

Wastewater Treatment System Design

CHEE / CE 476B/576B (3 units)

Spring 20xx



Instructor:

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Objectives:

This course focuses on the application of theory and engineering experience to the design of unit operations for the treatment of wastewater. It covers characteristics of wastewater; wastewater regulations; primary, secondary & tertiary treatment processes; selected topics on advanced treatment and resource recovery; sludge disposal; and design of water and wastewater treatment plants. At the end of the course, the students will have a working knowledge of the wastewater industry and have the skills to perform a preliminary design of a treatment plant. This will be achieved through descriptive lectures, calculations and field trips to several full-scale treatment plants.

Graduate-level requirements:

Graduate-level requirements include additional homework problems, a course paper, and additional exam questions.

Text books:

Required (undergraduate/graduate students): M. L. Davis. 2017. *Water and Wastewater Engineering*. 7th Ed. McGraw-Hill, ISBN: 978-1259064838

Free access to this E-book: via D2L or using the link below

<https://ebookcentral.proquest.com/lib/uaz/detail.action?docID=4658082>

Recommended (graduate students): Metcalf & Eddy, 2013. *Wastewater Engineering: Treatment and Resource Recovery*, 5th Ed, McGraw-Hill. ISBN-13: 978-0073401188

Lecture time: Date / Time TBD Venue: TBD

Field trips: Two different municipal wastewater treatment plants

TA / Office hours: TA TBD, email: XXX@... Office hours: Days / Times / Location TBD

Homework: There will a number of homework assignments during the semester, and a due date is provided with each. Homework is due on the due date at the BEGINNING of class. Penalties for homework handed in late are:

- One day or less: 30% off
- 2 to 3 days: 50% off.
- More than 3 days: no credit.

Student learning outcomes:

On successful completion of this course students will be able to:

1. To discuss wastewater quality data.
2. To identify specific pollution problems associated with wastewater discharge and sludge disposal.
3. To describe the main physical, chemical and biological unit operations applied in municipal and industrial wastewater treatment systems.
4. To identify laws and regulations that apply to water and/or wastewater treatment.
5. To explain the principles of wastewater treatment, understand the main design criteria and operational parameters for wastewater treatment processes, and apply the knowledge in the process design.
5. To understand the principles of excess sludge treatment and apply the knowledge in the process design.
6. To formulate a preliminary design of a wastewater treatment plant.
7. To reflect on the importance of practical wastewater design considerations as well as sustainability issues

Grading:

	400-level	500-level
Midterm exams	25%, 25%	20%, 20%
Final exam	25%	25%
Homework	15%	10%
In class participation	10%	10%
Term paper/presentation		15%

Exam Guidelines and Policy

Exam Resources: A **single** 8.5 inch by 11.0 inch sheet of paper may be brought to each exam with any equations, information, worked problems, etc. the student feels useful. The paper may be typed or handwritten, and both sides may be used. One or more sheets of conversion factors, constants, numerical values, etc. will be handed out with the test. These will **NOT** include equations.

Late Exams: No make-up exams will be given except by prior arrangement with the instructor, at least, one week before the scheduled exam time.

The date and time of the final exam, along with links to the Final Exam Regulations, <https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information>, and Final Exam Schedule, <http://www.registrar.arizona.edu/schedules/finals.htm>

EXAM or DATE DUE

DATE	Exam or Date due
Feb. xx	Deadline to choose topic for assignment (only 500-level)
Feb. xx	QUIZ 1
March xx	Turn in outline term paper (only 500-level)
April xx	QUIZ 2
April xx	Turn in term paper (1 st draft) (only 500-level)
April xx	Return corrected report draft
May xx	Turn in term paper
April xx & May xx	Graduate student presentations (only 500-level)
May xx	Final examination (Lecture 1 to end): time TBD

COURSE CONTENTS

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- Introduction
 - Wastewater generation
 - Wastewater characteristics – Physical and chemical characteristics
 - Wastewater characteristics- Biological characteristics
 - Environmental legislation / permitting
 - Wastewater microbiology
 - Pharmaceuticals and other organics in wastewater
 - Kinetics
 - Reactors
 - Wastewater equalization
 - Primary treatment of wastewater
 - Aeration and mass transfer
 - Lagoons
 - Activated sludge processes I
 - Activated sludge processes II
 - *Visit to wastewater treatment plants*
 - Aerobic biofilm processes
 - Lagoons
 - Nitrification and denitrification I
 - Nitrification and denitrification II
 - *Visit to wastewater treatment plant*
 - Phosphorous removal processes
 - Advanced wastewater treatment processes
 - Anaerobic wastewater treatment processes
 - Sludge handling and disposal
 - Industrial wastewater treatment
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PAPER GUIDELINES AND POLICY (576 Only)

The topic should concern a wastewater treatment process or problem and MUST be checked for acceptability with the instructor by **Date TBD**. You will give an oral presentation on the topic to the class. In addition, you are required to prepare a term paper.

The intent of the paper assignment is: 1) to become acquainted with and gain experience using the environmental science and engineering literature, 2) to obtain a more in-depth knowledge of a particular treatment process or problem, and 3) to improve your writing and critical evaluation skills.

Paper: 10-12 pages (excluding references, cover page and table of contents). Any appropriate, clearly legible, typeface may be used of 12 point. Lines should be 1.5 spaced. The paper will be organized as follows:

Cover page

Table of Contents

Abstract/Summary (maximum 1/2 page)

Introduction and background

Objectives: (objectives of your literature study)

Results (what is known from research papers on the topic, design/operation/application of the selected method)

Discussion (what are the potentials and limitations of the treatment system considered, what research still needs to be done)

Conclusions and recommendations

References: References should be cited within the paper, and a list of references should be appended.

Appendices, if any (not to exceed 5 pages)

= Outline of term paper due on **xx/xx** (one page listing the main topics to be

addressed). = First Draft Due Date: **xx/xx**

First draft will be edited for logic, content, and style by a fellow student, who will receive a grade based on their editing. The student editor's grade will make up 20% of the grade for his/her paper. Each student editor is responsible for making one copy of the edited version and comments to hand-in to the instructor, before returning the edited paper to its author. Failure to turn in a first draft will result in a 30% reduction on the final paper grade.

= First Draft Edits Return Date: **xx/xx**

= Final report Due Date: **xx/xx**

= Late Penalties: 20% per day or part thereof.

Oral report presentation (xx/xx and xx/xx)

1. Power Point presentation, approx. 10 minutes
2. Question/Answers session: max. 3-4 minutes

ADDITIONAL POLICIES, WARRANTIES AND DISCLAIMERS:

- 1) **Absence and Class Participation Policy.** Students are expected to attend lectures. The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>.
The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.
Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: <https://deanofstudents.arizona.edu/absences>
Students that fail to attend a field trip must submit a 5-page report on a topic assigned by the instructor. The report will be due no later than 7 days after the date when the field trip took place.
- 2) **Classroom Behavior Policy.** To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).
Please treat speakers with respect and in a professional manner. Please **do not arrive late to class** and give the speakers your attention (e.g. no texting, emailing, etc.)
- 3) Cell phones, pagers, and other electronic devices must be turned off before the start of class. If using such devices to take notes, please put switch to airplane mode.
- 4) **Accommodations for students with disabilities:** It is the University's goal that learning experiences be as accessible as possible. Students who need special accommodation or services should contact the Disability Resources Center, 1224 East Lowell Street, Tucson, AZ 85721, (520) 621-3268, FAX (520) 621-9423, email: uadrc@email.arizona.edu, <http://drc.arizona.edu/>. You must register and request that the Center or DRC send me official notification of your accommodations needs as soon as possible. Please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate. *The need for accommodations must be documented by the appropriate office.* Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.
- 5) **Code of Academic Integrity.** Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See:
<http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.
The University Libraries have some excellent tips for avoiding plagiarism, available at <http://new.library.arizona.edu/research/citing/plagiarism>.
- 6) **Threatening Behavior Policy.** The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

- 7) **UA Nondiscrimination and Anti-harassment Policy.** The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

- 8) **Special materials required for the class:** none

- 9) **Confidentiality of Student Records**

<http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa>

- 10) **Subject to Change Statement:** The information contained in the syllabus (except grade and absence policies) may be subject to change with reasonable advance notice, as deemed appropriate by the instructor.