

# CEE 633 Physical and Chemical Treatment (3)

## 1 Course Description

Introduction to physical and chemical processes for water and wastewater treatment: Review of momentum and mass transfer, chemical reactions, colloidal chemistry, coagulation and flocculation, granular filtration, sedimentation, carbon adsorption, gas transfer, disinfection and oxidation. A-F only. Recommended: 431 or consent.

## 2 Learning Objectives

After students take this course, students should be able to:

- have in-depth overview of environmental engineering and fundamentals of wastewater treatment
- understand and use water and wastewater characteristics for the process design and optimization later
- apply modeling approaches to understand, analyze, and predict treatment phenomena and performances
- understand the wastewater treatment as a coupled process of chemical, physical, and biological processes with scientific fundamentals.

## 3 Textbook

- Water Treatment: Principles and Design, 2nd Ed., John Wiley & Sons, Inc., 2005
- All the course materials will be available when needed, including Instructor's handouts

## 4 Instructor

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Instructor	Prof. Albert S. Kim
Office	POST 203C
Phone:	956-3718
Email:	albertsk@hawaii.edu
Course URL:	Laulima and Google Classroom (class code: TBA)
TA (grader)	None
Office hours	TBA, Shortly after each class or by appointment

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## 5 Grading

Items	Percentage (%)	Achievement	Grade
Online activity	10	90 – 100 %	A
Homework	10	76 – 90 %	B
Midterm 1	25	65 – 76 %	C
Midterm 2	25	50 – 65%	D
Final	30	< 50%	F

## 6 Class Schedule

- The final exam covers all the content covered, but focus on chapters after the second midterm.
- Specific holidays and break periods will be updated as needed.

## 7 Notes and Rules

- Homework will be assigned weekly and due in a week, unless specified.
- There will be three exams, and specific times and formats will be announced.
- Students' homework *should contain* proper figures, diagrams, procedures, and/or enough detailed explanation and should be very well organized in a logical flow.
- Homework must be submitted fully online using Google Classroom. The file name should have a standard format of, e.g., CEE633\_HW##\_LastName\_First.docx, e.g. **CEE633\_HW01\_Kim\_Albert.docx**. No spaces and special characters should be included in file names.
- Students do not need to type any mathematical derivations using the Equation Editor or MathType in MS Word files unless you really want to for your own record. But, students' hand-writing should be eligible although hand-written derivation procedures are enough to get credits.

Table 1: Course and Exam Schedule

Week	Lecture	Chapter	Ch. Sec.
1	1	General Course Introduction + Ch. 2	2.2
	2	Ch. 2 Physical and Chemical Quality	2.3-2.5
2	3	Ch. 5 Fundamentals of Chemical Reactions	2.6, 2.7
	4	Ch. 5 Fundamentals of Chemical Reactions	2.8
3	5	Labor Day (non-instructional day)	2.9
	6	Ch. 6 Reactor Analysis	3.2, 3.3
4	7	Ch. 6 Reactor Analysis	3.4
	8	Ch. 7 Separation Processes and Mass Transfer	3.5
5	9	Ch. 7 Separation Processes and Mass Transfer	3.6
	10	Ch. 9 Coagulation, Mixing, and Flocculation	MT1
6	11	Ch. 9 Coagulation, Mixing, and Flocculation	5.1-5.3
	12	Midterm I (Chs. 2, 5, and 6)	5.4
7	13	Ch. 10 Gravity Separation	5.5
	14	Ch. 10 Gravity Separation	6.3
8	15	Ch. 11 Granular Filtration	6.4
	16	Ch. 11 Granular Filtration	6.5, 6.6
9	17	Ch. 14 Air Stripping and Aeration	6.7, 6.8
	18	Ch. 14 Air Stripping and Aeration	6.9
10	19	Ch. 15 Adsorption	6.10-6.12
	20	Ch. 15 Adsorption	MT2
11	21	Ch. 16 Ion Exchange	4.1-4.3
	22	Ch. 16 Ion Exchange	4.4,4.5
12	23	Midterm II (Chs. 7, 9, 10, 11, and 14)	4.6-4.9
	24	Ch. 8 Chemical Oxidation and Reduction	7.1-7.4
13	25	Ch. 8 Chemical Oxidation and Reduction	7.5
	26	Ch. 13 Disinfection	7.6
14	27	Ch. 13 Disinfection	7.9
	28	Ch. 14 Disinfection/Oxidation Byproducts	7.10
15	29	Ch. 14 Disinfection/Oxidation Byproducts	7.11
	30	Membrane Separations: Ch. 17 Reverse Osmosis	
16	31	Membrane Separations: Ch. 17 Reverse Osmosis	
	32	Course review	
Final Exam			