UNSW Course Outline

ZEIT3601 Environmental Engineering - 2024

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General Course Information

Course Code : ZEIT3601
Year : 2024
Term : Semester 2
Teaching Period : Z2
Is a multi-term course? : No
Faculty : UNSW Canberra
Academic Unit : School of Engineering and Technology
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : UNSW Canberra at ADFA
Campus : UNSW Canberra
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course introduces the principles and applications of environmental engineering. It includes the fundamentals of environmental chemistry, microbiology, single species kinetics, interacting species and unit operations. Applications include studies of jets, wakes and plumes, dispersion

of pollutants, surface water pollution, soil and groundwater contamination, air pollution and noise pollution.

Course Aims

The aim of this 6UoC course is to gain a comprehensive understanding of the fundamental principles behind environmental engineering (physics, chemistry and biology) and their application to the analysis of environmental phenomena and systems. At the end of the course you will be expected to explain the scientific principles examined, and be able to apply them for the descriptive and quantitative analysis of specific technical problems.

Relationship to Other Courses

Prerequisite: ZEIT2602

This 6UoC course builds on the knowledge gained in your first-year chemistry and second-year materials courses, and in the fluids courses ZEIT2500 Thermofluids and ZEIT2602 Hydraulic Engineering. This course is followed by the fourth year course ZEIT4604 Hydrology & Environmental Engineering Practice, which focuses much more closely on the principles and practice of hydrology and environmental hydraulics.

Course Learning Outcomes

Course Learning Outcomes	Engineers Australia - Professional Engineer (Stage 1)
CLO1 : Understand and be able to explain a range of fundamental scientific principles (chemistry, physics and biology) which underpin environmental engineering.	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline
CLO2 : Apply simple chemical, biological and physical equations to calculate quantitative results pertaining to a variety of environmental systems.	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE1.5 : Knowledge of engineering design practice and contextual factors impacting the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE3.2 : Effective oral and written communication in professional and lay domains
CLO3 : Understand the principles of unit operations, and be able to apply these to the solution of continuous-flow and plug-flow reactor problems.	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE1.5 : Knowledge of engineering design practice and contextual factors impacting the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE3.2 : Effective oral and written communication in professional and lay domains
CLO4 : Describe mechanisms of pollutant fate and transport and apply mathematical models to assess environmental impacts in a range of contexts, and also to understand the limitations of the models used.	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.3 : In-depth understanding of specialist

	bodies of knowledge within the engineering discipline • PEE1.5 : Knowledge of engineering design practice and contextual factors impacting the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE3.2 : Effective oral and written communication in professional and lay domains
CLO5 : Learn and become versant in the various units used in environmental engineering.	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline

Course Learning Outcomes	Assessment Item
CLO1 : Understand and be able to explain a range of fundamental scientific principles (chemistry, physics and biology) which underpin environmental engineering.	• Mid-Session Quiz • Fieldwork/Laboratory Assignment • Tutorial-style and presentation-style assignments • Final Exam
CLO2 : Apply simple chemical, biological and physical equations to calculate quantitative results pertaining to a variety of environmental systems.	• Mid-Session Quiz • Fieldwork/Laboratory Assignment • Tutorial-style and presentation-style assignments • Final Exam
CLO3 : Understand the principles of unit operations, and be able to apply these to the solution of continuous-flow and plug-flow reactor problems.	• Mid-Session Quiz • Tutorial-style and presentation-style assignments • Final Exam
CLO4 : Describe mechanisms of pollutant fate and transport and apply mathematical models to assess environmental impacts in a range of contexts, and also to understand the limitations of the models used.	• Fieldwork/Laboratory Assignment • Tutorial-style and presentation-style assignments • Final Exam
CLO5 : Learn and become versant in the various units used in environmental engineering.	• Tutorial-style and presentation-style assignments • Final Exam

Learning and Teaching Technologies

Moodle - Learning Management System

Learning and Teaching in this course

Moodle is the Learning Management System used at UNSW Canberra. All courses have a Moodle site which will become available to students at least one week before the start of semester. Please find all help and documentation (including Blackboard Collaborate) at the Moodle Support page.

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UNSW Moodle supports the following web browsers:

» Google Chrome 50+
» Safari 10+
** Internet Explorer is not recommended

** Addons and Toolbars can affect any browser's performance.

Operating systems recommended are:

Windows 7, 10, Mac OSX Sierra, iPad IOS10

For further details about system requirements click here.

Log in to Moodle here.

If you need further assistance with Moodle:

For enrolment and login issues please contact:
IT Service Centre
Email: itservicecentre@unsw.edu.au
Phone: (02) 9385-1333

International: +61 2 9385 1333

For all other Moodle issues please contact:
External TELT Support
Email: externalteltsupport@unsw.edu.au
Phone: (02) 9385-3331
International: +61 2 938 53331

Opening hours:
Monday – Friday 7:30am – 9:30 pm
Saturday & Sunday 8:30 am – 4:30pm

Additional Course Information

This course has been designed to be technically rigorous and demanding. The course content and teaching methods have been informed by course evaluations and discussions with key stakeholders in academia, industry and Defence, to provide essential knowledge and skills for practicing civil engineers.

It is expected that students will purchase the reference text, and keep abreast of each topic as it is taught in class. This will include reading the relevant section(s) of the text prior to each class (note some topics will require wider reading), and completion of all tutorials and assessment work. Students are expected be fully prepared to participate during all classes.

Academic Integrity and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. All students are expected to adhere to UNSW's Student Code of Conduct https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf

Plagiarism undermines academic integrity and is not tolerated at UNSW. *It is defined as using the words or ideas of others and passing them off as your own, and* can take many forms, from deliberate cheating to accidental copying from a source without acknowledgement.

For more information, please refer to the following:

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

Referencing

In this course, students are required to reference following the APA 7 / Chicago NB referencing style. Information about referencing styles is available at: https://guides.lib.unsw.adfa.edu.au/c.php?g=472948&p=3246720

Study at UNSW Canberra

https://www.unsw.adfa.edu.au/study

Study at UNSW Canberra has lots of useful information regarding:

- Where to get help
- Administrative matters
- Getting your passwords set up
- How to log on to Moodle
- Accessing the Library and other areas.

Additional Information as required

CRICOS Provider no. 00098G

The University of New South Wales Canberra.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates	Engineers Australia - Professional Engineer (Stage 1)
Mid-Session Quiz Assessment Format: Individual	25%	Start Date: 13/09/2024 01:00 PM Due Date: 13/09/2024 03:00 PM	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE1.5 : Knowledge of engineering design practice and contextual factors impacting the engineering discipline • PEE3.2 : Effective oral and written communication in professional and lay domains
Fieldwork/Laboratory Assignment Assessment Format: Group	10%	Start Date: 23/08/2024 12:00 PM Due Date: 13/09/2024 06:00 PM	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE3.2 : Effective oral and written communication in professional and lay domains • PEE1.5 : Knowledge of engineering design practice and contextual factors impacting the engineering discipline • PEE2.1 : Application of

			established engineering methods to complex engineering problem solving
Tutorial-style and presentation-style assignments Assessment Format: Individual	25%	Start Date: Not Applicable Due Date: Not Applicable	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE3.2 : Effective oral and written communication in professional and lay domains • PEE1.5 : Knowledge of engineering design practice and contextual factors impacting the engineering discipline
Final Exam Assessment Format: Individual	40%	Start Date: Not Applicable Due Date: Not Applicable	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE3.2 : Effective oral and written communication in professional and lay domains • PEE1.5 : Knowledge of engineering design practice and contextual factors impacting the engineering discipline

Assessment Details

Mid-Session Quiz

Assessment Overview

The examination components of the assessment provide assurance that the knowledge and understanding demonstrated are your own and a measure of that knowledge and understanding. They also provide an extra incentive for study. The mid-session quiz will be 2 hours long, and make up 25% of the marks.

Course Learning Outcomes

- CLO1 : Understand and be able to explain a range of fundamental scientific principles (chemistry, physics and biology) which underpin environmental engineering.
- CLO2 : Apply simple chemical, biological and physical equations to calculate quantitative results pertaining to a variety of environmental systems.
- CLO3 : Understand the principles of unit operations, and be able to apply these to the solution of continuous-flow and plug-flow reactor problems.

Detailed Assessment Description

The quiz will examine the topics presented up to the time of the quiz. All students MUST attend the quiz.

Assessment Length

2 hours

Assignment submission Turnitin type

Not Applicable

Fieldwork/Laboratory Assignment

Assessment Overview

A major fieldwork and laboratory assignment will also be conducted in this course, worth 7 marks. This will involve a field excursion for the sampling of polluted waters, which will then be analysed in the laboratory for coliform bacteria, run by the School of PEMS. The fieldwork will be conducted in accordance with the ‘UNSW Fieldwork Guideline’ and ‘Fieldwork Authorisation & Medical Questionnaire for Students (OHS009)’.

The laboratory component will run for approximately 2 hours and will be run for groups of four students. Each group will prepare a joint group report on the experiment, following the standard scientific reporting structure to be given as part of this course.

Course Learning Outcomes

- CLO1 : Understand and be able to explain a range of fundamental scientific principles (chemistry, physics and biology) which underpin environmental engineering.
- CLO2 : Apply simple chemical, biological and physical equations to calculate quantitative results pertaining to a variety of environmental systems.
- CLO4 : Describe mechanisms of pollutant fate and transport and apply mathematical models to assess environmental impacts in a range of contexts, and also to understand the limitations of the models used.

Detailed Assessment Description

The excursion is scheduled for Fri 23 August at 12:00-15:00, followed by the lab at Fri 23 August at 15:00-18:00. The report will be due after the break, on Fri 13 Sept at 18:00. All students MUST attend both the excursion and laboratory classes - no exceptions are allowed for any reason.

The assessments will be group submissions, with a single mark allocated to all group members

Assessment Length

6 hours

Assignment submission Turnitin type

Not Applicable

Tutorial-style and presentation-style assignments

Assessment Overview

A number of tutorial-style or presentation-style assignments will be issued during this course, which will constitute part of the formal assessment. The first category will involve tutorial-type questions and/or computations. They must be prepared in a clearly structured and sufficiently annotated way so that the development of the final results is clearly shown. The second category will consist of presentation-style assignments and/or debates. The assignments are intended to foster discussion with the lecturers, other staff and fellow students on the nature of the assignment problems and their solution. The detailed working of the solution and the preparation of the assignment submission itself must be your own work.

The written component of the assignments should be submitted on Moodle. Please submit the main assignments in pdf format only (not doc format), in a single document, with all fonts embedded (otherwise it will be corrupted and unreadable). Please do not make multiple submissions based on each page of your assignment! You must also attach all supporting information (e.g. spreadsheet, Matlab or Maple files, etc).

All assignment submissions must also be enclosed in the SEIT coversheet, which will be made available on Moodle.

Course Learning Outcomes

- CLO1 : Understand and be able to explain a range of fundamental scientific principles (chemistry, physics and biology) which underpin environmental engineering.
- CLO2 : Apply simple chemical, biological and physical equations to calculate quantitative results pertaining to a variety of environmental systems.
- CLO3 : Understand the principles of unit operations, and be able to apply these to the solution of continuous-flow and plug-flow reactor problems.
- CLO4 : Describe mechanisms of pollutant fate and transport and apply mathematical models to assess environmental impacts in a range of contexts, and also to understand the limitations of the models used.
- CLO5 : Learn and become versant in the various units used in environmental engineering.

Assessment information

In total there will be 5 separate assignments, of 5 marks each, making a total of 25%. The dates for each assignment are listed in the course schedule calendar.

All assignments must be submitted.

Assignment submission Turnitin type

Not Applicable

Final Exam

Assessment Overview

The examination components of the assessment provide assurance that the knowledge and understanding demonstrated are your own and a measure of that knowledge and understanding. They also provide an extra incentive for study.

The final examination will be 3 hours long, and make up 40% of the marks. It will be held either in the final week of session or the November exam period. Detailed instructions for the final exam will be issued with the examination timetable.

Course Learning Outcomes

- CLO1 : Understand and be able to explain a range of fundamental scientific principles (chemistry, physics and biology) which underpin environmental engineering.
- CLO2 : Apply simple chemical, biological and physical equations to calculate quantitative results pertaining to a variety of environmental systems.
- CLO3 : Understand the principles of unit operations, and be able to apply these to the solution of continuous-flow and plug-flow reactor problems.

- CLO4 : Describe mechanisms of pollutant fate and transport and apply mathematical models to assess environmental impacts in a range of contexts, and also to understand the limitations of the models used.
- CLO5 : Learn and become versant in the various units used in environmental engineering.

Assessment Length

3 Hours

Assignment submission Turnitin type

Not Applicable

General Assessment Information

Late submissions of assignments: Unless prior arrangement is made with the lecturer or a formal application for special consideration is submitted, a penalty of 5% of the total available mark for the assessment will apply for each day that an assessment item is late up to a maximum of 5 days (120 hours) after which an assessment can no longer be submitted and a grade of 0 will be applied.

Feedback before census date: Assignment 1 will be due in week 2, enabling written feedback and grades to be given to students before the census date (11 August).

Use of generative AI: You are permitted to use generative AI tools, software or services to generate initial ideas, structures, or outlines. However, you must develop or edit those ideas to such a significant extent that what is submitted is your own work, i.e., what is generated by the tool, software or service should not be a part of your final submission. You should keep copies of your iterations to show your Course Authority if there is any uncertainty about the originality of your work.

If your Convenor has concerns that your answer contains passages of AI-generated text or media that have not been sufficiently modified you may be asked to explain your work, but we recognise that you are permitted to use AI generated text and media as a starting point and some traces may remain. If you are unable to satisfactorily demonstrate your understanding of your submission you may be referred to UNSW Conduct & Integrity Office for investigation for academic misconduct and possible penalties.

This category permits the use of generative AI as ‘inspiration’ for assessment. Beyond that, use of generative AI is prohibited. It is appropriate for assessments that are intended to be completed without generative AI assistance to improve a final product/answer.

We note that since most of the assignments will consist of mathematical or tutorial-style problems, generative AI is unlikely to be useful for their preparation in this course.

Grading Basis

Standard

Requirements to pass course

Overall passing mark is set at 50%.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 15 July - 19 July	Lecture	Lecture 1: Welcome; noise pollution
	Lecture	Lecture 2: Noise pollution
Week 2 : 22 July - 26 July	Lecture	Lecture 3: Noise pollution
	Lecture	Lecture 4: Noise pollution
	Assessment	Assignment 1: Noise pollution, due Fri 26 July 2024 at 18:00
Week 3 : 29 July - 2 August	Lecture	Lecture 5: Chemistry
	Lecture	Lecture 6: Chemistry
Week 4 : 5 August - 9 August	Lecture	Lecture 7: Chemistry
	Lecture	Lecture 8: Chemistry
	Assessment	Assignment 2: Chemistry, due Fri 9 August 2024 at 18:00
Week 5 : 12 August - 16 August	Lecture	Lecture 9: Biology
	Lecture	Lecture 10: Biology
Week 6 : 19 August - 23 August	Lecture	Lecture 11: Biology / Unit Operations
	Fieldwork	Excursion / laboratory class: Friday 23 August, 12:00 to 18:00 (possibly longer)
	Assessment	Assignment 3: Biology, due Fri 23 August 2024 at 18:00
Week 7 : 9 September - 13 September	Lecture	Lecture 12: Unit operations
	Assessment	Laboratory assignment due Fri 13 Sept 2024 at 18:00
	Assessment	Midsession quiz: Fri 13 Sept at 13:00 (sharp) to 15:00
Week 8 : 16 September - 20 September	Lecture	Lecture 13: Surface waters
	Lecture	Lecture 14: Surface waters
Week 9 : 23 September - 27 September	Lecture	Lecture 15: Surface waters, groundwater and NAPLs
	Lecture	Lecture 16: Groundwater and NAPLs
Week 10 : 30 September - 4 October	Lecture	Lecture 17: Groundwater and NAPLs
	Lecture	Lecture 18: Groundwater and NAPLs
	Assessment	Assignment 4: Surface waters, groundwater and NAPLs, due Fri 4 Oct at 18:00
Week 11 : 7 October - 11 October	Lecture	Lecture 19: Air pollution
	Lecture	Lecture 20: Air pollution
Week 12 : 14 October - 18 October	Lecture	Lecture 21: Air pollution
	Lecture	Lecture 22: Global Environmental Change
Week 13 : 21 October - 25 October	Lecture	Review week
	Assessment	Assignment 5: Air pollution + global environmental change, due Fri 25 Oct at 18:00

Attendance Requirements

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

General Schedule Information

This is a hands-on course with demonstrations of phenomena during class. Students are therefore **expected to attend all classes** in the course in which they are enrolled. All requests for exemption from attendance or absence should be addressed to the Course Authority and where applicable, be accompanied by a medical certificate.

This attendance requirement applies irrespective of other non-educational commitments, for example sporting trips, or Defence-supported travel or study tours. **In no situation can another decision or offer from Defence override the requirement to attend this class.** All Defence and Defence-funded students must also seek approval from relevant Defence authority for each exemption from attendance or absence - for Defence students, all such applications will be discussed with your DO.

Course Resources

Prescribed Resources

Moodle Website:

A website of course materials and other resources will be established on Moodle. Please log in regularly to access new course materials and information on the assignments, and to complete the barrier tests, needed to progress to each new subtopic.

Compulsory text (you should have this book):

• Mihelcic, J. R. and Zimmerman, J. B. Environmental engineering: Fundamentals, Sustainability, Design. John Wiley & Sons, NY, edition 2, 2014, ISBN 978-1118741498 (edition 1 is OK, but the problems given are different).

A link to the library resources for this and the other recommended books is available here:

https://unsw.alma.exlibrisgroup.com/leganto/public/61UNSW_INST/lists/62674143610001731?auth=SAML

Recommended Resources

Recommended reading:

The following are recommended as additional reading (some material is drawn from these books):

• Masters, G.M., Ela, W.P. (2008), “Introduction to Environmental Engineering and Science”, 3rd. ed., Pearson Int. Ed., Prentice Hall (especially useful for surface water quality and air quality).

• Mihelcic, J.R., Auer, M.T., Hand, D.W., Honrath, R.E., Jr, Perlinger, J.A., Urban, N.R. & Penn, M.R. (1999), “Fundamentals of Environmental Engineering”, John Wiley & Sons (a precursor of your current textbook).

• Domenico & Schwartz (1990), “Physical and Chemical Hydrogeology”, John Wiley & Sons, N.Y. (especially for groundwater pollution).

• Streeter, V.L., Wylie, E. B. and Bedford, K.W. (1998), “Fluid Mechanics”, 9th ed., McGraw-Hill, Boston, (especially for the treatment of dispersion).

For engineering report writing, refer to:

• Winckel, A. & Hart, B. (2002), “Report Writing Style Guide for Engineering Students”, 4th ed., Faculty of Engineering, University of South Australia, Adelaide; *https://lo.unisa.edu.au/pluginfile.php/1687722/mod_resource/content/0/Report%20style%20writing%20guide_Engineering.pdf*

Other texts will also be nominated for specific topics within this course.

Course Evaluation and Development

One of the key priorities in the 2025 Strategy for UNSW is a drive for academic excellence in education. One of the ways of determining how well UNSW is progressing towards this goal is by listening to our own students. Students will be asked to complete the myExperience survey towards the end of this course.

Students can also provide feedback during the semester via: direct contact with the lecturer, the “On-going Student Feedback” link in Moodle, Student-Staff Liaison Committee meetings in schools, informal feedback conducted by staff, and focus groups. Student opinions really do make a difference. Refer to the Moodle site for this course to see how the feedback from

previous students has contributed to the course development.

Important note: Students are reminded that any feedback provided should be constructive and professional and that they are bound by the Student Code of Conduct Policy

https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Robert Niven		Room 129, building 20	Please contact by email	By appointment, all weeks	No	Yes
Lecturer	Marion Burgess		SET, UNSW Canberra	Please use email	Weeks 1-2	No	No