Department of Civil Engineering
Class: Tues/Thur 4:30-5:50pm, CRBL 304
CRN: 27742

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Philosophy

I believe that *teaching* and *learning* are interdependent; you cannot have one without the other. You and I are partners and colleagues, working together to help you become a knowledgeable, curious, intrinsically motivated, and confident engineer. I want to help you become a critical thinker with sharpened skills of analysis, evaluation, and synthesis. I incorporate team-based, hands-on projects in all of my courses to help prepare you for professional practice and to help you develop as a more robust and intrinsically-motivated engineer. I have also realized that it is important to provide weekly homework assignments and quizzes, which help students keep up with understanding and applying concepts. Thus, I have implemented a combination of homework assignments, quizzes, exams, and team projects in all of my courses, with strategic emphasis for the particular course.

Required Text:
MWH (2012) Water Treatment: Principles and Design, 3rd Ed., Wiley;

Supplemental Texts:
Benjamin and Lawler (2013) Water Quality Engineering: Physical & Chemical Treatment Proc., Wiley;
AWWA (2011) Water Quality & Treatment, 6th Ed., Edzwald (ed), McGraw Hill;
Davis (2010) Water and Wastewater Engineering, McGraw Hill;
Viessman et al (2009) Water Supply & Pollution Control, 8th Ed., Pearson Prentice Hall.
Droste (1997) Theory and Practice of Water and Wastewater Treatment, Wiley

Description and Objectives

This course involves an advanced study of theory and design of physical-chemical water treatment processes, in greater detail than the introduction provided in CE 4342 (Water & Wastewater Engineering), and complementary with CE 5409 (Environmental Engineering Chemistry), CE 5349 (Membrane Filtration and Desalination), and CE 5344 (Biological Unit Operations). Topics include mass-flow balances, reactor models, coagulation/flocculation, settling, adsorption, disinfection, and AOPs.

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.*

Peer Evaluation

Peer evaluations of team members will be facilitated through the Comprehensive Assessment of Team Member Effectiveness (CATME) system. Students will receive an email invitation to log-in online to rate themselves and their teammates using a secure, web-based interface to evaluate based on five dimensions of team-member contributions (Contributing to Work; Interacting with Teammates; Keeping Team on Track; Expecting Quality; and Having Knowledge/Skills). The system allows instructors to view each student's ratings of every team member, which increases students' accountability for their ratings. Students can also make confidential comments in the system, which go only to their instructor. The system flags a number of "exceptional conditions" in the rating patterns to alert instructors to teams or students who might benefit from their attention. The system also allows instructors to release feedback to their students. The feedback shows students their self-rating, the average rating that teammates gave the student, and the team-average rating for each of the five dimensions of the CATME Peer Evaluation scale. In addition, the feedback suggests behaviors that could improve students' ratings in each of the five dimensions. For more information, please visit http://info.catme.org/.

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.) Your total course average will be computed by the following:

Evaluation	**Contribution (%)**
Homeworks (7)	35
Quizzes	5
Midterm Exam	30
Final Exam	30
Total	*100*

Final Grade

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

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
1	T	JAN	19	Mass balance and ideal reactors: PFR, CMR	6.1-3
2	R		21	Fluid mechanics	-
3	T		26	Chemical equilibrium and kinetics	5.1-5, 6.4
4	R		28	CMRs in series	6.3b
5	T	FEB	2	Ideal reactors with reactions	6.5
6	R		4	Tracer tests to exit age distribution	6.6
7	T		9	Modeling non-ideal reactors: DFM/TIS	6.7
8	R		11	Non-ideal reactors with reactions	6.8
9	T		16	PFRs in parallel, Segregated-Flow Model	6.9
10	R		18	Mixing, blending	6.10
11	T		23	Coagulation	9.1-5
12	R		25	Exam review	-
13	T	MAR	1	Flocculation	9.6-7
14	R		3	*Drinking Water Treatment Plant Tour*	*Upper Valley WTP*
-	T		8	*Spring Break*	-
-	R		10	*Spring Break*	-
15	T		15	Settling	10.1-9
16	R		17	Mass transfer: diffusion	7.1-3
17	T		22	Interfacial transfer	7.4-6
18	R		24	**EXAM 1**	**Ch. 5-6**
19	T		29	Operation and enhance. of mass-transfer	7.7-9
20	R		31	Gas-liquid interfacial theory	14.1-4
21	T	APR	5	Adsorption	15.1-6
22	R		7	Air stripping design	14.5-8
23	T		12	*Wastewater Treatment Plant Tour*	*Haskell Street WWTP*
24	R		14	Adsorption continued	-
25	T		19	Disinfection kinetics and design	13.1-8
26	R		21	Documentary: "*How we got to here: clean*"	-
27	T		26	DBPs	19.1-5
28	R		28	*Wastewater Reuse Treatment Plant Tour*	*Fred Hervey Reuse Plant*
29	T	MAY	3	AOPs with O_3, H_2O_2, and UV	18.1-3
30	R		5	Review for Final	
31	T		10	**FINAL EXAM, 4:00pm-6:45pm**	**(comprehensive)**