CVEN1701

Environmental Principles and Systems

Term 3, 2022

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Prof. Tommy Wiedmann	t.wiedmann@unsw.edu.au	agree via email	Room 106, School of Civil & Environmental Engineering (Building H20)	+61 2 9065 2065

Lecturers

Name	Email	Availability	Location	Phone
Dr Ruth Fisher	ruth.fisher@unsw.edu.au	agree via email	Room 311, School of Civil & Environmental Engineering (Building H20)	+61 2 9385 5073

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

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Course Details

Units of Credit 6

Summary of the Course

This is an introductory course in techniques to analyse the environmental impact of corporations and economies in regions, using operations research, environmental material accounting and environmental risk assessment. Sustainability principles introduced in DESN1000 will be quantitatively developed to enable the identification and control of significant environmental aspects in corporations and regions. Techniques may include game theory, simulation, life cycle assessment, ecological footprints, human health and environmental risk assessment.

Course Aims

The aim of the course is to introduce a number of analytical tools that environmental engineers use in defining and assessing problems at corporate and regional scale, and which provide them with information that enables optimal solutions to be designed. In this course we will:

- Review sustainability principles, and describe them in terms of materials management and risk management, from the perspective of an environmental engineer.
- Describe principles of industrial ecology, systems modelling and decision making and show how these methods can be used to optimise the design of systems and facilities.
- Describe a range of environmental accounting and assessment tools, apply them to simple problems, and explain how information from them can be used in policy, system, and facility design.
- Describe human health and ecological risk assessment procedures in general terms, and show how the outcomes of assessments can be used in the design of systems and facilities.

In addition, the course aims to foster (see also EA Stage 1 Competencies below):

- Capacity for analytical and critical thinking and for creative problem solving
- Ability to engage independent and reflective learning
- Skills for collaborative and multi-disciplinary work
- A respect for ethical practice and social responsibility

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Evaluate and analyse simple environment-related systems by adopting environmental footprints, life cycle assessment and material flow analysis.	PE1.1, PE1.4, PE1.6, PE2.1, PE3.1
2. Assess an environment-related problem and apply appropriate tools to quantitatively solve the problem, demonstrating how information from the application of these tools can be applied in solution development.	PE1.2, PE1.3, PE2.1, PE2.2, PE3.2, PE3.5, PE3.6

Learning Outcome	EA Stage 1 Competencies
3. Use multicriteria analysis (MCA) and make recommendations towards more sustainable decision making processes	PE1.2, PE1.3, PE2.1, PE3.4
4. Conduct a risk assessment and formulate reasonable conclusions	PE1.3, PE2.1, PE2.2, PE3.2, PE3.4, PE3.5, PE3.6

Teaching Strategies

Lectures will provide an explanation of procedures to follow to undertake environmental material/footprint accounting, environmental risk assessment, and systems modelling methods. Examples will be given in these lectures. Students then learn these procedures by applying them to real world problems that they have some familiarity with. The approaches to learning are:

Private Study	• Review lecture material, reference books, and resources on UNSW Moodle. • Do set problems and preparation so that you can participate in workshops • Work in groups on class assignments • Reflect on class problems and assignments
Lectures	• Take notes during lectures to get a full set of reference notes for the course. • Learn analytical methods of analysis of environmental problems that are not well documented in reference books • Participate in working out example problems in class • Ask questions on how the content of lectures applies to assignment questions.
Workshops	• Work actively in small ad hoc groups on problems set in class • Ask questions on assignment problems
Assessments	• Formative and summative assessment of knowledge and skills in assignments, with students encouraged to seek formative informal assessment via consultation with the lecturer during preparation of assignments • Demonstrate higher understanding and problem solving on real world problems in hypothetical, but realistic problem settings. • Exams are summative assessments on knowledge gained in the course, particularly as indicated by the ability to quickly undertake exercises set in the Workshop problems

Additional Course Information

This course builds on the broad multidisciplinary introduction to sustainability provided in the DESN1000 Engineering Design and Innovation projects, by viewing these principles from an environmental engineering perspective. A range of environmental accounting, environmental risk assessment, and industrial ecology research tools will be introduced to be able to quantifiably define sustainable economies at the corporate and regional scale. These analytical tools will then be applied in courses in years 2 to 4 in a range of areas, including the core courses below and electives in 4th year:

- CEIC2009 Mass balances in the chemical engineering process industry
- CVEN2402 Transport engineering and environmental sustainability
- CVEN3701 Environmental frameworks, law and economics
- CVEN3702 Solid wastes and contaminant transport
- CVEN3502 Water and wastewater engineering

- CVEN4701 Planning sustainable infrastructure

For instance, Material Flow Analysis will be used to describe the partitioning of heavy metals through waste to energy plants in CVEN3702 and system dynamics will be used in the design of sustainable regional waste management systems in CVEN4701.

Assessment

Marking criteria: All assignments will be marked on the basis of whether the student demonstrates an understanding of the material. Where numerical errors can be identified as simple slips, penalties will not be as large as when errors appear to be a result of a conceptual misunderstanding, or the source of the error is difficult to determine from the work. The major assignment will be additionally assessed with respect to the depth of the analysis, the breadth of its consideration of the question at hand and the clarity of the way in which the answer is presented. The use of tables and diagrams is encouraged. Please make sure you do not exceed the imposed word/page limits.

Late work for assignments will be penalised at the rate of **5% per day** after the due time and date have expired. A submission is deemed late if it is submitted **one second after the due time**!

If you are unwell or have other extenuating circumstances which prevent you from completing an assessment, you **always have** to apply for **Special Consideration** before the submission deadline through official University channels: https://student.unsw.edu.au/special-consideration. Otherwise, the fit-to-submit rule applies, i.e. by sitting or submitting an assessment on the scheduled assessment date, the you are declaring that you are fit to do so and cannot later apply for Special Consideration.

Beware of plagiarism! 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

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Quiz	10%	05/10/2022 04:05 PM	1, 2
2. Assignment 1	25%	21/10/2022 08:00 PM	1, 2
3. Assignment 2	25%	11/11/2022 08:00 PM	3, 4
4. Final exam	40%	Final exam period	1, 2, 3, 4

Assessment 1: Quiz

Start date: 05/10/2022 04:05 PM
Assessment length: 25 minutes
Submission notes: Online quiz on Moodle
Due date: 05/10/2022 04:05 PM

Students will be expected to demonstrate an understanding of the qualitative and quantitative concepts presented in the first three weeks of the course.

This is not a Turnitin assignment

Assessment criteria

This quiz is to be taken by all students. It's a summative assessment worth 10% of the final course mark.

There are 15 questions in the quiz. These are mostly multiple choice or true/false questions. There might be some questions where you have to insert words and some questions requiring simple calculations. Each question is worth 1 mark. The total mark will be scaled to 10 (i.e. multiplied with 10/15) Only one attempt is allowed. Questions are in sequential order (you cannot go back to a question).

All material presented, discussed and worked through in Weeks 1, 2 and 3 is assessable in the quiz. This includes all lectures, workshops, interactive online exercises and essential readings of the first three weeks. The Reference Material is excluded.

Assessment 2: Assignment 1 (Group)

Assessment length: 10 pages
Due date: 21/10/2022 08:00 PM
Marks returned: 2 weeks after submission

This is a group assignment where environmental footprints of households are calculated, compared, altered and discussed and suggestions for changes presented. The aim is to demonstrate an understanding of environmental sustainability and footprinting methodology, the capacity for analytical and critical thinking, for creative problem solving and skills for collaborative teamwork.

This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Assessment criteria

The assessment criteria refer to the study context, methodology and calculations, assumptions and explanations, results, discussion, recommendations, conclusions, summary and the overall report quality.

Assessment 3: Assignment 2

Assessment length: To be specified by lecturer
Due date: 11/11/2022 08:00 PM
Marks returned: Two weeks after submission

This assignment is related to decision-making and/or risk assessment and students will be expected to demonstrate an understanding of these topics. Details will be provided on Moodle when the assignment brief is released.

This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Assessment 4: Final exam

Assessment length: 2 hours
Due date: Final exam period

The exam will test the students' ability to synthesise the overall course. All material presented during the session will be examinable in the exam unless otherwise noted.

This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Assessment criteria

The final exam is **2-hour open book exam** during the normal exam period conducted online. The exam will test the students' ability to synthesise the overall course. All material presented during the term will be examinable in the exam unless otherwise noted. Students must be available at the stipulated exam time no matter the time zone in the country they may be currently residing in.

The final examination is compulsory. A mark of at least 40% in the final examination is required before the class work (quiz and assignments) is included in the final mark. Therefore, **A MARK OF AT LEAST 40% IN THE FINAL EXAMINATION IS REQUIRED TO PASS THE WHOLE COURSE!**

The Exam date is set by Exams Branch and is confirmed in about Week 8 of session. You can access the time and date of the exam via MyUNSW. Do not make arrangements that will prevent you from doing the exam in the Exam Period, or after the exam date is set in Week 8, on the day of the exam. You are required to be available during all exam dates, including supplementary examinations, should you require one.

Hurdle requirement

A mark of at least 40% in the final examination is required before the class work is included in the final mark. Therefore, A MARK OF AT LEAST 40% IN THE FINAL EXAMINATION IS REQUIRED TO PASS THE WHOLE COURSE.

Attendance Requirements

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

Course Schedule

Lectures and Workshops will be given by Prof. Tommy Wiedmann (Weeks 1-5) and Dr Ruth Fisher (Weeks 7-10).

View class timetable

Timetable

Date	Type	Content
Week 1: 12 September - 16 September	Lecture	Sustainability Principles, Sustainable Engineering, Industrial Ecology and Circular Economy
	Workshop	Sustainability Principles
Week 2: 19 September - 23 September	Lecture	Footprint Accounting (carbon and environmental footprints)
	Workshop	Calculate your Ecological Footprint
Week 3: 26 September - 30 September	Lecture	Systems Engineering and Modelling, System Dynamics modelling (by guest lecturer Dr Graeme Bushell)
	Workshop	Systems and Limits to Growth
Week 4: 3 October - 7 October	Lecture	Material Flow Analysis
	Workshop	Interactive Material Flow Analysis + **Online Quiz**
	Assessment	Quiz: Online quiz on Moodle
Week 5: 10 October - 14 October	Lecture	Life Cycle Assessment
	Workshop	Life Cycle Assessment
Week 6: 17 October - 21 October	Homework	Week 6 is Flexibility Week, i.e. there is no lecture and no workshop. Use the time to work on assignments.
	Assessment	Assignment 1
Week 7: 24 October - 28 October	Lecture	Probability density functions, Monte Carlo Simulation
	Workshop	Probability density functions
Week 8: 31 October - 4	Lecture	Environmental risk assessment, Bayesian

November		Networks
	Workshop	Bayesian Networks
Week 9: 7 November - 11 November	Lecture	Decision Making, Advanced Decision Making
	Workshop	Decision Making, Advanced Decision Making
	Assessment	Assignment 2
Week 10: 14 November - 18 November	Lecture	Risk Analysis Concepts, Multi-Criteria Decision Analysis
	Workshop	Risk Analysis Concepts, Multi-Criteria Decision Analysis

Resources

Prescribed Resources

All material required for this course will be provided on UNSW Moodle. It is compulsory for all students to access and follow the course on Moodle (https://moodle.telt.unsw.edu.au).

Recommended Resources

Textbook

There is no required textbook for this course. However, we **strongly recommend** the following textbook:

- Peters, G. and Svanström, M. 2019. ***Environmental Sustainability for Engineers and Applied Scientists***. Cambridge University Press, Cambridge. https://doi.org/10.1017/9781316711408 [Available through UNSW Library at https://www.library.unsw.edu.au].

Recommended Readings

Sustainability and Industrial Ecology:

- Hoekstra, A. Y. and T. O. Wiedmann. 2014. Humanity's unsustainable environmental footprint. Science 344(6188): 1114-1117. http://dx.doi.org/10.1126/science.1248365
- Hellweg, S. and L. Milà i Canals. 2014. Emerging approaches, challenges and opportunities in life cycle assessment. Science 344(6188): 1109-1113. http://www.sciencemag.org/content/344/6188/1109.abstract
- Brunner PH and Rechberger H, 2004; Practical Handbook of Material Flow Analysis, CRC Press Ltd.

Environmental Risk Assessment:

- EnHealth 2012 guidelines on Health Risk Assessment: http://health.gov.au/internet/main/publishing.nsf/Content/804F8795BABFB1C7CA256F1900045479/$File/DoHA-EHRA-120910.pdf

Course Evaluation and Development

We welcome student feedback throughout the course - either through the Discussion Forum or the weekly Feedback tool on Moodle. This is very important to us – let us know what you think works well and what we can do better. This information will be used to continually improve the course.

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

Coxs River, Kanimbla Valley (photo taken by T. Wiedmann)

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	✓