

Module Code	CEU22E07
Module Name	Engineering and the Environment
ECTS Weighting¹	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Assoc Prof. Sarah McCormack (mccorms1@tcd.ie) Prof. Laurence Gill (gilll@tcd.ie) Asst Prof. Liwen Xiao (liwen.xiao@tcd.ie)
<u>Module Learning Outcomes</u> with reference to the <u>Graduate Attributes</u> and how they are developed in discipline	<p>On successful completion of this module, students should be able to:</p> <p>LO1. Have a knowledge of the fundamental causes of environmental impact including a basic familiarity with the methods of analysis.</p> <p>LO2. Have acquired knowledge of the major measures of environmental and energy sustainability.</p> <p>LO3. Have developed skills in the areas of environmental analysis, scientific reasoning and communication.</p> <p>LO4. Have developed practical experimental skills in environmental and energy measurement.</p> <p>LO5. Appraise claims of emerging technologies in terms of sustainability and contribution to supply.</p> <p>LO6. Gain an ability to undertake problem identification and to apply knowledge and understanding of basic science and engineering principals.</p> <p>LO7. Gain an ability to communicate effectively, not only with engineers but more importantly with the community at large.</p> <p>LO8. Develop a basic awareness of global development issues and approaches to ensuring that basic rights and needs are fulfilled.</p> <p>LO9. Understand the importance of listening, engaging with and respecting local knowledge before proposing solutions.</p> <p>LO10. Have demonstrated an understanding of the need for high ethical standards in the practice of their profession, including the responsibilities of the profession towards people and the environment.</p> <p>Graduate Attributes: levels of attainment</p> <p>To act responsibly - Introduced</p> <p>To think independently - Introduced</p> <p>To develop continuously - Enhanced</p> <p>To communicate effectively - Enhanced</p>

¹ [TEP Glossary](#)

Module Content

Introduction

- Population growth and environmental interaction; urbanisation; correlation of energy and economic growth; energy and environmental impact
- Introduction to concepts of sustainability, pollution and contamination
- Introduction to UN SDGs with focus on Energy and Water

Environmental measurements and analysis

- Introduction: Concentrations, flux, units and conversions
- Mass Balance: The control volume concept, conservation of mass in the control volume, terms in the mass balance equation
- Mass transport processes: Advection, dispersion and dilution

Environmental chemistry

- Chemistry in the natural environment:
- Chemical equilibria: Examples of equilibrium processes: volatilisation, air/water equilibrium, dissolution/precipitation, sorption
- Chemical kinetics: rate laws

Biological Processes

- Clean water, Sanitation and Diseases
- Carrying capacity: Monod kinetics; Modelling microbial growth
- Energy flow in ecosystems: Sources of energy; photosynthesis and primary production. Food chains, food webs, and the energy pyramid
- Nutrients and eutrophication in natural waters: trophic state and water quality

Energy demand & Supply

- Energy and environmental impact: greenhouse gases, carbon cycle, climate change
- Energy demand – how much do we use? Sectoral usage, electricity, heating
- Energy supply - low-carbon generation: wind, wave, tidal, photovoltaic, biofuels, nuclear, solar, geothermal, storage
- How much energy use is sustainable?

Engineers without Borders (EWB)

- Focus on UNSDG of Water and Energy in international development.
- Appraising sustainable energy and water technologies for international development projects.
- Groupwork to focus on Energy & Water solutions for EWB National competition.

Teaching and Learning Methods

The module is taught using a combination of lectures, guest lectures laboratories, tutorials and workshops. Students work individually and in groups thereby encouraging teamwork and cooperation.

Associated laboratory/project/tutorial programme

- Individual Project: Energy & Water consumption
- Laboratory: Measurement of dispersion in a fluid
- Tutorials on all sections of course with 2 marked class tests
- Groupwork on the EWB design solutions

Lectures will be given face to face as well as live streamed and recorded.

Assessment Details² Please include the following: <ul style="list-style-type: none"> • Assessment Component • Assessment description • Learning Outcome(s) addressed • % of total • Assessment due date 	Assessment Component	Assessment Description	LO Addressed	% of total	Week due			
	Laboratory	Dispersion laboratory	LO4, LO6	10%	1 week after the lab session			
	Energy & Water Demand	Individual report on energy and water usage	LO2, LO3, LO4, LO6	10%	4			
	Class tests	Biological and chemical concepts	LO4, LO6	20%	8 & 10			
	EWB workshops	Write up on progress at each tutorial	LO1 to LO10	10%	2-11			
	Poster	Group poster on EWB concept	LO1 to LO10	10%	6			
	Presentation	Group presentation on EWB concept	LO1 to LO10	10%	11 or 12			
	EWB Report	Group report on EWB concept	LO1 to LO10	30%	12			
Reassessment Requirements								
Contact Hours and Indicative Student Workload²								
<table border="1" style="width: 100%;"> <tr> <td>Contact hours: 47 hrs (33hrs lectures, 3 hr lab, 11hrs tutorials)</td> </tr> <tr> <td>Independent Study (preparation for course and review of materials): 40 hrs</td> </tr> <tr> <td>Independent Study (preparation for assessment, incl. completion of assessment): 40 hrs</td> </tr> </table>						Contact hours: 47 hrs (33hrs lectures, 3 hr lab, 11hrs tutorials)	Independent Study (preparation for course and review of materials): 40 hrs	Independent Study (preparation for assessment, incl. completion of assessment): 40 hrs
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Recommended Reading List								
Recommended reading Environmental Engineering: Fundamentals, Sustainability, Design, JR Mihelcic, JB Zimmerman, 2010, Wiley [ISBN: 978-0470165058]								

² [TEP Guidelines on Workload and Assessment](#)

	Heat - How to Stop the Planet From Burning, George Monbiot, South End Press, 2009 [ISBN: 978-0896087873]
Module Pre-requisite	None
Module Co-requisite	None
Module Website	https://www.tcd.ie/Engineering/undergraduate/baiyear2/modules/2E7.pdf
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	No
Module Approval Date	
Approved by	
Academic Start Year	September 2022
Academic Year of Date	2022/2023