CVEN2701

Water and Atmospheric Chemistry

Term 2, 2022

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
T. David Waite	d.waite@unsw.edu.au		Room 114 (H22 – Vallentine Annexe)	9385 5060
A. Ninh Pham	anninh.pham@unsw.edu.au		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

This course aims to provide an introduction to water chemistry and atmospheric chemistry, as a foundation for understanding both the natural processes in these environments and the effects of pollution on them. It will build on the basic chemical concepts learned in CHEM1011 and will develop additional concepts as required, in order to describe the chemical processes occurring in aquatic and atmospheric systems.

Course Aims

To provide students with fundamental concepts of water chemistry that may be encountered by environmental engineers.
To provide a basis for more advanced courses in later years in water quality, water and wastewater treatment, contaminant fate and transformation and waste management.

Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Demonstrate understanding of the basic concepts in water and atmospheric chemistry including: a) chemical equilibrium and thermodynamics, b) chemical reaction kinetics c) acids and bases, d) alkalinity, e) solid dissolution and precipitation, f) complexation reactions, g) redox reactions and h) reactions on solid surfaces	PE1.1, PE1.2, PE1.3
2. Predict the behaviour and/or estimate the concentrations of various environmentally important chemicals in aquatic and atmospheric systems.	PE1.2, PE1.5, PE2.1, PE2.2
3. Describe the various chemical processes that occur in rivers, lakes, groundwater, marine and atmospheric environments.	PE1.3, PE2.1, PE2.2
4. Extend skills and knowledge of a specific system to explain/solve complex, real world type problems	PE2.1, PE2.2, PE2.4, PE3.1, PE3.3

Teaching Strategies

The teaching strategies that will be used in this course are traditional lecture teaching combined with workshop and independent study.

The approaches to learning are:

Private Study	• Review lecture material and textbook • Do set problems and assignments • Join Moodle discussions of problems • Reflect on class problems and assignments • Download materials from Moodle • Keep up with notices and find out marks via Moodle
Lectures	• Find out what you must learn • See methods that are not in the textbook • Follow worked examples • Hear announcements on course changes
Workshops	• Be guided by Demonstrators • Practice solving set problems • Ask questions
Assessments	• Demonstrate your knowledge and skills • Demonstrate higher understanding and problem solving

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

All assessments are individual.

The online census-quiz (5%) will be uploaded on UNSW Moodle one week prior to the due date mentioned above. Students can attempt this quiz in their own time within that one-week period once. The online mid-term quiz (20%) however, will only be available at the designated time as mentioned above.

Both census-quiz and mid-term quiz may have short-answer, multiple choice, true-false, fill in the blanks and/or calculation-based questions. Please ensure that your computer is UNSW Moodle compatible before attempting the quizzes. Please check the following link for system requirement for UNSW Moodle and other information on UNSW Moodle.

https://moodle.telt.unsw.edu.au/

Please inform the course coordinator/lecturer immediately if you are not able to take the quiz in the allotted time or regarding any computing problems.

Assignments are to be submitted to the designated assignment box located on Level 1, Building H20 (under the name CVEN2701 Waite/Pham). Students are responsible to keep spare copies of their submitted assignments.

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Online census quiz	5%	26/06/2022 11:00 PM	1, 2
2. Online mid-term quiz	20%	14/07/2022 05:15 PM	1, 2, 3, 4
3. Assignment	25%	05/08/2022 12:00 AM	1, 2, 3, 4
4. Final Exam	50%	Not Applicable	1, 2, 3, 4

Assessment 1: Online census quiz

Start date: 19/06/2022 11:00 PM
Submission notes: This is an online submission.
Due date: 26/06/2022 11:00 PM
Deadline for absolute fail: 26/06/2022
Marks returned: 26/06/2022

Materials in Unit 1 to be assessed.

This is not a Turnitin assignment

Assessment criteria

This is an online quiz.

Assessment 2: Online mid-term quiz

Start date: 14/07/2022 04:15 PM
Submission notes: This is an online submission.
Due date: 14/07/2022 05:15 PM
Deadline for absolute fail: 14/07/2022
Marks returned: 24/07/2022

Materials in Units 1 and 2 to be assessed.

This is not a Turnitin assignment

Assessment criteria

This is an online assessment and is open book.

Assessment 3: Assignment

Submission notes: Submit in Waite/Pham Assignment Box, Level 1, Building H20.
Due date: 05/08/2022 12:00 AM
Deadline for absolute fail: 10/08/2022
Marks returned: 14/08/2022

Materials in Units 3, 4 and 5 to be assessed.

This is not a Turnitin assignment

Assessment criteria

This is a calculation-based written assignment.

Assessment 4: Final Exam

Start date: TBD

Materials in Units 1-6 to be assessed.

Assessment criteria

This is an online exam that will take place during the exam period. It is an open book exam.

Hurdle requirement

A mark of at least 40% in the final examination is required before the class work is included in the final mark.

Attendance Requirements

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

Course Schedule

View class timetable

Timetable

Date	Type	Content
Week 1: 30 May - 3 June	Lecture	*Foundation considerations* • Global carbon cycle • Concentration units • Tableau method: properties of components, mole balance equations • Electroneutrality condition
Week 2: 6 June - 10 June	Lecture	*Chemical equilibrium and energetics* and Tools for problem-solving • Thermodynamics of chemical systems: equilibrium and mass law equations • Solution of chemical equilibrium problems: Trial and error and graphical method (LogC-pH diagram) • Effect of ionic strength in non-ideal systems
Week 3: 13 June - 17 June	Lecture	*Kinetics of chemical reactions* • Types and orders of reactions • Reaction mechanisms, rates, rate constants and half-life
Week 4: 20 June - 24 June	Lecture	*Acids and bases: pH and alkalinity* • Major acid/base systems and acidity constants • Alkalinity concept • Equilibrium with the gas phase • Acid rain
Week 5: 27 June - 1 July	Lecture	*Acids and bases: Effects of biological processes* • Mixing of two waters • Effects of biological processes on pH and alkalinity

Week 6: 4 July - 8 July	Reading	***Non Teaching Week. Use this time to catch up on your work.***
Week 7: 11 July - 15 July	Lecture	*Solid dissolution and precipitation* • Solubility of metal hydroxides ($Fe(OH)_3(s)$) • Solubility of carbonates ($CaCO_3$) • Acquisition of alkalinity in freshwaters
	Assessment	Online mid-term quiz: This is an online submission.
Week 8: 18 July - 22 July	Lecture	*Complexation* • Aqueous complexes: fundamental concepts • Ion association among major aquatic constituents • Inorganic complexation of trace elements • Organic complexation
Week 9: 25 July - 29 July	Lecture	*Oxidation – Reduction* • Fundamental concepts of redox reactions • Energetics of microbial processes • pe-pH diagrams
Week 10: 1 August - 5 August	Lecture	*Reactions on solid surfaces* and *Revision* • Coordinative properties of surfaces and adsorption isotherms • Complexation model of adsorption: Adsorption of lead on alumina example • Adsorption kinetics, particle settling & aggregation
	Assessment	Assignment: Submit in Waite/Pham Assignment Box, Level 1, Building H20.

Resources

Prescribed Resources

- Prescribed text: Morel, F.M.M. and Hering, J.G. (1993) Principles and Applications of Aquatic Chemistry, Wiley Interscience, New York

Recommended Resources

- Additional materials provided on Moodle.

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 T2 2022 will be held online between 12th - 25th August 2022 inclusive, and supplementary exams between 5th - 9th September 2022 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.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	✓
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	✓
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	✓
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering problem solving	✓
PE2.2 Fluent application of engineering techniques, tools and resources	✓
PE2.3 Application of systematic engineering synthesis and design processes	
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	✓
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	✓
PE3.2 Effective oral and written communication in professional and lay domains	
PE3.3 Creative, innovative and pro-active demeanour	✓
PE3.4 Professional use and management of information	
PE3.5 Orderly management of self, and professional conduct	
PE3.6 Effective team membership and team leadership	