WATR-503: WATER TREATMENT PLANT OPERATIONS I & II

Effective Term
Fall 2026

BOT Approval Date
12/11/2025

Discipline
WATR - Water Technology
Course Number
503

Course Title
Water Treatment Plant Operations I & II

Short Title
Water Treatment Plant OP I&II

Credit Status (CB 04)
D - Credit - Degree applicable

Units

Lecture Units
3.00

Total Units
3.00

Hours

Lecture Contact Hours
48-54
Out of Class Hours Lecture
96-108

Total Contact Hours
48 - 54

Total Out of Class Hours
96 - 108

Total Student Learning Hours
144 - 162

Distance Education
Yes

Distance Education

Distance Education Type
Both Fully Online and Hybrid Online

Fully Online Delivery Requirements:
a. Students must be notified via the college schedule of classes and the syllabus for the class if proctored tests are required for this course
b. Any planned face-to-face meetings, such as an orientation or study session, must be optional

c. The MSJC curriculum committee requires the use of accessible, asynchronous discussion as a component of every fully online course

Are you using publisher content?

No

Regular Substantive Interaction

Instructor-to-student, student-to-student, and student-to-content contact shall be distributed in a manner that will ensure regular substantive interaction (RSI) is maintained not only weekly but also for the duration of the course. Instructor interactions should be equivalent in time, quality and consistency to the engagement students would receive in a face-to-face course—for example, through announcements, discussion participation, personalized feedback, video messages, or other instructional communications. Instructors are expected to be responsive to student inquiries within a 24-72 hour time frame excluding holidays. RSI will be maintained through a variety of methods: • Orientation - Students must be oriented to the online and face-to-face portions at the start of the course. • Announcements - Announcements using the course management system must be posted at least weekly to keep students current on course events, due dates, materials, etc. • Discussion Forums - Content-related discussion forums within the designated CMS will include appropriate instructor participation and will be initiated and maintained, with timely feedback provided. Instructors are required to monitor the discussions and related activities to provide guidance and direction. Open-ended discussion boards may be used to further learning and interaction. • MSJC Communication – Instructor will use MSJC-administered communication tools (such as email or the designated CMS communication tools) to regularly communicate with and provide ease of access to students. • Timely Feedback - Timely feedback on student work will be provided by the instructor, which may include comments and/or rubrics, within the Grades area of the designated CMS. • Scheduled Meetings – Hybrid and synchronous courses will meet at regularly scheduled times. ADA Compliance - All course interactions and content must be designed with accessibility in mind and meet ADA requirements.

Catalog Description

This course offers a comprehensive foundation in drinking water treatment and the day-to-day operations of a water treatment plant. It integrates theory with practical skills to prepare students for entry-level and intermediate operator roles, including Water Treatment Plant Operator I (T-1) and II (T-2) licenses in California. The course emphasizes real-world applicability, safety, regulatory compliance, and mathematics essential to design, operate, and troubleshoot water treatment systems.

Requisites

Recommended Preparation

Recommended Preparation (note that students can enroll in the class even if they haven't take the recommended course)
WATR-790.

Codes

TOP Code (CB 03)

0958.00* - *Water and Wastewater Technology

CIP Code

15.0506 - Water Quality and Wastewater Treatment Management and Recycling Technology/Technician.

Repeatability Code

No

Grading Option

Letter grade OR P/NP

Minimum Qualifications

Minimum Qualifications	And/Or
Environmental Technologies	End

Learning Objectives

Learning Objectives

Learning Objective
1. Solve basic waterworks mathematics calculations for dosage rates, area, volume, and pressure, incorporating accessible instructional methods and clear explanations to support learners from diverse backgrounds in achieving mathematical proficiency.
2. Differentiate the various sources and treatment of water in California, recognizing how historical and structural inequities have shaped access to safe drinking water, and exploring equitable approaches to service delivery for diverse communities.
3. Evaluate various methods of disinfection as they relate to specific regulatory cases (ESWTR, TCR, and Nitrate) with attention to environmental justice considerations, transparent documentation, and inclusive stakeholder engagement in decision-making processes.
4. Analyze and explain basic water testing in laboratory procedures, ensuring accessible lab practices, culturally responsive coaching, and accommodations that support all learners in performing accurate analyses and reporting.
5. Assess and compare regulations relating to water quality by using methods of disinfection as they relate to filtration, nitrification, and corrosion control, while examining how regulations impact historically underserved communities and promoting inclusive policy interpretation and communication.
6. Assess and define the procedures and components used in water treatment—coagulation, sedimentation, and filtration—with emphasis on equitable access to safe water, inclusive teamwork in design and operation, and consideration of diverse user needs in system performance.
7. Analyze the hazards and safety procedures related to water treatment—plant safety, chemical safety, and electrical safety—through an equity lens that includes inclusive safety training, accessible safety materials, bias-aware incident reporting, and accommodations for diverse staff and contractors.
8. Compare types of reactions as applied to water treatment: physical, chemical, and biological, while incorporating culturally responsive pedagogy, multilingual resources where needed, and equitable access to hands-on experiences and interpretation of results.
9. Compare and contrast corrosion control and taste/odor control, incorporating community impact considerations, transparent communication of findings to diverse stakeholders, and opportunities to involve underrepresented groups in problem-solving and solution assessment.

Learning Outcome Information

Course Learning Outcomes

Learning Outcome
1. Students will identify water sources and distinguish between groundwater and surface water systems, recognizing how access to safe water and infrastructure impacts diverse communities differently and exploring equity considerations in service delivery.
2. Students will describe the major unit processes used in drinking water treatment and explain their purposes, with attention to how design and operations influence equity, reliability, and access for all customers
3. Students will explain how to operate and monitor typical water treatment equipment (pumps, meters, gauges) and recognize normal vs. abnormal conditions, while applying inclusive communication and teamwork practices that value diverse perspectives in problem-solving.
4. Students will apply fundamental water quality concepts (pH, turbidity, chlorine residual, temperature) and interpret routine readings, incorporating culturally responsive communication of data to diverse stakeholders and considering public health implications across communities.
5. Students will understand potential microbial and chemical contaminants and their sources, recognizing how environmental justice, historical disparities, and social determinants affect exposure risks and access to safe water.
6. Students will articulate knowledge of safety, personal protective equipment (PPE), hazard communication, and regulatory requirements, including an emphasis on creating inclusive, respectful workplaces and ensuring accommodations for diverse staff and contractors.
7. Students will perform essential water treatment mathematics for dosage calculations, flow relationships, tank/reservoir volumes, unit conversions, and chemical feed rates, while communicating methods clearly to diverse audiences and considering equitable distribution of water resources.

Content

Course Lecture Content

1. Water treatment processes
    a. Coagulation, flocculation, sedimentation, and filtration
        i. Principles of particle destabilization and aggregation
        ii. Jar testing and coagulant dose optimization
        iii. Sedimentation basin hydraulics, overflow rate calculations, and sludge handling
        iv. Filtration media types (sand, anthracite, a dual-media approach) and backwash scheduling
        v. Troubleshooting common issues (turbidity spikes, color, algae blooms) and corrective actions
    b. Disinfection processes
        i. Chlorine chemistry, breakpoint chlorination, and dechlorination strategies
        ii. Alternatives and complements (chloramine, ozone, UV) and when to apply them
        iii. Residual management, contact time, and monitoring strategies for distribution systems
    c. Corrosion control and treatment
        i. Lead and copper risk assessment, corrosion control strategies, and approaches
        ii. Impacts of pH, alkalinity, and residuals on corrosion rates
        iii. Materials selection and protective coatings for system longevity
2. Water quality and safety
    a. Water quality protection and storage
        i. Strategies to prevent recontamination after treatment (reservoir turnover, sanitary seals)
        ii. Storage tank hydraulics, mixing, and stratification considerations
        iii. Storage-related corrosion control and material compatibility with disinfectants
    b. Microbial contamination and pathogen control
        i. Pathogen types relevant to drinking water, transmission pathways, and prevention
        ii. Monitoring for microbial safety, including sampling design and frequency
        iii. Response planning for contamination events and communication strategies
    c. Contamination sources and risk assessment
        i. Source water protection, land-use impacts, and vulnerability assessments
        ii. Hazard identification, risk ranking, and mitigation planning
    d. Analytical methods and QA/QC
        i. Sample collection design, preservation, containers, and sample sizes
        ii. Laboratory QA/QC procedures, calibration routines, and method validation
        iii. Chain of custody, data integrity, and securely documenting results
    e. Chemical safety and handling
        i. Safe storage, labeling, inventory control, and spill response
        ii. PPE selection, exposure controls, and routine safety audits
        iii. Hazard communication and Safety Data Sheets (SDS) utilization in daily operations
    f. Analytical instrumentation and interpretation
        i. Disinfectant analysis (DPD methods for free and total chlorine; amperometric methods)
        ii. pH measurement techniques and calibration (buffers, temperature compensation)
        iii. Interpreting data trends for operational decisions
3. Lab and field procedures
    a. Field sampling and site assessment
        i. Site scouting, accessibility considerations, and safety planning for fieldwork
        ii. Representative sampling techniques across source, treatment, and distribution points
        iii. Chain-of-custody documentation and secure sample transport
    b. Laboratory testing workflows
        i. Standard operating procedures for routine tests (turbidity, residual disinfectants, pH, alkalinity)
        ii. Preparation, reagent handling, and timing controls to ensure accuracy
        iii. Data recording, result entry, and preliminary quality checks before reporting
    c. Documentation and record-keeping
        i. Laboratory notebooks, digital data logs, and archival practices for regulatory compliance
        ii. Version control for procedures and updated methods
        iii. Audit-ready record-keeping practices and data traceability
4. Access to safe water and infrastructure; equity in service delivery

a. Municipal aging infrastructure (Stockton, Vallejo, Fresno);
    i. Investigations into lead, Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS), and service reliability
    ii. Impact of neighborhood wealth, race/ethnicity, and housing tenure correlate with service interruptions, as well as the role of community groups in monitoring and advocacy
b. Low-income coastal/delta communities (e.g., towns and small coastal cities) facing supply reliability
    i. Intermittent service, large interties, and contractor-based management in smaller utilities
    ii. Equity of reliability, prioritization of capital projects, and access to alternative water sources during outages

5. Water treatment design/operations; influence on equity, reliability, and access
    a. Small California community water systems (CCWS) in disadvantaged communities (DACs)
        i. Frequent compliance challenges, staffing, and funding constraints
        ii. Impact of treatment facility age and staffing on reliability for DAC households, access to state-funded upgrades; consumer-facing information about water quality
    b. Desalination and energy-intensive facilities near coastal counties (e.g., Santa Barbara, Carlsbad)
        i. Water rate design and environmental justice considerations
        ii. Allocation of higher energy/water costs, benefits to adjacent communities vs. inland customers, and local public engagement processes
6. Water regulations; impact on historically underserved communities; inclusive policy interpretation and communication
    a. California Groundwater Sustainability Act and DAC protections
    b. California drinking water regulations and small systems (e.g., SDWA-equivalent state oversight for CCWS)
    c. California water efficiency and climate resilience policies in DACs (e.g., urban water use efficiency mandates)
        i. Drought response, tiered pricing, and rebates
        ii. Affordability impacts for low-income residents; accessibility of rebates and program information in multiple languages; co-design with community organizations
    d. Indigenous water rights and state-federal co-management in California
        i. Treaties, settlements, and public trust responsibilities
        ii. Effectiveness of co-management mechanisms, data-sharing, and culturally appropriate risk communication
    e. Post-disaster water regulation and recovery in California (wildfires, earthquakes)
        i. Regulatory adjustments for emergency recovery, reconstruction standards
        ii. Inclusion of vulnerable populations in recovery planning, emergency communication accessibility, and rapid funding access for DACs

Methods of Instruction

Method

Film/video Viewing and Discussion

Integration

Students will engage with a curated mix of videos and podcasts that examine California's public water resources, contexts, and regulatory frameworks, ensuring the content reflects diverse perspectives, including voices from Indigenous communities, urban and rural residents, farmworkers, utility operators, public health officials, and environmental advocates. Materials will cover historical development, current governance structures, funding mechanisms, and regulatory requirements at local, state, and federal levels, while highlighting how policy choices affect access, affordability, infrastructure resilience, and environmental justice.

DE Adaptations for MOI

All multimedia will be embedded in Canvas with full accessibility, including captions, transcripts, and alternate formats to support varied learning needs. Discussions will invite students to articulate how water issues affect different communities, surface social inequities, and explore culturally sensitive problem-solving approaches. Structured activities will guarantee equal opportunities for participation and contribution, and learners will be guided to evaluate media sources for bias, situating water management within historical and social contexts. Throughout, prompts and tasks will be designed to foster respectful dialogue and inclusive analysis, with ongoing feedback and reflection on how diversity, equity, and inclusion influence water policy and practice.

To support accessibility and inclusive learning, all multimedia will be embedded in the CMS platform with captions, transcripts, and alternative formats, and content will be organized with clear, navigable structures (headings, summaries, and accessible media descriptions). Students will critically compare sources, identify biases or framing, and connect media narratives to real-world water challenges faced by varied California communities, including underserved or marginalized populations.

Method
Field Trips

Integration
Discussion of observations derived from a field trip to a water treatment facility. Students will discuss the water filtration systems, treatment processes, and their observations.

DE Adaptations for MOI
Simulations, streaming animations, and video materials that represent drinking water plant structures and processes will be utilized to allow students to "virtually" tour these facilities and observe the different technologies involved. These visual and multi-media demonstrations of the components used in water treatment—coagulation, sedimentation, and filtration—will be posted to CMS for the students to access. Closed caption materials will be used when indicated. The assignment including the submission of observation summaries of the "virtual site" will be posted to CMS.

Method
Group Projects

Integration
Students will work in diverse groups to tackle water treatment challenges as applied to water treatment: physical, chemical, and biological, corrosion control and taste/odor control, with a focus on inclusive participation and real-world relevance. Groups will be deliberately mixed to bring a range of backgrounds and perspectives, and norms will be co-created to ensure everyone can contribute, especially quieter or underrepresented voices. Prompts will center on social justice, community impact, and culturally informed water treatment issues to foster equity awareness. Instructors will monitor group dynamics to address biases, microaggressions, or voice dominance and to model respectful, inclusive dialogue.

DE Adaptations for MOI
Distance education adaptations will be integrated through the CMS to support accessibility for all learners. Materials will be provided in accessible formats, with clear structure, captions, and transcripts where needed. Students in both in-person and online sections will have multiple ways to participate, including asynchronous discussions, text or audio contributions (with transcripts), and video if appropriate, all guided by rubrics that reward inclusive collaboration. Group work will use peer review and feedback loops, shared spaces, or project boards in CMS to organize notes and deliverables. Students will reflect after group tasks on how diversity influenced water treatment decisions and the importance of equity in the field.

Assessment will emphasize equitable participation and the incorporation of diverse perspectives into problem-solving. Deliverables (reports, diagrams, and presentations) will be submitted via the CMS with accessibility considerations, and feedback will be provided in accessible formats. The course will maintain a clear DEI commitment: groups are formed to maximize diverse viewpoints, norms prohibit bias and microaggressions, and reflective prompts connect course content to real-world disparities.

Method
Visiting Lecturers

Integration
Students will engage with guest speakers who bring current industry insights and real-world field experiences to illuminate water treatment challenges, access to safe water and infrastructure impacts. Speakers will be selected from diverse cultural, racial, gender, and socioeconomic backgrounds to broaden perspectives on technical issues and workplace realities. Presentations will reflect varied community contexts, including underserved and marginalized populations, to enhance cultural sensitivity and relevance.

DE Adaptations for MOI
To support inclusive practice, all audio-visual materials from guest lectures will be embedded within the CMS with full accessibility: captions, transcripts, and alternative formats will be provided. After each guest session, instructors will guide both instructor-led and student-facilitated discussions that examine cultural and social considerations, workplace diversity, and equity within the water sector, using prompts that solicit input from all students and promote respectful dialogue. Ongoing feedback and reflection will encourage students to articulate how diversity, inclusion, and equitable practices influence water treatment decisions and organizational cultures.

Method

Online Activity/Discussion

Integration

Group discussions of current news articles on water treatment, including desalination and advances in direct filtration, will connect course concepts to real-world developments. The instructor will facilitate equitable participation, rotating roles (moderator, recorder, presenter) to ensure all voices are heard and to model inclusive collaboration.

DE Adaptations for MOI

Online discussions and asynchronous forums will carry forward current topics, with the instructor guiding critical analysis and synthesis of readings. Students will be encouraged to cite diverse sources and consider impacts on different communities. DEI considerations will emphasize accessibility of materials and respect for varied perspectives.

Alternative discussion formats (short video summaries, infographic analyses) will be offered to accommodate different communication strengths and access needs. The instructor will ensure that online discussions remain inclusive and constructive. In the CMS, discussions will support screen-reader compatibility, adjustable font sizes, and the ability to attach accessible documents or multimedia with captions and transcripts.

Methods of Evaluation

Method

Exams/Tests

Integration

Exams will assess knowledge and problem-solving across core topics such as waterworks mathematics, sources, disinfection, water quality, and corrosion control. Questions will combine multiple-choice, short answer, and problem-solving items aligned with prior in-class discussions and practice problems to ensure alignment with course objectives and safety/regulatory standards. Instructors will use rubrics that describe criteria for correctness, reasoning shown, and the application of concepts to realistic plant scenarios.

DE Adaptations for MOE

Exams will be submitted electronically via the CMS, with options for upload and secure exam environments as appropriate. Feedback will be delivered through the CMS rubrics and annotated answer sheets within one to two class days of submission.

DE Adaptations for the MOE Accommodations may include alternative submission formats (e.g., scans of handwritten work, audio explanations of problem-solving steps), extended time windows, and alternative item formats to support access without changing core assessment goals. Feedback methods will be flexible to meet diverse access needs, including written, audio, or video explanations, and feedback delivery will be documented within the CMS for transparency.

Method

Other

Integration

Graded assignments/Worksheets Students will submit worksheets in hard copy or scanned form, and instructors will provide timely, criterion-based feedback referencing specific rubric criteria. Feedback will be delivered in person or via annotated rubrics, with opportunities for brief one-on-one clarification during office hours. DEI considerations will ensure prompts reflect inclusive communities and that language is accessible to multilingual learners

DE Adaptations for MOE

Assignments will be submitted through the CMS, with rubrics applied identically across modalities. Feedback will be posted within the CMS, with options for private comments or public exemplars, and students can request revisions or clarification. DEI adaptations will include multilingual prompts and accessible formats, plus options for alternative demonstrations of mastery (e.g., slide decks or audio narrations) if needed.

Alternative submission formats (audio narration, captioned videos, or oral defenses) may be offered. Flexible deadlines within policy and scaffolds such as sentence starters or glossaries will support students while preserving assessment rigor.

Method

Quizzes

Integration

Periodic short objective quizzes will measure comprehension and retention of course-related concepts, including water treatment operations, distribution system roles, and safety considerations. Quizzes will be aligned with learning objectives and practice problems from lectures and labs, with quick feedback to guide subsequent study. DEI considerations will include diverse context items and accessible formats to minimize barriers for language learners and students with different study practices.

DE Adaptations for MOE

Quizzes will be taken online with automatic scoring and instant feedback. Instructors will provide annotated explanations and accessible formats (captioned videos, screen-reader friendly materials). DEI-focused instructional design will ensure varied contexts and inclusive representation.

Extensions may include extended time, read-aloud item prompts, or shortened item stems (see examples) to support accessibility while keeping the core goals intact. These accommodations help students by reducing barriers to demonstrating knowledge, keeping items clear, scannable, and aligned with learning outcomes. Shortened stems will also preserve the essential tasks and depth of knowledge of water treatment operations, while extended time and read-aloud prompts improve accessibility without changing the assessment's core objectives.

Shortened item stem examples:
Multiple choice (recall/understand): Original: "Which of the following best describes the primary function of a water treatment plant in removing contaminants and ensuring safe drinking water?" Shortened: "What is the primary function of a water treatment plant?"

Multiple choice (apply): Original: "Given a scenario where a community lacks reliable disinfection, which treatment option would best restore safe water quality while considering cost and energy use?" Shortened: "Which disinfection option best restores water quality given the scenario?"

Method

Research Projects

Integration

Research Projects on topics such as how water treatment design and operations influence equity, reliability, will be submitted as in-class presentations or handouts uploaded for assessment, with rubrics evaluating research quality, regulatory alignment, and communication. Feedback will be delivered as written comments and/or rubric-guided oral feedback during presentations. DEI considerations will guide group formation to ensure diverse perspectives and equitable participation.

DE Adaptations for MOE

A written report or research paper will be utilized to research current issues concerning the water industry and pending regulations pertaining to water treatment operations. The ability to apply the concepts of water treatment in a cohesive manner and in a regulatory context will be emphasized. Written presentations of environmental research information will involve use of online library resources and the world-wide web. Students will be graded based on their ability to clearly convey findings from electronic and printed resources with proper documentation and the professional presentation of the work. The finished written product will be submitted for evaluation through the CMS with grades and/or comments posted also using CMS.

Method

Group Projects

Integration

Small-group activities on fundamental water quality concepts (pH, turbidity, chlorine residual, temperature) along with interpretation of routine readings microbial and chemical contaminants and their sources, will be evaluated through instructor observations of collaboration and mastery of concepts, with opportunities to reflect on group processes. Participation will be monitored to emphasize inclusive engagement. DEI considerations will include structured roles and equitable participation opportunities.

DE Adaptations for MOE

Online small-group work will be assessed for collaboration quality, contribution balance, and problem-solving outcomes, with accessible collaboration tools and clear expectations for all members. DEI adaptations may include alternative participation modalities and flexible attendance options.

Flexible grouping, individual reflections paired with group results, and asynchronous collaboration options (i.e. discussion forums, message boards, collaborative documents, or blogs) will be made available to support diverse schedules and communication styles, while preserving course learning objectives.

Method

Homework

Integration

Take-home word problem worksheets will cover dosage rate, area, volume, and pressure, with opportunities for oral or written discussion of solutions during class. The instructor will model problem-solving strategies, provide worked examples, and offer guided feedback in person to support multiple learning styles.

DE Adaptations for MOE

Homework submissions will be collected via the CMS, with rubrics that emphasize clarity of reasoning, accuracy of calculations, and the ability to justify solutions. The instructor will provide written feedback and hold optional virtual office hours to discuss challenges.

DE adaptations will include accessible problem statements, multilingual glossaries, and options for alternative submission formats (audio narration, slide decks, or annotated PDFs). All documents will be tagged in the CMS with proper heading structure, alt text, and readable fonts. The instructors will provide feedback in the CMS using supported formats (text comments, audio feedback, or video feedback with captions).

Alternative prompts, extended time, or additional scaffolds (step-by-step guides, glossary terms) will be available to support learners who need more structured guidance without compromising rigor.

Assignments

Assignment Type

Reading

In-class and/or outside of class

In-class
Outside of class

Formative or Summative

Summative

Assignment

Read Chapters #1 and #2 from the textbook, focusing on the core responsibilities of a water treatment operator and the scientific principles of the water hydrological cycle. As you read, consider the following questions. These topics will be integrated into the chapter test to ensure a holistic understanding of the material.

1. The Operator's Role: Beyond the Technical: How does the role of a water treatment operator intersect with issues of public health and environmental justice? Think about historical and systemic factors, like redlining, that have led to disparities in water quality and access for communities of color and low-income populations. What ethical obligations does an operator have to ensure equitable service?

2. The Hydrological Cycle and Community Impact: The hydrological cycle is often presented as a purely natural process. However, human infrastructure (dams, pipes, treatment plants) and actions (pollution, climate change) significantly impact it. How do these

human-driven changes affect different communities, especially those historically marginalized, and what is our responsibility to mitigate these impacts?

3. Anti-Racism in Water Operations: Reflect on how systemic racism may have influenced the development and distribution of water infrastructure in the past. What does an anti-racist approach to water operations and management look like today? How can operators and the water sector as a whole work to address historical inequities and ensure fair access to clean water for all?

How assignment will be adapted in online format

Asynchronous Discussion Forum: Instructor will create discussion boards in the CMS for each DEI-AR question. For example, a forum on "Operator's Role; Beyond the Technical" could require students to post their ideas and respond to at least two classmates, fostering a deeper exchange of ideas.

Assignment Type

Writing

In-class and/or outside of class

In-class
Outside of class

Formative or Summative

Formative

Assignment

Research Paper Assignment: Water Resource Management and Environmental Justice
Assignment Description: This assignment will require students to write a four-to-five-page research paper exploring the intersection of water resource management, treatment operations, and the principles of diversity, equity, and inclusion (DEI), and anti-racism (AR). The written work product should investigate a specific aspect of water quality or a water-related environmental challenge, using the technical knowledge gained in this course, while critically examining its impact on different communities

How assignment will be adapted in online format

A central goal of this paper is to analyze how the benefits and burdens of water treatment and policy are distributed across various populations, particularly historically marginalized groups, including but not limited to communities of color, low-income populations, and Indigenous communities. The assignment can be presented within the CMS. Students can use online research tools, government databases, and mapping resources to gather information relevant to the DEI-AR questions.

Assignment Type

Other

In-class and/or outside of class

In-class
Outside of class

Formative or Summative

Summative

Assignment

Students will use the assigned "Blending and Dilution Calculations" worksheet to perform the required mathematical computations for alum dosage.

1. Perform the Mathematical Calculations: Using the assigned worksheet, perform the basic mathematical calculations to determine the required dosage, feed rate, and concentration of alum to be used during the sedimentation process. Students must clearly show your work and provide the final calculated values for the specified flow rate.

2. Analyze the Technical Justification: Explain the technical reasons for using alum coagulation in the scenario described. Your explanation should include:
a. The scientific purpose of alum (aluminum sulfate) in treating the source water.

b. The parameters (e.g., turbidity, pH) that you must monitor to ensure the effectiveness of the treatment.

How assignment will be adapted in online format

The "Blending and Dilution Calculations" worksheet can be converted into an online quiz or an interactive module. This allows students to practice the calculations at their own pace and receive automated feedback before applying the concepts for example:

Resource Allocation: In an equitable scenario, how should a water utility determine the "given flow rate" for treatment?

Course Materials

Textbooks

California State University, Office of Water Programs (2017). Water Treatment Plant Operation, Volume I California State University, Sacramento. ISBN: 978-1-323-78665-9.

Lane, A., Norton M., Ryan, S. (2017). Water Resources: A New Water Architecture, Norton M., Ryan, S.. Water Resources: A New Water Architecture . ISBN: 978-1-118-79390-9

Clausen. J. C (2018). Introduction to Water Resources Waveland Press. ISBN: 978-1-47862-800-2.

Textbook availability is limited for this subject area. The chosen textbook is widely regarded by water industry professionals as best practice and provides solid coverage of current standards and methods. To support understanding, the instructor will supplement the text with additional materials, including handouts, case studies, and data sheets that align with the course goals. These handouts will offer practical examples, updated regulatory context, and notes to connect textbook content to real-world applications.

Other Resources

Textbook availability is limited for this subject area. The chosen textbook is widely regarded by water industry professionals as best practice and provides solid coverage of current standards and methods. To support understanding, the instructor will supplement the text with additional materials, including handouts, case studies, and data sheets that align with the course goals. These handouts will offer practical examples, updated regulatory context, and notes to connect textbook content to real-world applications.

Class Size Information

Class Size

40

Class Size Category

A - Lecture/discussion 40

Diversity and Inclusion

Course Design and Materials: Course will incorporate diverse perspectives, authors, and examples that reflect a variety of cultures, identities, and lived experiences. Instructional materials will be reviewed regularly to ensure representation, inclusivity, and alignment with equity-minded practices across disciplines.

Inclusive Learning Environment: Instructors will establish classroom norms and policies that promote respect, civil discourse, and belonging in both online and face-to-face classes. Clear expectations for communication and engagement will support a learning space where all students feel valued and heard.

Accessible Instruction: Course content will be delivered using accessible design. Materials will follow accessibility guidelines within the CMS, including captioned media, readable document formats, and multiple means of engagement to support diverse learning.

Equitable Teaching Practices: Instructors will use transparent and grading criteria, varied assessment methods, and timely feedback to promote fairness and student success. Opportunities for revision, reflection, and multiple demonstrations of learning may be incorporated when appropriate to the discipline.

Culturally Responsive Pedagogies: Instructional strategies will encourage critical thinking about diverse perspectives and systems of power relevant to the course content. Faculty will foster opportunities for students to connect course material to real-world contexts.

Ongoing Reflection and Improvement: Faculty will engage in continuous professional development related to IDEAA principles and reflect on course practices using metacognition to identify opportunities for increased equity, inclusion, and accessibility.

Explain how diversity and inclusion(e.g., gender, culture/race, sexuality, etc.) is infused into the course.

In order to promote inclusivity and cultural responsiveness within the course, various strategies will be implemented to ensure that all students feel represented and engaged regardless of their background or identity. While the Environmental Technologies discipline may not directly address diversity, equity, and inclusion (DEI) issues, it is crucial that the course content reflects diverse perspectives whenever relevant.

The course design will focus on incorporating a range of methods to structure the content and create a learning environment that caters to the needs of all learners. This will include activities and assignments that foster a sense of community through collaborative work, as well as providing support and guidance to students who may be facing challenges. Universal design principles will be employed to present information in multiple formats, such as oral and visual, to accommodate various learning preferences and address potential visual or auditory impairments.
Moreover, careful consideration will be given to the selection of course materials and technologies to ensure that diverse viewpoints and voices are represented. Readings, videos, graphics, and other resources will be chosen to reflect a range of perspectives and ideas. The course will incorporate a variety of materials, such as scholarly works and open educational resources, that showcase different beliefs and viewpoints. Lecture examples, PowerPoints, and infographics will also be designed to include a diverse array of human examples and representations, while avoiding stereotypes.

Additionally, assignments will be reviewed to ensure that they are relevant and relatable to students from diverse backgrounds and cultures. Assessments will be framed within socio-cultural contexts and will emphasize progress and effort rather than innate talent. Grading practices will be flexible to allow students the opportunity to improve and recover from any early challenges they may face in the course. These strategies will collectively contribute to creating a learning environment that is inclusive, culturally responsive, and supportive of all students.

Describe how assignments, instruction, evaluation, course content, and interactions are contextualized for diverse learners promoting an equitable course.

This introductory course in drinking water treatment will ensure equitable access to foundational knowledge, practical skills, and licensure readiness (T-1 and T-2) by blending theory with real-world applications, safety, regulatory compliance, and essential mathematics. Equity will start with a needs assessment that captures prior knowledge, learning preferences, and accessibility needs, creating a student resource bank and optional practice tasks. Early data will guide targeted supports, including video explanations and alternative assignments that affirm different starting points.

Assessments will emphasize progress and effort, using clear, objective rubrics to provide fair feedback and multiple opportunities to improve. Visual, auditory, and kinesthetic learners will benefit from simulations, animations, and practice tests, plus campus math and technical writing support to close skill gaps. Instruction will use multimodal delivery tied to licensing outcomes and regulatory requirements to stay relevant for diverse learners and career goals.

Video accessibility will be central: all videos will include captions and transcripts, downloadable slide decks and narrated summaries, adjustable playback speed, instructor annotations and ASL where appropriate, accessible metadata, and screen-reader friendly structure. Caption accuracy will be regularly reviewed, with options for alternative formats (audio-only or modular segments) via the accessibility support team. The design will explicitly map content, assignments, instruction, evaluations, and interactions to equity goals and T-1/T-2 objectives, creating a clear path from foundational knowledge to competent practice in water treatment operations.

Interactions

Explain how the course will incorporate student-to-student interaction.

Incorporation of Student-to-Student Interaction
The course will emphasize collaborative learning and peer engagement to enhance understanding, foster diverse perspectives, and build a supportive learning community. Key strategies include:

1. Collaborative Group Projects:
Students will work in diverse groups to analyze case studies, develop water treatment plans, or design community outreach strategies. This promotes teamwork, peer learning, and appreciation of different cultural and experiential backgrounds.

2. Discussion Forums and Online Dialogues:
Structured discussion boards will facilitate ongoing conversations on topics such as water justice, cultural considerations, and ethical practices. Students will be encouraged to respond to peers' posts, share insights, and challenge ideas in a respectful manner.

3. Peer Review and Feedback:
Students will review each other's assignments, proposals, or reflections, providing constructive feedback. This promotes critical engagement, enhances learning from multiple perspectives, and develops communication skills.

4. Peer-Led Presentations and Sharing:
Students will have opportunities to prepare and deliver short presentations on selected topics, fostering peer-to-peer teaching and dialogue. This cultivates leadership and confidence, especially in diverse cultural contexts.

5. Small Group Discussions and Case Analyses:
Instructors will organize breakout sessions or small-group activities during synchronous sessions, allowing students to discuss complex issues more intimately, share cultural insights, and collaboratively solve problems.

6. Community Engagement Activities:
Students may collaborate on projects or research that involve local communities or organizations, encouraging dialogue and relationship-building beyond the classroom.

7. Reflection and Sharing of Personal Perspectives:
Assignments will include prompts for students to share their personal experiences, cultural backgrounds, or viewpoints, fostering mutual understanding and respect among peers.

Explain how the course will incorporate instructor-to-student interaction.

The course will be designed to foster meaningful and ongoing interaction between the instructor and students, which is essential for personalized guidance, motivation, and clarification of complex concepts.

Key strategies include:
1. Regular Feedback on Assignments and Reflections:
Instructors will provide timely, constructive feedback on written assignments, reflections, and participation to help students deepen their understanding, recognize strengths, and address misconceptions.

2. Synchronous and Asynchronous Q&A Sessions:
Scheduled live sessions (e.g., webinars, virtual office hours) will allow students to ask questions directly to the instructor, engage in discussions, and clarify uncertainties in real-time. Additionally, asynchronous communication channels (discussion boards, email) enable ongoing dialogue.

3. Personalized Guidance and Mentorship:
Instructors will offer personalized support tailored to students' backgrounds, interests, and learning needs, especially when discussing complex technical topics or social justice issues. This may include one-on-one mentoring or advising.

4. Facilitation of Discussions and Debates:
Instructors will actively moderate and participate in online discussions, encouraging students to critically analyze topics related to water treatment, equity, and inclusion. They will pose probing questions to stimulate deeper thinking.

5. Monitoring and Encouraging Engagement:
Using learning management system analytics, instructors will monitor participation and reach out to students who may be less active, providing encouragement and additional support to foster engagement.

6. Incorporating Real-World Examples and Case Studies:
Instructors will share relevant case studies and personal experiences to connect theoretical content with practical applications, making learning more relatable and meaningful.

7. Supporting Diverse Learning Needs:
Instructors will adapt communication styles and provide additional resources to accommodate diverse learners, ensuring equitable access to knowledge and support.

Explain how the course will incorporate student-to-content interaction.

Incorporation of Student-to-Content Interaction
The course is designed to actively engage students with the material through various interactive strategies that promote deep understanding, critical thinking, and personal connection to the content.
Key methods include:
1. Interactive Readings and Case Studies:

Students will analyze and discuss real-world case studies related to water treatment and social justice issues. These activities encourage them to apply theoretical concepts to practical situations, fostering active engagement with course content.

2. Reflective Journals and Self-Assessment:
Students will maintain reflective journals where they critically consider how course topics relate to their own backgrounds, beliefs, and future professional roles. This ongoing reflection deepens their personal connection to the material.

3. Quizzes and Concept Checks:
Periodic online quizzes and quick assessments will be embedded within the course modules to reinforce understanding, prompt active recall, and identify areas needing further review.

4. Problem-Based Learning Activities:
Students will work through complex scenarios or problems related to water treatment challenges, requiring them to synthesize information from readings and lectures to develop solutions.

5. Multimedia and Interactive Modules:
The course includes videos, animations, and simulations that allow students to visualize processes like reverse osmosis or ion exchange, providing an engaging way to explore technical concepts.

6. Discussion Forums and Online Dialogues:
Although primarily fostering student-to-student interaction, discussion forums also serve as an active engagement with content, where students pose questions, analyze readings, and debate topics related to social justice and technical practices.

7. Self-Directed Research Projects:
Students will select topics related to water treatment and social equity to research further, creating presentations or reports that demonstrate their understanding and personal engagement with the content.

8. Application Assignments:
Assignments such as designing a water treatment plan for a diverse community or evaluating policies through an equity lens require students to apply their knowledge creatively and critically

Explain how the course will incorporate student-to-self interaction (metacognitive).

The course will be structured to promote students' reflection on their own learning processes, fostering self-awareness, critical thinking, and personal growth.

Key strategies include:
1. Reflective Journals and Learning Logs:
Students will regularly maintain journals where they record their understanding of key concepts, questions that arise, and insights gained. This encourages them to monitor their progress, identify areas of confusion, and set goals for improvement.

2. Self-Assessment Exercises:
Throughout the course, students will complete self-assessment checklists or reflection prompts after each module or major topic. These activities prompt them to evaluate their grasp of the material, recognize their strengths, and identify gaps in knowledge.

3. Goal-Setting Activities:
At the start and midpoint of the course, students will define personal learning goals related to mastering technical skills and understanding social justice issues. They will revisit and revise these goals, fostering ownership of their learning journey.

4. Critical Reflection Assignments:
Assignments will include prompts such as: "Reflect on how your perspective has evolved regarding equity in water management," or "Identify how your cultural background influences your understanding of water access issues." This encourages deep personal engagement and self-awareness.

5. Metacognitive Questioning:
Throughout lectures and readings, students will be encouraged to ask themselves questions like: "Do I understand this concept? How does this relate to my previous knowledge? What strategies can I use to improve my understanding?" This internal dialogue enhances active learning.

6. Learning Strategy Evaluation:

Students will periodically evaluate which study methods and learning strategies are most effective for them, promoting adaptive learning and self-regulation.

7. Portfolio Development:
At the course's conclusion, students will compile a portfolio reflecting on their learning process, including key insights, challenges faced, and how they plan to apply their knowledge in real-world contexts.

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