CEE 442/642 Treatment Processes in Environmental Engineering

Department of Civil and Environmental Engineering

Syracuse University

Welcome![1] *Every part of this course is structured to support your learning and help you succeed.*

Course Description (from University Catalog)

Fundamental engineering concepts and principles used for the design and operation of water and wastewater treatment systems. Estimating water demand and wastewater flows in the urban water use cycle. Significance of government regulations and standards.

Course Co-requisites

CEE 327 Principles of Fluid Mechanics & CEE 341 Introduction to Environmental Engineering

Course Website

Blackboard: CEE.442/642.MERGED.FALL25.Treatment Proc. in Env. Eng. (14606.1261c)

Class Time and Location

Lectures
Link Hall 152
Tuesdays & Thursdays
11:00 am – 12:20 pm

Labs / Field Trips
Link Hall 405 / Off-Campus
Tuesdays / Thursdays
12:30 pm – 2:30 pm

Instructor

Teng Zeng (preferred name Teng)
Associate Professor
Office: **Link Hall 151K**
Phone: (315) 443-1099

Q&A Sessions[2]
Email, in-person, or Zoom
Email: tezeng@syr.edu
Please feel free to reach out!

Teaching Assistant

Not available

Learning Objectives[3]

CEE 442/642 introduces students to the fundamental chemical, physical, and biological principles that underpin the design and operations of effective drinking water and wastewater treatment systems, along with current and emerging issues faced by water professionals. By the end of this course, you will be able to:

[1] A welcoming statement was added upfront in the syllabus to set a positive tone.
[2] Office hours were "rebranded" to encourage engagement, so students may see these sessions as an opportunity for learning rather than a formality.
[3] These learning objectives were revised to align with the CALMS framework (i.e., clear, attainable, learning-focused, measurable, and specific).

1. Describe overall process configurations for municipal drinking water purification and wastewater treatment, and explain the function and purpose of each treatment step;
2. Analyze design and operational parameters using scientific and engineering principles, laboratory measurements, and field observations, and recommend solutions to specific treatment needs;
3. Interpret water quality data and evaluate treatment system performance against established regulatory and performance standards.

Learning Outcomes (ABET 1, 2, 6 student outcomes)

Upon satisfactory completion of the course, you will be able to attain:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
6. An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions.

Performance Assessment

This course is for seniors and first-year graduate students. Your learning will be assessed using homework assignments, laboratory reports, field trip reflections, technical brief, and exams.

Assessment	**Quantity**
Homework Assignments	6
Labs with Reports	2
Field Trips with Reflections	2
Technical Brief & Video Presentation (B.S./M.S., M.S., or Ph.D. students only)	1
Exams	3

Grading Scheme

Letter grades will be assigned according to the following scale:

Undergraduate Students		Grade	
Homework	24 %	A	93–100 % (4.00)
Labs w/ Reports	10 %	A−	90–92 % (3.66)
Field Trips w/ Reflections	10 %	B+	87–89 % (3.33)
Exam I	18 %	B	83–86 % (3.00)
Exam II	18 %	B−	80–82 % (2.66)
Exam III	20 %	C+	77–79 % (2.33)
		C	73–76 % (2.00)
		C−	70–72 % (1.66)
		D	60–69 % (1.00)
		F	0–59% (0.00)

Graduate & 4+1 Students		Grade	
Homework	18 %	A	93–100 % (4.00)
Labs w/ Reports	8 %	A−	90–92 % (3.66)
Field Trips w/ Reflections	8 %	B+	87–89 % (3.33)
Technical Brief	8 %	B	83–86 % (3.00)
Video Presentation	4 %	B−	80–82 % (2.66)
Exam I	18 %	C+	77–79 % (2.33)
Exam II	18 %	C	73–76 % (2.00)
Exam III	18 %	C−	70–72 % (1.66)
		No D or F	

Reference Materials

No textbook is required for this course. I will provide hardcopy handouts with topic-related learning objectives, recommended readings, and key content from lecture[4] slides to help you focus on understanding the material rather than on extensive note-taking. Below is a short list of classic textbooks and books on water sustainability for those who wish to explore topics in greater depth:

1. **Water and Wastewater Engineering: Design Principles and Practice**, 2nd Edition, 2019; 1344 pages; *Publisher*: McGraw-Hill Education; *Author*: Mackenzie L. Davis. (**eBook available online through SU Libraries: Permalink**)
   This required textbook, commonly referred to as the "Davis" book, has been used by previous instructors of this course. It covers both drinking water and wastewater treatment, whereas the other two textbooks listed focus on one or the other.

2. **Stantec's Water Treatment - Principles and Design (formerly the MWH Book)**, 3rd Edition, 2022; 1952 pages; *Publisher*: John Wiley & Sons, Inc.; *Authors*: John C. Crittenden, R. Rhodes Trussell, David W. Hand, Kerry J. Howe, and George Tchobanoglous. (**eBook available online through SU Libraries: Permalink**)
   *This comprehensive book on **drinking water engineering** was first authored by Montgomery-Watson, an engineering consulting firm. Montgomery-Watson merged with Harza in 2001 to form MWH, which was later acquired by Stantec in 2016. The book is now published under Stantec, but many practitioners still refer to it as the "MWH" book.*

3. **Wastewater Engineering: Treatment and Resource Recovery (The Metcalf & Eddy Book)**, 5th Edition, 2013; 2048 pages; *Publisher*: McGraw-Hill Education; *Authors*: Metcalf & Eddy, Inc. and George Tchobanoglous, H. David Stensel, Ryujiro Tsuchihashi, and Franklin Burton. (**eBook available online through SU Libraries: Permalink**)

[4] This statement was revised to clearly communicate the purpose and value of the handouts: they consolidate key materials to support active engagement during lectures.

*This comprehensive book on **wastewater engineering** was first authored by Metcalf & Eddy, an engineering consulting firm - much like the drinking water book is attributed to MWH. Metcalf & Eddy was acquired by AECOM in 2000, right before Montgomery-Watson merged with Harza. Most practitioners refer to it as the "Metcalf & Eddy" book.*

4. **Water 4.0: The Past, Present, and Future of the World's Most Vital Resource**, 1st Edition, 2014; 353 pages; *Publisher*: Yale University Press; *Authors*: David Sedlak. (**eBook available online through SU Libraries: Permalink**)

   This is not a textbook, but an engaging read that explores the history, current state, and future of water treatment. Its author, Dr. David Sedlak, is the Malozemoff Professor of Civil and Environmental Engineering at the University of California, Berkeley.

5. **Water for All: Global Solutions for a Changing Climate**, 1st Edition, 2023; 440 pages; *Publisher*: Yale University Press; *Authors*: David Sedlak. (**eBook available online through SU Libraries: Permalink**)

   This more recent book by Dr. David Sedlak offers fresh perspectives on addressing emerging water challenges driven by climate change.

Course Mapping (Tentative timeline as of August 2025)

Note: The schedule below represents my best estimate of how the semester will progress. I reserve the right to adjust this timeline as needed.

Week	Date	Topic	Assessment / Activity
1	Aug 26 Aug 28	Course Introduction Water Quantity, Quality & Regulations	 Pre-class survey due[5]
2	Sep 2 Sep 4	Reactor Analysis Reactor Analysis	
3	Sep 9 **Sep 11**	Coagulation & Flocculation Coagulation & Flocculation	HW1 due **Lab 1**
4	**Sep 16** Sep 18	Sedimentation Sedimentation	**Lab 1**
5	**Sep 23** Sep 25	Granular Filtration Granular Filtration	Lab 1 Report due | **Field Trip 1** HW2 due
6	Sep 30 **Oct 2**	Review I **Exam I (class time Link 152)**	Field Trip 1 Reflection due
7	**Oct 7** **Oct 9**	Disinfection Disinfection	**Lab 2** **Lab 2**
8	Oct 14 Oct 16	Fall Break! Disinfection	 HW3 due
9	Oct 21 Oct 23	Membrane Filtration Membrane Filtration / Reverse Osmosis	Lab 2 Report due

[5] This pre-class survey has been used to gather information on students' preferred names, pronouns, and learning preferences, and will be updated to also invite them to share their expectations for the course.

10	Oct 28 Oct 30	Reverse Osmosis Review II	HW4 due
11	**Nov 4** Nov 6	**Exam II (class time Link 152)** Wastewater Characteristics & Regulations	
12	Nov 11 Nov 13	Preliminary & Primary Treatment Secondary Treatment	HW5 due
13	Nov 18 **Nov 20**	Secondary Treatment Secondary Treatment	**Field Trip 2**
14	Nov 25 Nov 27	Thanksgiving Break!!	No Class
15	Dec 2 Dec 4	Nutrient Removal Review III & Course Evaluation	Field Trip 2 Reflection | HW6 due
16	**Dec 9** **Dec 11**	**Exam III (class time Link 152)**	**Technical Brief due**

Homework Information

Assignment	Date Out	Date Due
1	Sep 2 (Tuesday)	Sep 9 (Tuesday)
2	Sep 18 (Thursday)	Sep 25 (Thursday)
3	Oct 9 (Thursday)	Oct 16 (Thursday)
4	Oct 21 (Tuesday)	Oct 28 (Tuesday)
5	Nov 6 (Thursday)	Nov 13 (Thursday)
6	Nov 18 (Tuesday)	Dec 2 (Tuesday)

Note: Please see "**Homework_InfoSheet_Fall2025**" on Blackboard for the grading rubric. Each assignment includes at least one question with performance indicators mapped to one of the ABET student outcomes.

Lab Information

Lab 1:	Jar Test (Coagulation/Flocculation/Sedimentation)
Lab Date/Time:	**Sep 11 (Thursday)** or **Sep 16 (Tuesday) 12:30 – 2:30 pm**
Location:	Link Hall 405 (a.k.a. CEE Teaching Lab)
Report Due Date/Time:	**Sep 23 (Tuesday)**
Lab 2:	Reaction Kinetics (Chlorine Disinfection)
Lab Date/Time:	**Oct 7 (Tuesday)** or **Oct 9 (Thursday), 12:30 – 2:30 pm**
Location:	Link Hall 405 (a.k.a. CEE Teaching Lab)
Report Due Date/Time:	**Oct 21 (Tuesday)**

Note: Please see "**Lab_InfoSheet_Fall2025**" on Blackboard for more information. We cannot offer make-up lab sessions because the teaching lab is shared by multiple instructors and courses.

Field Trip Information

Field Trip 1:	OCWA Drinking Water Treatment Plant
Address:	2458 Lawrence Rd, Marcellus, NY 13108
Transportation:	Hale Transportation (~30 min drive)
Field Trip Date/Time:	**Sep 23 (Tuesday), 12:30 pm – 2:50 pm**
Report Due Date/Time:	**Sep 30 (Tuesday)**
Field Trip 2:	Meadowbrook-Limestone Wastewater Treatment Plant
Address:	7530 Manlius Center Rd, Kirkville, NY 13082
Transportation:	Hale Transportation (~ 15 min drive)
Field Trip Date/Time:	**Nov 20 (Thursday), 12:30 pm – 2:50 pm**
Report Due Date/Time:	**Dec 2 (Tuesday)**

Note: Please see "**FieldTrip_InfoSheet_Fall2025**" on Blackboard for more information. We cannot offer make-up trips because these tours and transportation are scheduled months in advance.

Course-Specific Policies and Guidelines

Class Attendance and Participation[6]

- I encourage you to attend lectures in person, as Syracuse University policy requires attendance for all courses. Being present not only helps you stay engaged but also ensures you receive important announcements, participate in activities, and access materials that may not be posted on Blackboard. While in class, please help maintain a respectful learning environment by avoiding behaviors that may distract others (e.g., side conversations, loud typing, eating strongly scented food) and by silencing your phone, tablet, and/or laptop.
- I recognize that some of you are balancing coursework with family, work, or other responsibilities, and I respect your effort. If you face challenges that require you to miss lectures, please let me know so we can work together to identify a pathway for you to catch up. In some cases, Zoom recordings may be posted on Blackboard upon request; however, not all lectures will be recorded, and any recordings will be auto-deleted from the cloud the following week.

Homework Assignments

- Over the semester, I plan to assign six homework assignments, each posted on Blackboard at least one week before the due date. Please submit your typed or scanned work via Blackboard. If something comes up that may prevent you from meeting a deadline, email me (tezeng@syr.edu) at least 24 hours in advance to request an extension. I understand that unexpected situations can arise, and I will do my best to work with you when reasonable.[7]
- Homework is designed to help you engage with and better understand the course material. You are welcome to discuss problems with peers as part of a genuine learning exchange, but you must submit your own original work.[8] Any form of copying, including but not limited to calculations, figures, tables, spreadsheets, and narratives, will be considered a violation of academic integrity.
- Your assignments will be graded based on ***completeness*** rather than strict accuracy
  - 0 pts – No submission, or the work contains no attempted problems, or the handwriting is illegible or excessively messy.
  - 10 pts – Minimal effort shown; responses are limited to listing basic equations without further calculation or explanation.
  - 20 pts – Completion of 25% of the assigned questions, with partial calculations or brief explanations; several steps are missing or incomplete.
  - 30 pts – Completion of 50% of the assigned questions, with most calculations shown and explanations that convey partial understanding.

[6] This section was revised to adopt a more supportive tone, convey respect for students' competing responsibilities, and encourage open communication about absences and make-up arrangements.
[7] This statement communicates flexibility and a willingness to accommodate students facing unforeseen circumstances.
[8] This statement encourages collaborative problem-solving and peer-to-peer learning while reinforcing the expectation of academic integrity and independent work.

- 40 pts – Completion of 75% of the assigned questions, with clear calculations and explanations that demonstrate sound understanding, though some details are missing.
- 50 pts – Completion of 100% of the assigned questions, with thorough calculations and well-reasoned explanations; only minor details may be missing.

- Handwriting must be legible and work clearly organized, as unclear or poorly structured solutions may *not* be graded. Engineering calculations should be presented in a logical sequence, with correct units and an appropriate number of significant figures.

Lab Exercises (in-person)

- You will participate in two lab experiments as small groups in **Link Hall 405** (CEE Teaching Lab). To help you prepare, lab manuals and/or short pre-lab tutorial videos will be posted on Blackboard before each lab for your preview. Gloves and safety goggles are required during labs, and all safety guidelines must be followed. If you anticipate missing your assigned session, please notify me (tezeng@syr.edu) at least one week in advance so I can try to place you in another session *if space allows*. I will *not* offer make-up sessions because these labs are designed to be collaborative and cannot be completed individually.
- Submit your ~~individual or group~~[9] lab reports via Blackboard. If you or your group cannot meet a deadline, email me (tezeng@syr.edu) at least 24 hours in advance to request an extension. Your reports will be evaluated on the clarity of your data analysis and the depth of your technical discussion. I encourage you to connect your findings to your own observations and understanding, and I highly value critical thinking and attention to detail.
- Please see "**Lab_InfoSheet_Fall2025**" on Blackboard for more information.

Field Trips (in-person)[10]

- You will participate in two field trips that connect classroom learning to real-world applications. In September, you will tour the Onondaga County Water Authority (OCWA) drinking water treatment plant in Marcellus. In November, you will visit the Meadowbrook-Limestone Wastewater Treatment Plant in Kirkville. The purpose of these trips is to provide direct exposure to real-world operations and help you connect core concepts with professional practice through on-site observation and interaction.
- I have arranged bus transportation for our class (private vehicles are not permitted under treatment plant policies). ~~Each trip typically takes a~~bout 1.5 to 2 hours (this may vary depending on traffic). Portions of the tours will take place outdoors and may involve ~~walking on uneven surfaces, so please dress appropriately. I will *not* offer~~ make-up trips because these tours are scheduled far in advance and require coordination with facility staff.
- Submit your individual field trip reflections via Blackboard.[11] If you cannot meet a

[9] This phrasing provides students the flexibility to demonstrate their learning individually or collaboratively as part of a team.

[10] This section was revised to emphasize a student-centered approach by providing opportunities to observe full-scale drinking water and wastewater treatment operations and fostering engagement through direct interaction

[11] These field trips are designed to support student-centered learning by encouraging active engagement, asking questions, and drawing connections between observed practices and course concepts. Students are expected to reflect on what they see and consider how these experiences might inform their future professional work. The term "reports" was replaced with "reflections" to emphasize reflective assignments

deadline, email me (tezeng@syr.edu) at least 24 hours in advance to request an extension.
- Please see "**FieldTrip_InfoSheet_Fall2025**" on Blackboard for more information.

Technical Report[12] & Video Presentation (Graduate Students and 4+1 Students only)

- You will have the opportunity to explore a focused topic of your choice from the following list: (1) source water browning, (2) harmful algal blooms, (3) potable reuse, or (4) desalination. In addition to your paper, you will prepare a short video presentation featuring a slideshow with voiceover narration to share the main points of your paper.
- I reserve the right to use *Turnitin* with its built-in AI writing indicator. Plagiarism is not acceptable and will result in zero credit. The use of generative AI tools to create content is discouraged, but please consult me if you are unsure whether a particular use is acceptable.
- Submit your technical brief and video presentation file via Blackboard by **11:59 pm, Dec 9 (Tuesday)**. Email me (tezeng@syr.edu) in advance if you need an extension.
- Please see "**TechnicalBrief_InfoSheet_Fall2025**" on Blackboard for more information.

Exams (in-person)

- You will take three exams. Exam I is scheduled for **October 2 (Thursday)** and Exam II for **November 4 (Tuesday)**. The final exam has been scheduled by the Office of the Registrar for Friday, December 12, 5:15 pm-7:15 pm, but I plan to move it to **December 11 (Thursday)** during our regular class time so it will serve as Exam III. All three exams will be held in Link Hall 152. I will announce any changes to the dates well in advance.
- Exams are closed book, but you are welcome to bring personal note sheets[13] to support your problem-solving. For Exams I and II, you may bring one double-sided 8.5-by-11-inch sheet of paper; for Exam III, you may bring two. Note sheets must be hand-written - no photos, scans, printed copies, or mechanical reproductions. Please bring a standard engineering calculator. Laptops, tablets, cell phones, and other electronic devices are *not* permitted.
- Exams I and II will be *non-cumulative*, while Exam III will be *cumulative*. Exams typically consist of quantitative problems and open-ended questions. Exam questions will be designed in a way such that regular engagement with lectures, labs, field trips, and homework will prepare you well. To earn full or partial credit, show your work in a clear, logical order, label your numerical answers with the correct units, and use an appropriate number of significant figures.
- If you know in advance that you will miss an exam, email me (tezeng@syr.edu) as early as possible in the semester so we can discuss options. For unexpected absences due to illness, family emergencies, or other unforeseen events, you will need to provide documentation. I can arrange make-up Exams I and II with prior approval or valid documentation; however, Exam III must be completed by December 12 and cannot be

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that prompt students to explore the real-world relevance of their observations, rather than simply compiling factual summaries

[12] The phrase "term paper" was replaced with "technical brief" to reflect the expectation that students synthesize and present technical information in a focused, professional format rather than a generic narrative. Students are welcome to choose one of four topics that best aligns with their interests.

[13] These note sheets encourage active review, while the closed-book format tests conceptual understanding.

postponed further.

Artificial Intelligence

- All generative-AI tools are prohibited in this course because their use inhibits achievement of the course learning objectives. This policy applies to all stages of project and writing processes including researching, brainstorming, outlining, organizing, and polishing. Do not use Generative-AI tools to create any content (i.e., images and video, audio, text, code, etc.). If you have any questions about a feature and whether it is considered Generative-AI, ask your instructor.

Copyright

- Course materials posted on Blackboard or distributed in class, including but not limited to the syllabus, handouts, lab manuals, homework problems/solutions, information sheets, exams, spreadsheets, and class session recordings, are protected by copyright. Sharing these materials publicly (e.g., posting online), in whole or in part, whether in their original or modified form, may violate intellectual property laws and the Code of Student Conduct. Video or audio recording of class sessions is prohibited without my prior written consent.
- If I wish to use academic work you complete this semester in future semesters for educational purposes, I will either obtain your written consent or remove all identifying information to ensure anonymity before doing so.

University-Mandated Course Policies

Academic Integrity

As a pre-eminent and inclusive student-focused research institution, Syracuse University considers academic integrity at the forefront of learning, serving as a core value and guiding pillar of education. Syracuse University's Academic Integrity Policy provides students with the necessary guidelines to complete academic work with integrity throughout their studies. Students are required to uphold both course-specific and university-wide academic integrity expectations such as crediting your sources, doing your own work, communicating honestly, and supporting academic integrity. The full Syracuse University Academic Integrity Policy can be viewed by visiting the Syracuse University Policies website.

Upholding Academic Integrity includes the protection of faculty's intellectual property. Students should not upload, distribute, or share instructors' course materials, including presentations, assignments, exams, or other evaluative materials without permission. Using websites that charge fees or require uploading of course material (e.g., Chegg, Course Hero) to obtain exam solutions or assignments completed by others, which are then presented as your own violates academic integrity expectations in this course and may be classified as a Level 3 violation. All academic integrity expectations that apply to in-person assignments, quizzes, and exams also apply online.

Students found in violation of the policy are subject to grade sanctions determined by the course instructor and non-grade sanctions determined by the School or College where the course is offered. Students may not drop or withdraw from courses in which they face a suspected violation. Any

established violation in this course may result in course failure regardless of violation level.

Disability-Related Accommodations

Syracuse University values diversity and inclusion; we are committed to a climate of mutual respect and full participation. My goal as an instructor is to create a learning environment that is useable, equitable, inclusive, and welcoming. Students who are in need of disability-related academic accommodations should contact the Center for Disability Resources (CDR) located at 804 University Avenue, Suite 303 and fill out a registration form on the CDR website (under the *Students* tab). Students may also email disabilityresources@syr.edu or call 315-443-4498 or TDD 315-443-1371 to communicate with CDR staff to discuss disability-accommodations or specific access needs. Students with authorized disability-related accommodations should provide a current Disabilities Accommodation Authorization Letter from CDR to the instructor and review those accommodations with the instructor. Since accommodations may require early planning and are not provided retroactively, students are encouraged to contact CDR as early as possible.

Religious Observances Notification and Policy

Syracuse University's Religious Observances Policy recognizes the diversity of faiths represented in the campus community and protects the rights of students, faculty, and staff to observe religious holy days according to their traditions. Students are given an opportunity to make up any examination, study, or work requirements that may be missed due to a religious observance, provided they notify the instructor no later than the academic drop deadline (Sep 19, 2022). For observances occurring before the drop deadline, students must notify the instructor at least *two* academic days in advance. Students may enter their observances in *MySlice* under *Student Services/Enrollment/My Religious Observances/Add a Notification*. Students are asked to consider that it is more difficult to arrange appropriate accommodations for laboratory experiments, field trips, and the final exam, so students should evaluate their need for accommodation for religious observances as they plan their schedule.

Non-Discrimination and Anti-Harassment Policies (Zero-tolerance)

Syracuse University does not discriminate and prohibits harassment (including sexual harassment, assault, domestic/dating violence, stalking, sexual exploitation, and retaliation) or discrimination related to any protected category (including creed, ethnicity, citizenship, sexual orientation, national origin, sex, gender, pregnancy, disability, marital status, age, race, color, veteran status, military status, religion, sexual orientation, domestic violence status, genetic information, gender identity, gender expression or perceived gender). If you or someone you know has been harassed or assaulted, I encourage you to obtain confidential counseling support, 24 hours a day, 7 days a week, from the Sexual and Relationship Violence Response Team at the Counseling Center (315-443-4715, 200 Walnut Place, Syracuse, New York 13244-5040). Incidents of sexual violence or harassment should be reported non-confidentially to the University's Title IX Officer (Sheila Johnson-Willis, 315-443-0211, titleix@syr.edu, 005 Steele Hall). Reports to law enforcement can be made to the University's Department of Public Safety (315-443-2224, 005 Sims Hall), the Syracuse Police Department, or 911 in case of emergency. I will seek to keep information you share with me private to the greatest extent possible; however, as an instructor, I have mandatory reporting responsibilities to share information regarding sexual misconduct, harassment, and

crimes with the University's Title IX Officer to help make our campus a safer place for all.

Health & Wellness Considerations

Mental health and overall well-being are significant predictors of academic success. Students may familiarize themselves with the range of resources the Barnes Center provides and seek out support for mental health concerns as needed. Counseling services are available 24/7, 365 days, at 315-443-8000, and students are encouraged to explore the resources available through the Wellness Leadership Institute.