Module Code	CEU44A031
Module Name	4A3(1) Environmental Engineering 1
ECTS Weighting[1]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Laurence Gill, Brian Broderick
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: 1. Categorise the difference in quality of water from different sources (such as groundwater and surface water). 2. Interpret a variety of different water quality parameters (physical, chemical and microbiological) with respect to likely waste source and pollution potential. 3. Analyse the degradation of biodegradable organic matter introduced into a watercourse with respect to time. 4. Calculate the dissolved oxygen sag in a water course downstream of an input of organic pollution. 5. Estimate the effect of increased phosphorous loading onto a water body with respect to eutrophic state. 6. Apply chemical engineering process design concepts to the design of a series of reactors for the treatment of both potable water and wastewater. 7. Calculate the size of unit processes for the treatment of potable water and wastewater on the basis of physical, chemical or biological environmental engineering concepts. In addition, be able to calculate the energy / chemical requirements and resultant by-products from such processes. 8. Demonstrate an awareness of the overall context of water and wastewater treatment with respect to national and international legislation and also human and environmental health. 9. Plan and prepare an overall design of a wastewater treatment plant from basic flow and load data. 10. Recognise a variety of atmospheric pollutants and their sources and analyse their dispersion from point sources under different meteorological conditions. **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Enhanced To develop continuously - Enhanced

	To communicate effectively - Enhanced
Module Content	This module runs throughout the first semester of the academic year and comprises three lectures per week. In addition, there is a two hour laboratory / tutorial periods every week for the module. This module aims to develop the basic concepts of Environmental Engineering encountered by the students in the Senior Freshman year by the application of such principles in terms of the analysis of the pollution of the natural aquatic environment, engineering of wastewater treatment and water treatment processes and then the study of air pollution. Analysis of environmental concepts in engineering includes the design of physical, chemical and biological treatment processes, the degradation of pollutants in the natural environment and the atmospheric dispersion of anthropogenic air pollutants. **Module content** ○ **Water Quality Fundamentals** Physical / Chemical / Biological characteristics ○ **Natural Processes** Dilution / Sedimentation Mass transfer /Heat transfer Stratification / Eutrophication Gas transfer (aeration) / Dissolved Oxygen model ○ **Process Design Concepts** Reactor analyses / Mass balance Kinetics of biological growth Hydraulic profiles ○ **Wastewater Treatment** Legislation & quality parameters Wastewater network overview Wastewater characteristics Preliminary / Primary / Secondary / Tertiary treatment Sludge treatment ○ **Water Treatment** Legislation & quality parameters Water sources & characteristics Coagulation / Flocculation Filtration / Adsorption Disinfection Oxidation / catalytic ppt / ion exchange / membranes Sludge treatment ○ **Air Quality** Atmospheric pollutants and sources

	Meteorology Atmospheric stability and turbulence Atmospheric dispersion – Gaussian model
Teaching and Learning Methods	This module is taught by a combination of lectures, laboratory classes and tutorials during which a Group Design Project of a wastewater treatment plant is carried out. Extensive handouts for the module are given at the beginning of each lecture. The Group Design Project is handed out to the students in week 6 of the module and aims to encourage problem-based learning and teamwork. The completed design has to be submitted by the end of the first week of the second semester. The projects are marked and returned to the students with extensive comments. Two laboratory experiments are also undertaken, one examining the aeration of water and the other demonstrating the coagulation and flocculation of water in order to remove colloidal particles. As assignment on air pollution also forms part of the continuous assessment of this module. These are directly related to material covered in the module and enable the student to experience the practical application of the theoretical analysis of the lectures. Both practicals have to be written up and handed in by the end of the first semester.

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
Continuous assessment 1	Group Design Project	LO2,3,4,6,7,9	10%	12
Continuous assessment 2	2 laboratory practicals	LO2,4,6,7	8%	7
Continuous assessment 2	Air pollution assignment	LO10	7%	12
Examination	2 hour written examination	LO1-9	75%	-

Reassessment Requirements

100% written examination

Contact Hours and Indicative Student Workload[2]

Contact hours: 27 lectures, 1 x 3hr lab session, 3 x 2hr project tutorial
Independent Study (preparation for course and review of materials): 30 hrs
Independent Study (preparation for assessment, incl. completion of assessment): 60 hrs

Recommended Reading List

Fundamentals of Environmental Engineering – Mihelcic (Wiley)

Wastewater Engineering – Metcalf and Eddy (McGraw-Hill)

Water Supply – Twort et al. (IWA)

Environmental Engineering – Kiely (McGraw-Hill)

Module Pre-requisite

Module Co-requisite

Module Website

https://www.tcd.ie/Engineering/undergraduate/baiyear4/modules/4A31.pdf

Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.

Module Approval Date

Approved by	
Academic Start Year	September 2021
Academic Year of Date	2021-22

COVID-19 contingency statement:

While the intention is to deliver some lectures, tutorials and labs face-to-face, there is uncertainty due to the Covid-19 situation and the entire module delivery may need to change to an online delivery if required by government restrictions. In the case of a possible new lockdown scenario during teaching term:

- All lectures, tutorials and labs will be delivered online using Blackboard. Some of these sessions will be ***live*** sessions and your attendance at live sessions is required.
- Assignments and examinations will be conducted and submitted online.