

CVEN4504

Advanced Water and Wastewater Treatment

Term 3, 2022



Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
David Waite	d.waite@unsw.edu.au	Consultation by appointment only	Room 114 H22 - Vallentine Annexe	9385 5060
An Ninh Pham	anninh.pham@unsw.edu.au	Consultation by appointment only	Room 108 H22 - Vallentine Annexe	9385 5102

School Contact Information

[Engineering Student Support Services](#) – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

[Engineering Industrial Training](#) – Industrial training questions

[UNSW Study Abroad](#) – study abroad student enquiries (for inbound students)

[UNSW Exchange](#) – student exchange enquiries (for inbound students)

[UNSW Future Students](#) – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

Course Details

Units of Credit 6

Summary of the Course

The course discusses both the fundamental concepts and practical aspects involved in the design of various conventional and advanced treatment unit processes to meet specified water quality standards with emphasis on removal of non-traditional and emerging contaminants.

Course Aims

To provide a comprehensive understanding of the fundamental concepts and design principles in both conventional and advanced water treatment unit processes.

Course Learning Outcomes

1. Identify important water quality parameters and various constituents that affect water quality.
2. Analyse the principles of chemical reactions and concepts involved in design of important treatment units in a conventional treatment plant including coagulation, flocculation, clarification, mixed-media filtration and disinfection
3. Apply various advanced treatment methods including: a) advanced oxidation and reductive processes b) membrane-based treatment processes c) electrodialysis and capacitive deionization d) adsorption and ion exchange processes to produce water of high-quality standards.
4. Evaluate and disseminate knowledge and technologies from published literature effectively in a written report or as a seminar presentation.
5. Develop interpersonal and process management skills in team-work environments.

Teaching Strategies


Please refer to the information in Moodle

Additional Course Information

For each hour of contact it is expected that you will put in at least 1.5 hours of private study.

Assessment

Late work will be penalised at the rate of 5% per day (after the due time and date have expired) and capped at 5 days (120 hours), after which a student cannot submit an assessment, and no permitted variation.

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Quizzes	25%	Each quiz is due at a different date (see course outlines)	1, 2, 3
2. Final exam	50%	During the exam period	1, 2, 3
3. Group Work Assessments 	25%	See course outlines	1, 2, 3, 4, 5

Assessment 1: Quizzes

Due date: Each quiz is due at a different date (see course outlines)

All quizzes are online assessments. Quiz 1 (5%) is designed to provide an early feedback on student performance prior to the census date. Quiz 2 and Quiz 3 are both worth 7.5% while Quiz 4 is worth 5%.

Assessment 2: Final exam

Due date: During the exam period

Final exam is a 2 hr online, open book exam.

Assessment 3: Group Work Assessments (Group)

Due date: See course outlines

This is a team work assessment which consists of a) an in-class presentation worth 10%, b) a written report worth 10% and c) semina engagement worth 5%.

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Schedule

Tue 9:00AM - 11:00AM (Matthews 102/Online)

Thu 12:00PM - 2:00PM (Matthews 102/Online)

[View class timetable](#)

Timetable

Date	Type	Content
Week 1: 12 September - 16 September	Lecture	Introduction to Water Quality & Treatment Processes: <ul style="list-style-type: none">• Australian Drinking Water Guidelines and water quality parameters• Overview of water treatment unit processes
Week 2: 19 September - 23 September	Lecture	Principles of Chemical Reactions: <ul style="list-style-type: none">• Chemical reactions and stoichiometry• Equilibrium reactions and thermodynamics of chemical reactions• Reaction kinetics• Reactions used in water treatment
Week 3: 26 September - 30 September	Lecture	Coagulation & Flocculation: <ul style="list-style-type: none">• Surface charge of particles in suspension• Coagulants and mechanisms of coagulation• Coagulation practices• Flocculation modelling• Flocculation practices
Week 4: 3 October - 7 October	Lecture	Clarification & Mixed-media Filtration: <ul style="list-style-type: none">• Particle settling theory• Conventional sedimentation basin design• Alternative sedimentation processes• Rapid filtration classification and filter media• Models for rapid filter behaviour• Rapid filter design
Week 5: 10 October -	Lecture	Disinfection & Advanced Oxidation Processes:

14 October		<ul style="list-style-type: none"> • Disinfection kinetics • Design of disinfection contactors • Disinfection with free and combined chlorine, chlorine dioxide, ozone and UV • Advanced Oxidation Processes (AOP) • Kinetics of AOPs and major factors affecting AOPs • Types of AOPs
Week 7: 24 October - 28 October	Lecture	<p>Membrane Processes:</p> <ul style="list-style-type: none"> • Membrane classification, properties & configuration • Filtration mechanism, permeate flux and fouling • Process design of membrane filtration • Application for reverse osmosis (RO) • RO process description • RO fundamentals and fouling
Week 8: 31 October - 4 November	Lecture	<p>Electrodialysis & Capacitive Deionization:</p> <ul style="list-style-type: none"> • Fundamentals of ED and its applications • ED process design and energy requirement • Unique advantages of CDI and cell architectures • Operational modes of a CDI system and key performance indicators • Reactions at, and materials for CDI electrodes
Week 9: 7 November - 11 November	Lecture	<p>Adsorption & Ion Exchange:</p> <ul style="list-style-type: none"> • Fundamentals of adsorption & adsorption isotherms • Powdered and granular activated carbon • Fundamental of ion exchange and mechanisms • Classification and properties of ion exchange media • Ion exchange process configuration
Week 10: 14 November - 18 November	Lecture	<p>Residuals Management:</p> <ul style="list-style-type: none"> • Sources and characterization of residuals • Management of residual liquid stream & concentrate • Management of sludges

Resources

Recommended Resources

1. Water Treatment: Principles and Design, 3rd Edition, MWH, Wiley, 2012.
2. Water Quality Engineering: Physical/Chemical Treatment Processes, Benjamin & Lawler, Wiley 2013.

Submission of Assessment Tasks

Please refer to the Moodle page of the course for further guidance on assessment submission.

UNSW has a standard late submission penalty of:

- 5% per day, for all assessments where a penalty applies, capped at five days (120 hours), after which a student cannot submit an assessment, and no permitted variation.

Academic Honesty and Plagiarism

Beware! An assignment that includes plagiarised material will receive a 0% Fail, and students who plagiarise may fail the course. Students who plagiarise are also liable to disciplinary action, including exclusion from enrolment.

Plagiarism is the use of another person's work or ideas as if they were your own. When it is necessary or desirable to use other people's material you should adequately acknowledge whose words or ideas they are and where you found them (giving the complete reference details, including page number(s)). The Learning Centre provides further information on what constitutes Plagiarism at:

<https://student.unsw.edu.au/plagiarism>

Academic Information

Final Examinations:

Final exams in T3 2022 will be held online between 25th November - 8th December 2022 inclusive, and supplementary exams between 9th - 13th January 2023 inclusive. You are required to be available on these dates. Please do not to make any personal or travel arrangements during this period.

ACADEMIC ADVICE

- Key Staff to Contact for Academic Advice (log in with your zID and password): <https://intranet.civeng.unsw.edu.au/key-staff-to-contact-during-your-studies-at-unsw>
- [Key UNSW Dates](#) - eg. Census Date, exam dates, last day to drop a course without academic/financial liability etc.
- CVEN Student Intranet (log in with your zID and password): <https://intranet.civeng.unsw.edu.au/student-intranet>
- Student Life at CVEN, including Student Societies: <https://www.unsw.edu.au/engineering/civil-and-environmental-engineering/student-life>
- Special Consideration: <https://student.unsw.edu.au/special-consideration>
- General and Program-Specific Questions: [The Nucleus: Student Hub](#)
- Book an Academic Advising session: <https://app.acuityscheduling.com/schedule.php?owner=19024765>

Disclaimer

This course outline sets out description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle should be consulted for the up to date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline (as updated in Moodle), the description in the Course Outline/Moodle applies.

Image Credit

Mike Gal.

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.