Module Code	CEU22E07
Module Name	Engineering and the Environment
ECTS Weighting[1]	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)
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1.Have a knowledge of the fundamental causes of environmental impact including a basic familiarity with the methods of analysis. LO2.Have acquired knowledge of the major measures of environmental and energy sustainability. LO3.Have developed skills in the areas of environmental analysis, scientific reasoning and communication. LO4.Have developed practical experimental skills in environmental and energy measurement. LO5.Appraise claims of emerging technologies in terms of sustainability and contribution to supply. LO6.Gain an ability to undertake problem identification and to apply knowledge and understanding of basic science and engineering principals. LO7.Gain an ability to communicate effectively, not only with engineers but more importantly with the community at large. LO8.Develop a basic awareness of global development issues and approaches to ensuring that basic rights and needs are fulfilled. LO9.Understand the importance of listening, engaging with and respecting local knowledge before proposing solutions. 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. **Graduate Attributes: levels of attainment** To act responsibly - Introduced To think independently - Introduced To develop continuously - Enhanced To communicate effectively - Enhanced

[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 Details[2]
Please include the following:

- **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 Workload[2]

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

[2] TEP Guidelines on Workload and Assessment

Recommended Reading List	Recommended reading Environmental Engineering: Fundamentals, Sustainability, Design, JR Mihelcic, JB Zimmerman, 2010, Wiley [ISBN: 978-0470165058] 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