ChEE 475/575 **Syllabus** **Fall 2021**

Water Treatment System Design

Instructor: James Farrell 306-A Civil Engineering Building
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Grade Basis: Midterm Exams 20% each; Final Exam 25%; Homework 15%
Grading: A (85-100%); B (75-85%); C (65-75%); D (50-65%); E (<50%)

Text: Mackenzie L. Davis, *Water and Wastewater Engineering, Design Principles and Practice*, McGraw Hill, 2011. ISBN 978-0-07-339786-3

Course Objectives

The objectives of this course are to teach the student water treatment unit operations that are commonly used for producing potable water from a variety of water sources. The student will be taught the physical and chemical processes that are used to remove different types of water contaminants for both health and aesthetic purposes. This course will also cover the design of water treatment unit operations which includes how the operating parameters affect the costs and efficiency of contaminant removal.

Learning Outcomes

Upon completion of this course, the student will be able to identify potential sources of potable water and to determine the appropriate treatment for improving the health and aesthetics of the water. This includes: 1) selecting an appropriate disinfectant based on water quality parameters, 2) determining the type and dosing of coagulants, 3) choosing among various filtration technologies, 4) sizing sedimentation basins and filtration systems, 5) designing ion exchange processes, and 6) evaluating options for disposal of liquid and solid residuals. Additional learning outcomes for graduate students include the ability to combine value judgements and engineering insight in selecting and designing water treatment processes.

Requirements for Graduate Credit

Enrollment in ChEE 575 requires additional homework problems identified on the syllabus. These problems are open ended discussion questions from the textbook and require the student to weigh the pros and cons of various treatment options.

Additional Policies, Warranties and Disclaimers:

1. University-wide Policies link: https://academicaffairs.arizona.edu/syllabus-policies:
2. Required attendance policy: Attendance at lectures is not mandatory. For examinations: All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion. Absences pre-approved by the UA Dean of Students (or Dean's designee) will be honored.
3. Late homework will not be accepted without prior approval of the instructor.
4. Required extracurricular activities: none
5. Special materials required for the class: none
6. *Accessibility and Accommodations:* ***At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, https://drc.arizona.edu) to establish reasonable accommodations.***
7. Information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor.
8. Final Exam Regulations: http://www.registrar.arizona.edu/schedule101/exams/examrules.htm
9. Final Exam Schedule: http://www.registrar.arizona.edu/schedules/finals.htm.

Date	Topic	Reading	Homework 475/575	Discussion Questions
8/24/21	Introduction - Water Quality	2-22 to 2-39		
8/26/21	Water Chemistry			
8/31/21	Coagulation/Flocculation	3-1 to 3-29	3.1, 3.3, 3.5, 3.7, 3.8, 3.9 due 9/7/21	3.1, 3.2
9/2/21	Coagulation/Flocculation			
9/7/21	Lime-Soda Softening	4-1 to 4-40	4.1, 4.2, 4.3, 4.10.4.11, 4.18 4.20, 4.27, 4.29 due 9/19/21	4.1, 4.3
9/9/21	Lime-Soda Softening			
9/14/21	Lime-Soda Softening			
9/16/21	Ion Exchange	5-1 to 5-25	5.1, 5.2, 5.3, 5.4, 5.8, 5.9	5.1
9/21/21	Ion Exchange			
9/23/21	**Exam 1**			
9/28/21	Ion Exchange		due 10/3/21	
9/30/21	Reverse Osmosis Nanofiltration	6.1 to 6.18	6.1, 6.4, 6.6, 6.8, 6.10, 6.12	6.1
10/5/21	Reverse Osmosis & Nanofiltration		due 10/12/21	
10/7/21	Reverse Osmosis & Nanofiltration			
10/12/21	Sedimentation	7.1 to 7.39	7.1, 7.3. 7.6, 7.9, 7.13, 7.16 due 10/24/21	
10/14/21	Sedimentation			
10/19/21	Sedimentation			
10/21/21	Granular Filtration	8.1 to 8.47	8.1, 8.2, 8.5, 8.8, 8.12, 8.13 8.17, 8.21 due 11/2/21	8.1, 8.2
10/26/21	**Exam 2**			
10/28/21	Granular Filtration			
11/2/21	Membrane Filtration	9.1 to 9.19	9.1, 9.2, 9.3, 9.7, 9.8	9.1, 9.2
11/4/21	Membrane Filtration			
11/9/21	Disinfection		due 11/9/21	
11/11/21	Disinfection	10.1 to 10.48	10.1, 10.2, 10.3, 10.5, 10.6 10.8, 10.11, 10.14, 10.15, 10.16 due 11/23/21	10.1, 10.2
11/16/21	Disinfection			
11/18/21	Disinfection			
11/23/21	Specific Contaminants			
11/30/21	**Exam 3**			
12/2/21	Residuals Management	11.1 to 11.52	11.1, 11.2, 11.4, 11.5, 11.8, 11.13, 11.15, 11.16 due 12/10/21	11.1, 11.2
12/7/21	Residuals Management			
12/15/21	**Final Exam 1-3 PM**			