School of Civil and Environmental Engineering

Term 2, 2020

CVEN2701 WATER AND ATMOSPHERIC CHEMISTRY

COURSE DETAILS

Units of Credit	**6**	
Contact hours	6 hours per week	
Class	Mon 1:00PM - 3:00PM	Online
	Tue 4:00PM - 6:00PM	Online
Workshop	Wed 4:00PM - 6:00PM	Online

Course Coordinator and Lecturer	Prof. T. David Waite Email: d.waite@unsw.edu.au Office: Room 114 (H22 – Vallentine Annexe) Phone: 9385 5060
Lecturer	Dr. A. Ninh Pham Email: anninh.pham@unsw.edu.au Office: Room 108 (H22 – Vallentine Annexe) Phone: 9385 5102

INFORMATION ABOUT THE COURSE

This course will provide an introduction to water chemistry as a foundation for understanding chemical processes in both natural and engineered systems. It will build on the basic chemical concepts taught in CHEM1011/1031 and will develop additional concepts required to describe the chemical processes occurring in rivers, lakes, groundwater, marine and atmospheric environments.

HANDBOOK DESCRIPTION

See link to virtual handbook*:*

https://www.handbook.unsw.edu.au/undergraduate/courses/2020/CVEN2701/

OBJECTIVES

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.

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

EXPECTED LEARNING OUTCOMES

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. The full list of Stage 1 Competency Standards may be found in Appendix A.

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.*	*PE1.2, PE1.3, 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, PE3.3*

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

COURSE PROGRAM

TERM 2 2020

Date	Topic	Lecture Content	Lecturer
01/06/2020 (Week 1)	Foundation considerations	• Concentration units • Tableau method: properties of components, mole balance equations • Electroneutrality condition	Waite/Pham
08/06/2020 (Week 2)*	Chemical equilibrium and energetics 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	Waite/Pham
15/06/2020 (Week 3)	Kinetics of chemical reactions	• Types and orders of reactions • Reaction mechanisms, rates, rate constants and half-life	Waite/Pham
22/06/2020 (Week 4)	Acids and bases: pH and alkalinity	• Major acid/base systems and acidity constants • Alkalinity concept • Equilibrium with the gas phase	Waite/Pham
29/06/2020 (Week 5)	Acids and bases: Effects of biological processes	• Mixing of two waters • Effects of biological processes on pH and alkalinity	Waite/Pham
06/07/2020 (Week 6)	***Non-teaching week for all courses***		
13/07/2020 (Week 7)	Solid dissolution and precipitation	• Solubility of metal hydroxides ($Fe(OH)_3(s)$) • Solubility of carbonates ($CaCO_3$) • Acquisition of alkalinity in freshwaters	Waite/Pham
20/07/2020 (Week 8)	Complexation	• Aqueous complexes: fundamental concepts • Ion association among major aquatic constituents • Inorganic complexation of trace elements • Organic complexation	Waite/Pham
27/07/2020 (Week 9)	Oxidation – Reduction	• Fundamental concepts of redox reactions • Energetics of microbial processes • pe-pH diagrams	Waite/Pham
03/08/2020 (Week 10)	Reactions on solid surfaces Revision	• Coordinative properties of surfaces and adsorption isotherms • Complexation model of adsorption: Adsorption of lead on alumina example • Adsorption kinetics, particle settling & aggregation	Waite/Pham

*Monday 8th June is a public holiday. A pre-recorded lecture will be provided.

ASSESSMENT

The final grade for this course will normally be based on the sum of the scores from each of the assessment tasks. The Final Examination is worth 50% of the Final Mark and the class work is worth 50% of the Final Mark. The formal exam scripts will not be returned but you are permitted to view the marked script.

Students who perform poorly in the online quiz and workshops are recommended to discuss progress with the lecturers during the semester.

Note: The lecturer reserves the right to adjust the final scores by scaling if agreed by the Head of School.

Details of each assessment component, the marks assigned to it, the criteria by which marks will be assigned, and the dates of submission are set out below.

Supplementary Examinations for Term 2 2020 will be held on Monday 7th – Friday 11th September (inclusive) should you be required to sit one. You are required to be available during these dates. Please do not to make any personal or travel arrangements during this period.

PENALTIES

Late work will be penalised at the rate of 10% per day after the due time and date have expired.

Special consideration can be applied at:

https://student.unsw.edu.au/special-consideration

ASSESSMENT OVERVIEW

Item	Length	Weighting	Learning outcomes assessed	Assessment Criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
Online census-quiz	45 min	5%	LO1, LO2	Materials in Unit 1 to be assessed.	Sun 21/06/2020, 11 pm Online submission (open book)	Fri 26/06/2020	Fri 26/06/2020
Online mid-term quiz	1 hr	20%	LO1, LO2, LO3, LO4	Materials in Units 1 and 2 to be assessed	Wed 15/07/2020, 4-5 pm Online submission (open book)	Wed 15/07/2020, 5 pm	Sun 26/07/2020
Assignment		25%	LO1, LO2, LO3, LO4	Materials in Units 3, 4 and 5 to be assessed (calculation-based written assignment)	Wed 05/08/2020, 11 pm Turnitin submission	Sun 09/08/2020, 11 pm	Sun 16/08/2020
Final exam	2 hrs	50%	LO1, LO2, LO3, LO4	Materials in Units 1-6 to be assessed	During the exam period Online, open book exam	N/A	TBA

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 in advance if you are not able to take the quiz in the allotted time or regarding any computing problems.

Assignments are to be submitted via Turnitin. Students are responsible to keep spare copies of their submitted assignments.

RELEVANT RESOURCES

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

DATES TO NOTE

Refer to MyUNSW for Important Dates available at:

https://student.unsw.edu.au/dates

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 ADVICE

(Formerly known as Common School Information)

For information about:

- Notes on assessments and plagiarism,
- School policy on Supplementary exams,
- Special Considerations: student.unsw.edu.au/special-consideration
- Solutions to Problems,
- Year Managers and Grievance Officer of Teaching and Learning Committee, and
- CEVSOC.

Refer to Academic Advice on the School website available at:

https://www.engineering.unsw.edu.au/civil-engineering/student-resources/policies-procedures-and-forms/academic-advice

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

	Program Intended Learning Outcomes
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals
	PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing
	PE1.3 In-depth understanding of specialist bodies of knowledge
	PE1.4 Discernment of knowledge development and research directions
	PE1.5 Knowledge of engineering design practice
	PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex 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
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability
	PE3.2 Effective oral and written communication (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