School of Civil and Environmental Engineering

Term 3, 2020

CVEN9884 ENVIRONMENTAL CHEMICAL AND MICROBIAL PROCESSES

COURSE DETAILS

Units of Credit	**6**		
Contact hours	5 hours per week		
Class	Monday (weeks 1-5, 7-10)	15:00 – 17:00	Online delivery
Tutorial	Tuesday (weeks 1-5, 7-10)	12:00 – 14:00	Online delivery
Computer Labs	Friday (weeks 5, 7-10)	10:00 – 12:00	Online delivery

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Lecturer Dr Helen Rutlidge (Chemical Processes)
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INFORMATION ABOUT THE COURSE

Prerequisites: Students are expected to have a basic understanding of microbiology and chemistry.

Microbial Processes (Weeks 1-4): The objective of this unit is to familiarise the student with the fundamentals of applied and environmental microbiology: structure and metabolism of cells and micro-organisms, metabolic diversity, monitoring methods for pathogens and indicator organisms, impact of water and wastewater treatment on disease transmission.

Chemical Processes (Weeks 5, 7-10): Introduction to principles of the chemistry of natural waters and polluted systems covering basic processes of acidity and alkalinity, mineral precipitation, complexation, oxidation/reduction and surface and colloid chemistry. Tools developed enabling solution of realistic water chemistry problems including introduction to use of chemical speciation computer codes.

HANDBOOK DESCRIPTION

See link to virtual handbook:

https://www.handbook.unsw.edu.au/postgraduate/courses/2020/CVEN9884

OBJECTIVES

To familiarise the student with the fundamentals of microbiology and water and wastewater chemistry as they may be encountered by Public Health, Waste Management and Environmental Engineers and hence enable a knowledgeable assessment of reports and data presented to them by specialists in these areas.

List of programme attributes:

- An in-depth engagement with the relevant disciplinary knowledge in its inter-disciplinary context
- Capacity for analytical and critical thinking and for creative problem solving
- Ability to engage independent and reflective learning
- Information literacy
- Skills for collaborative and multi-disciplinary work
- A respect for ethical practice and social responsibility
- Skills for effective communication

TEACHING STRATEGIES

Private Study	• Read suggested sections in the textbook and review lecture material • Do set problems and assignments • Reflect on class problems and workshops when doing assignments and preparing for the exam • Download materials from Moodle • Keep up with notices via Moodle and Teams • Keep up with notices via university email
Lectures	• Online Lectures will be available via Moodle and delivered using Blackboard Ultra • Come prepared (read course material beforehand) • Identify beforehand where you may have problems with parts of the course material • See methods that are not in the textbook • Follow worked examples • Hear announcements on course changes
Workshops	• Be guided by demonstrators • Get involved in workshops • Practice solving set problems • Don't be afraid to ask questions – this is how you learn! • Note: tutorials for Microbial Processes will take place on Microsoft Teams
Assessments	• Demonstrate your knowledge and skills • Demonstrate higher understanding and problem solving • Note: assessments for Microbial Processes will be on Microsoft Teams
Laboratory Work	• Hands-on work, to set studies in context

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

EXPECTED LEARNING OUTCOMES

To enable the student, by in-depth process understanding, in critically and independently assessing data related to aquatic chemistry and microbiology. Furthermore, to provide the student with practical tools for solving environmental problems.

Learning Outcome		EA Stage 1 Competencies
1.	*Carry out independent critical assessment of aquatic chemistry data*	*PE1.1, PE1.2, PE1.3*
2.	*Carry out independent critical assessment of microbiology data*	*PE1.1, PE1.2, PE1.3*
3.	*By the conclusion of this course the student will be able to solve environmental problems using the practical tools delivered*	*PE2.1, PE2.2, PE3.2, PE3.4*

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.

COURSE PROGRAM

Week	Date	Lecture	Topic	Lecturer	Assessments Due
1	14-Sep	M1	Introduction to Microbiology	Tamburic	Quiz 1
2	21-Sep	M2	Health-Related Microbiology	Tamburic	Quiz 2
3	28-Sep	M3	Microbial Systems	Tamburic	Quiz 3
4	05-Oct *	M4	Microbial Processes	Tamburic	Quiz 4 Assignment 1 Draft
5	12-Oct	A1+A2	Fundamentals of Aquatic Chemistry and Tools for Solving Problems in Aquatic Chemistry + computer lab exercise: Uranium in Seawater	Rutlidge	Assignment 1 Final
6	19-Oct	***Flexibility (non-teaching) week***			
7	02-Nov	A3+A4	pH and Alkalinity and Gas Exchange + computer lab exercise: Carbonate Chemistry	Rutlidge	Chem Quiz
8	09-Nov	A5	Reduction-Oxidation (Redox) Chemistry + computer lab exercise: Mixing and Redox	Rutlidge	
9	16-Nov	A6	Complexes in Aqueous Solutions + computer lab exercise: Metal Complexation	Rutlidge	Assignment 2
10	23-Nov	A7+A8	Solid Precipitation and Dissolution + Surface Chemistry + computer lab exercise: Surface Complexation	Rutlidge	Assignment 3
11	30-Nov	***Study for chemical processes exam***			

* Mon-05-Oct is a public holiday – lecture M4 will be made available as a recording

ASSESSMENT OVERVIEW

The assessment of this course will be the **3 assignments**, **4 quizzes** on Microbial Processes and an **online exam** on Chemical Processes. Students who perform poorly in the assignments and quizzes are recommended to discuss progress with the lecturer during the session. No student may pass a course until all assignments have been completed and returned to the School. An assignment will be considered completed if it is awarded a mark of 30% or more, i.e. significant effort must be demonstrated. The formal online exam scripts will not be returned to students. The Course Coordinator reserves the right to adjust the final scores by scaling if agreed by the Head of School.

Item	Weight	Issue date	Due date	Marks returned	Assessment criteria	Learning outcomes assessed
4 x Micro Quiz	20% (5% each)	every Tuesday (Week 1-4)	following Friday	following Monday	There will be no exam for Microbial Processes; instead, four online quizzes (available on Microsoft Teams) will evaluate the students' knowledge and understanding after each lecture.	*PE1.1, PE1.2, PE1.3*
Assignment 1	30%	Tue-15-Sep	Tue-13-Oct	Mon-26-Oct	For their major assignment in Microbial Processes, students will design an online poster (in Microsoft Sway) to explain what role microbial processes play in natural/engineered systems.	*PE2.1, PE2.2, PE3.2, PE3.4*
Chem Quiz	5%	Fri-06-Nov	Fri-06-Nov	Mon-10-Nov	This quiz will assess the students ability to construct a tableau to solve a aqueous equilibrium chemistry problem.	*PE1.1, PE1.2*
Assignment 2	10%	Tue-03-Nov	Mon-16-Nov	Mon-30-Nov	This assignment will assess the students ability to solve aqueous equilibrium chemistry problems. Some sub-questions will further test the student's conceptual understanding of equilibrium chemistry.	*PE1.1, PE1.2, PE2.1, PE2.2, PE3.2, PE3.4*
Assignment 3	10%	Tue-10-Nov	Mon-23-Nov	Fri-04-Dec	This assignment will assess the students ability to construct Eh-pH diagrams, construct balanced redox-reactions and evaluate ongoing redox-processes based on model simulations.	*PE1.1, PE1.2, PE1.3, PE2.1, PE2.2, PE3.2, PE3.4*
Online Exam	25%	TBA	TBA	TBA	The online exam will assess the students' knowledge of, and ability to solve, aqueous equilibrium chemistry problems. The exam will cover topics like acidity and alkalinity, mineral precipitation, complexation, surface and colloid chemistry.	*PE1.1, PE1.2, PE2.1, PE2.2, PE3.2, PE3.4*

NOTES:

1) *Feedback for all four micro quizzes will be provided before census date (Oct-11).*
2) *Online exam for chemical processes will take place during the Final Examination period.*
3) *Supplementary Examinations for Term 3 2020 will be held on Monday 11th January – Friday 15th January 2021 (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.

RELEVANT RESOURCES

Mandatory reading

CVEN 9884 Aquatic chemistry course notes. Following pages are mandatory reading:

- Unit 1: Sections 1 to 4.1 (pages 1-18)
- Unit 2: Section 1 (pages 1-16); section 2.1 (pages (17-18); section 3.1 (page 29) and sections 4-6 (Exercises 1-6 and workshop exercises 1-5, so excluding kinetic exercises).
- Unit 3: Sections 1- 8 (pages 1-25)
- Unit 4: Sections 1- 6 (pages 1-18)
- Unit 5: Sections 1- 5.1 (pages 1-17) and sections 5.4-8 (pages 19-27)
- Unit 6: Sections 1- 2 (pages 1-22) and sections 4-5 (pages 28-33)
- Unit 7: Sections 1- 3 (pages 1-14) and sections 5-6 (pages 16-18)
- Unit 8: Sections 1- 3 (pages 1-12)

Additional materials such as lecture slides and lecture recordings are provided on Moodle.

Recommended reading

Morel, F.M.M. and Hering, J.G., Principles and Applications of Aquatic Chemistry, Wiley Interscience, New York, 1993. ISBN 0-471-54896-0.

Reading guide to the textbook by Morel & Hering (M&H):

- Chapter 1: Sections 1 to 5 (p. 1-31).
- Chapter 2: All of the chapter up to section 5.7 (p. 40-87) and ignore sidebar 2.2
- Chapter 3: Sections 1 and 2 (p. 98-138) read cursorily !!!.
- Chapter 4: Sections 1, 2, 3, 4, 5 (p. 157-195), 7 (203-210) and 9 (to section 9.5) (p. 218-227).
- Chapter 5: All of Chapter 5 apart from Example 5 (p. 236-314).
- Chapter 6: Sections 2, 3, 4 (to section 4.3) (p. 345-375) and 5 (p. 395-404).
- Chapter 7: Sections 1, 2, 3, 4 (p. 421-477) and 6 (p. 491-502).
- Chapter 8: Sections 2 (p. 513-519), 3 (p. 519-521) and 6 (p. 563-567).

NOTE that Dispersed in the Aquatic chemistry lecture notes there are guides to when various sections in M&H may be useful reading.

Useful textbooks (Recommended only – not mandatory)

- Appelo, C.A.J., Postma, D., 2005. Geochemistry, Groundwater, and Pollution. 2nd ed. A.A. Balkema, Rotterdam. 649 pp. ISBN: 04 1536 428 0. It can be ordered via website www.crcpress.com
- Stumm, W. and Morgan, J.J., Aquatic Chemistry, 2nd Edition, Wiley, New York, 1981.
- Atlas, R.M., Microbiology-Fundamentals and Applications, Maxwell Macmillan, New York, 1989.

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

For information about:

- Notes on assessments and plagiarism;
- Special Considerations: student.unsw.edu.au/special-consideration;
- General and Program-specific questions: The Nucleus: Student Hub
- Year Managers and Grievance Officer of Teaching and Learning Committee, and
- CEVSOC/SURVSOC/CEPCA

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