School of Civil and Environmental Engineering

Term 3, 2020

CVEN1701 ENVIRONMENTAL PRINCIPLES AND SYSTEMS

COURSE DETAILS

Units of Credit	6	
Contact hours	6 hours per week	
Class	Monday, 9:00am – 11:00am	online
	Tuesday, 11:00am – 1:00pm	online
Workshop	Wednesday, 4:00pm – 6:00pm	online
Course Coordinator and Lecturer	Prof. Tommy Wiedmann email: t.wiedmann@unsw.edu.au office: CE 312 Civil Engineering Building (H20) phone: 9385 0142	
Lecturer	Prof. Stuart Khan email: s.khan@unsw.edu.au office: CE 311 Civil Engineering Building (H20) phone: 9385 5070	

INFORMATION ABOUT THE COURSE

This course builds on the broad multidisciplinary introduction to sustainability provided in the ENGG1000 Engineering Design and Innovation projects, by viewing these principles from an environmental engineering perspective. A range of environmental material 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 Flux 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.

HANDBOOK DESCRIPTION

The URL of your course online handbook is:

http://www.handbook.unsw.edu.au/undergraduate/courses/2020/CVEN1701.html

This is an introductory course in techniques to analyse the environmental impact of corporations and economies in regions, using industrial ecology principles, environmental material and footprint accounting and environmental risk assessment. Sustainability principles introduced in ENGG1000 will be quantitatively developed to enable the identification and control of significant environmental aspects in corporations and regions. Techniques may include life cycle assessment, environmental footprints, input-output analysis, simulation, human health and environmental risk assessment.

OBJECTIVES

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. The objectives of the course are to:

- Review sustainability principles, and describe them in terms of materials management and risk management, from the perspective of an environmental engineer.
- Understand 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

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 on skeleton overheads provided 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

COURSE PROGRAM

TERM 3, 2020

Date	Lecture Content Mondays, 9-11am	Lecture Content Tuesdays, 11am-1pm	Demonstration Content Wednesdays, 4-6pm
14/09/2020 (Week 1)	Sustainability Principles (incl. rel. vs abs. sust.)	Sustainable Engineering and Industrial Ecology	Sustainability Principles
21/09/2020 (Week 2)	Footprints (Carbon Footprint)	Footprints (Ecological Footprint)	Calculate your Ecological Footprint
28/09/2020 (Week 3)	Systems intro	System Dynamics modelling	Systems and Limits to Growth
06/10/2020 (Week 4)	Material Flow Analysis (Mon 5 Oct is a public holiday. This lecture will be made available online in Week 4)	Life Cycle Assessment 1	Interactive Material Flow Analysis + **Online Quiz**
12/10/2020 (Week 5)	Life Cycle Assessment 2	Probability density functions	Life Cycle Assessment
19/10/2020 (Week 6)	***Flexibility week for all courses (non-teaching)***		Probability density functions (No workshop, but students to work through problems)
26/10/2020 (Week 7)	Monte Carlo Simulation	Bayesian Networks	Probability Density Functions; Bayesian Networks
02/11/2020 (Week 8)	Game Theory	Decision Making	Decision Making
09/11/2020 (Week 9)	Advanced Decision Making	Risk Analysis Concepts	Advanced Decision Making; Risk Analysis Concepts
16/11/2020 (Week 10)	Multi-Criteria Decision Analysis	Environmental Health Risk Assessment	Multi-Criteria Decision Analysis; Environmental Health Risk Assessment

Prof. Tommy Wiedmann (purple shading, Weeks 1-5) and Prof. Stuart Khan (blue shading, Weeks 5-10) will be holding all lectures and workshops.

ASSESSMENT

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.

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 if class work is included and **100%** if class work is not included. The class work is worth **50%** of the final mark if included. **The final examination is compulsory**. A mark of at least 40% of the exam mark in the final examination is required before the class work is included in the final mark. The formal exam scripts will not be returned but students are permitted to view the marked script.

The exam will be a **2-hour open book exam** during the normal exam period. The questions will generally be similar to the workshop exercises. Calculators must be UNSW approved, for details see: https://student.unsw.edu.au/exam-approved-calculators-and-computers**.**

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.

Workshop problems and exercises are intended to give you formative assessment and assist with preparation of the formal assignments and the end-of-session exam. Students who perform poorly in the workshops are recommended to discuss progress with the demonstrators and lecturers during the semester.

The Course coordinator reserves the right to adjust the final scores by scaling if agreed to by the Head of School.

PENALTIES

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

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
LO1	*Use provided data to undertake analysis of simple facilities and systems using environmental footprints, life cycle assessment and material flow analysis.*	PE1.2, PE1.3, PE3.2, PE3.4, PE3.6
LO2	*Be able to assess a problem and to know which tools are appropriate in quantitatively understanding it, and how information from the application of these tools can be applied in solution development.*	PE1.1, PE1.6, PE3.1
LO3	*Be able to plan and describe a decision-making process, interpret the outcomes from each assessment method, evaluate them by using multicriteria analysis (MCA) and make recommendations towards more sustainable decision-making processes.*	PE1.1, PE1.2, PE1.3, PE1.4, PE1.6, PE2.1, PE2.2, PE3.6
LO4	*Describe the basic principles of risk assessment and be able to undertake risk assessment calculations and formulate reasonable conclusions based on risk assessment activities.*	PE1.1, PE1.2, PE1.3, PE1.4, PE1.6, PE2.1, PE2.2

ASSESSMENT OVERVIEW

Item	Length	Weighting	Learning outcomes assessed	Assessment Criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
Online quiz		10%	LO3	Students will be expected to demonstrate an understanding of the qualitative and quantitative concepts that underpin decision making.	**Wednesday 7 Oct / 16:00** (during workshop session)	**Wednesday 7 Oct / 16:00** (during workshop session)	**Wednesday 7 Oct / 16:00** (during workshop session)
Assignment 1 (carbon footprinting)	8 pages (excluding cover sheet and appendices)	25%	LO1, LO2	This is a group assignment where carbon 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 team work. The assessment criteria refer to the study context, methodology and calculations, assumptions and explanations, results, discussion, recommendations, conclusions, summary and the overall report quality.	**Friday 23 Oct / 20:00** Via Turnitin on Moodle. **One student per group submits one single document once. The first submission is final.** Include the Group ID in the file name!	2 weeks after submission deadline	2 weeks after submission deadline
Assignment 2 (Monte Carlo Simulation)	2 pages maximum	25%	LO4	Students will be expected to demonstrate and understanding of probability density functions and the use of Bayesian Networks.	**Friday 6 Nov / 20:00** Via Turnitin on Moodle.	2 weeks after submission deadline	2 weeks after submission deadline
Final exam	2 hours	40%	LO2, LO3, LO4	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.	**Final exam period** (do not to make any personal or travel arrangements during this period)	Date of exam	Official release of results

RELEVANT RESOURCES

UNSW Moodle

All material required for this course will be provided on UNSW Moodle. It is compulsory for all students to access this resource: *https://moodle.telt.unsw.edu.au/login/index.php*

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

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