



Trinity College Dublin

Coláiste na Tríonóide, Baile Átha Cliath

The University of Dublin

School of Natural Sciences and School of Engineering

Environmental Science and Engineering

Integrated Master's

TR064 Handbook

2026-27

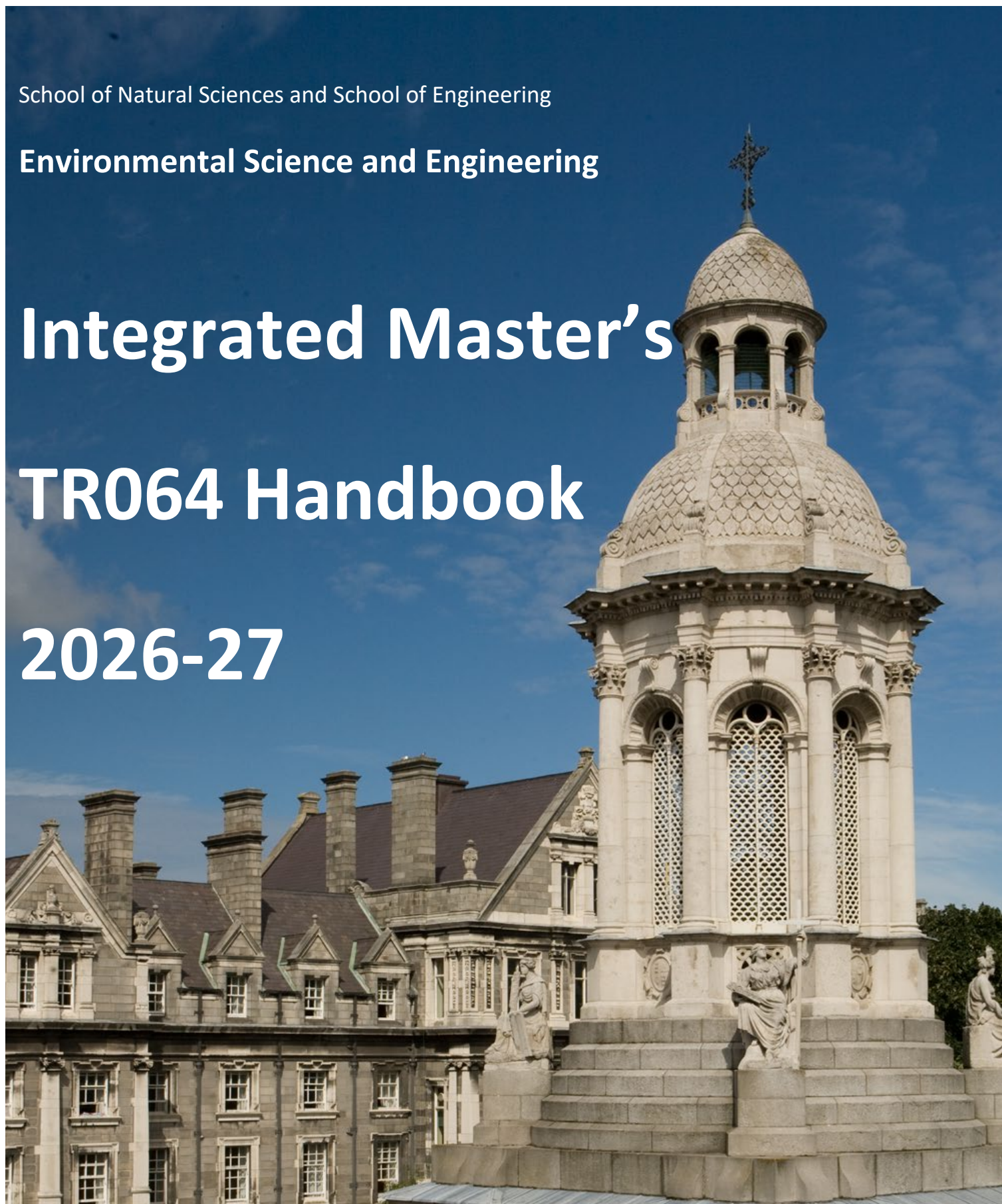


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Welcome

Congratulations on making it into Year 5 of the programme – the Masters Year. Hopefully, you all gained stimulating experiences last year, either out on Erasmus studying in a different country or on an industrial internship and are now ready to undertake your final year of studies. This year you will be able to really delve into the specialist subjects that you would like to study, with a wide variety of different options on offer. You must take the Independent Research “Capstone” Project module which aligns with their chosen stream (Environmental Engineering or Applied Environmental Science) in addition to at least three optional modules associated with their chosen stream. The only core module this year is the Team Design project in Semester 2.

The Capstone project (worth 30 ECTS) is a significant level of independent research that you will carry out that will result in significant piece of original work in your final year. It will provide you with the opportunity to showcase the skills and knowledge which you have developed across a range of subject areas and across your years of study. Please meet with your assigned supervisor as soon as possible (if you have not already done this over the summer) to make a strong start on your project which spans across both semesters

While there is a strong focus on scientific and technical content and problem solving in the syllabus, personal skills such as communication and teamwork are an integral part of your education, and you will have opportunities to apply these this year during the Design Module in the second semester. As in previous years you will be given the opportunity to provide us with considered feedback via your class representative. We also encourage you to provide feedback and guidance to your peers in Freshman and Sophister classes.

College offers a wide range of support services. If you are experiencing problems or need to seek advice (personal, financial, health, career or academic), there are a number of sources of help available: these are listed later in this handbook. Do not hesitate to call on these services should the need arise. Each of you has been allocated a tutor, and he/she is an excellent resource to help you with identifying relevant support services. We wish you a successful and enjoyable final year at University.

Professor Silvia Caldararu



School of Natural Sciences

Professor Laurence Gill



School of Engineering

Introduction

Environmental Science and Engineering is an integrated undergraduate with postgraduate degree course that aims to train the next generation of graduates who have the competencies, knowledge and experience necessary to design and deploy solutions that protect and improve our environment and human wellbeing, and that work with rather than against the natural world to foster biodiversity, climate action and sustainable use of earth's finite resources. The course will provide students with fundamental grounding in the Natural Sciences and Engineering, and in the applied skills required to develop sustainable solutions for major societal and environmental challenges. The unique combination of Engineering and Natural Sciences modules represents one of the first in Ireland and internationally. Strong emphasis is placed on students acquiring practical laboratory and field skills as well as working in teams.

Although the information in this handbook is correct at the time of production, the precise content of the course is subject to change. While every effort will be made to give due notice of major changes, the School Office reserves the right to suspend, alter or initiate courses, timetables, examinations and regulations at any time.

*****NOTE*** Students should expect to pay fees for mandatory field courses, which can take place in the 1st week of Semester 1 as well as reading week and final week of Semester 2. Fees can range from €500 to €1000 for any given field course. Details will be confirmed in advance by the Module Coordinator.*****

Overall Course Objectives/ Learning Outcomes

On completion of the *single honours integrated programme* in **Environmental Engineering** students should be able to:

LO1: Demonstrate knowledge and understanding of the mathematics, sciences, engineering sciences and technologies underpinning environmental system;

LO2: Demonstrate an interdisciplinary knowledge and appreciation of the importance and finite nature of Earth's resources and natural capital;

LO3: Demonstrate deep knowledge and understanding of local to global environmental challenges facing society;

LO4: Work effectively as an individual, in teams and in multi-disciplinary settings, together with the capacity to undertake lifelong learning;

LO5: Communicate effectively on engineering activities with the engineering community and with society at large;

LO6: Identify, formulate, analyse and solve engineering problem;

LO7: Perform the detailed design of a novel system, component or process using the analysis and interpretation of relevant data;

LO8: Design and conduct experiments and to apply a range of standard research tools and techniques of enquiry;

LO9: Display high ethical standards in the practice of engineering, including the responsibilities of the engineering profession towards people and the environment.

On completion of *year 5 of the integrated Environmental Science and Engineering programme*, **Environmental Engineering** students should be able to meet the following Course Learning Outcomes:

CLO1. Demonstrate advanced knowledge of the mathematics, sciences, engineering sciences and technologies underpinning Environmental engineering.

CLO2. Identify, formulate, analyse and solve complex engineering problems.

CLO3. Perform independently a detailed design of a novel system, component or process by analysing and interpreting relevant data.

CLO4. Design and conduct experiments and to apply a range of standard and specialised research (or equivalent) tools and techniques of enquiry.

CLO5: Display high ethical standards in the practice of engineering, including the responsibilities of the engineering profession towards people and the environment as well as demonstrating a wide perception of societal needs and dynamics.

CLO6: Work effectively as an individual, in teams and in multi-disciplinary settings.

CLO7: Communicate effectively on complex engineering activities with the engineering and environmental science community and with society at large.

CLO8. Engage in lifelong professional development

CLO9. Demonstrate advanced knowledge of specialized areas within environmental engineering.

On completion of the *single honours integrated programme* in **Applied Environmental Science**, students should be able to:

LO1. Demonstrate knowledge and understanding of the mathematics, sciences, engineering sciences and technologies underpinning environmental systems;

LO2.Demonstrate an interdisciplinary knowledge and appreciation of the importance and finite nature of Earth's resources and natural capital;

LO3.Demonstrate deep knowledge and understanding of local to global environmental challenges facing society;

LO4.Work effectively as an individual, in teams and in multi-disciplinary settings, together with the capacity to undertake lifelong learning;

LO5.Communicate effectively on environmental science activities with the environmental science (and engineering) community and with society at large;

LO6.Display advanced knowledge and skill in design, experimentation, data analysis and interpretation to develop and implement real-world solutions for local to global environmental issue;

LO7.Show a deep appreciation of the ethical, political and human rights principles underpinning sustainable development;

LO8.Demonstrate strong theoretical and technical competence in Environmental Science.

On completion of *year 5 of the integrated Environmental Science and Engineering programme*, **Applied Environmental Science** students should be able to:

CLO1. Demonstrate advanced knowledge and understanding of local to global environmental challenges facing society.

CLO2. Demonstrate advanced interdisciplinary knowledge and appreciation of the importance and finite nature of Earth's resources and natural capital.

CLO3. Make informed and ethical decisions that balance technical, social and environmental considerations.

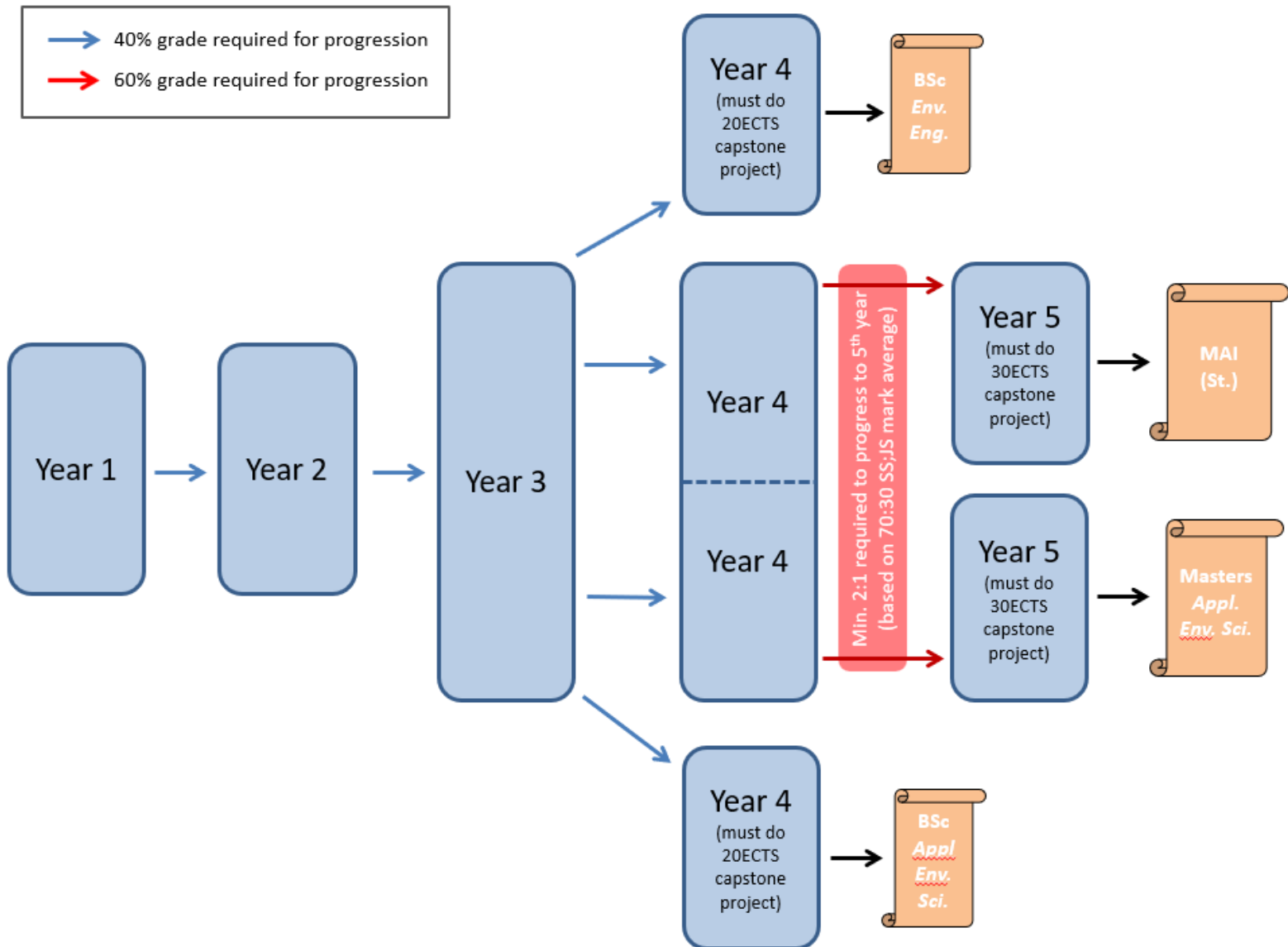
CLO4. Work effectively as an individual, in teams and in multi-disciplinary settings.

CLO5. Communicate effectively on environmental science activities with the environmental science and environmental engineering community and with society at large.

CLO6. Use advanced knowledge and skill in design, experimentation, data analysis and interpretation to develop and implement real-world solutions for local to global environmental issues and challenges.

CLO7. Demonstrate advanced theoretical and technical competence in Environmental Science through an independent research project.

Academic Progress and Streaming Process (Specific to Environmental Science and Engineering)



Progression

Year 5:

Progression will be on an annual basis. Progression from Year 4 to Year 5 will require a minimum overall mark of 60% for the combined Junior Sophister and Senior Sophister years (on a 30:70 basis) at the annual assessment session of the B.Sc. degree year.

In year 5, students will be able to carry failed modules from semester to semester. Progression through year 5 leading to the final awards of M.A.I. (St.) and Master in Applied Environmental Science depending on the route chosen, requires a 50% pass grade for award of pass degree on the results of students' continuous assessment and examinations. The award of distinction degree shall require at least 70 per cent in both examinations and the dissertation and at least 70 per cent in the final credit weighted average.

Streaming Rules

In Year 5 - students must take the Independent Research Capstone Project module which aligns with their chosen in addition to at least **three optional modules** associated with their chosen stream.

The European Credit Transfer Accumulation System (ECTS)

The European Credit Transfer and Accumulation System (ECTS) is an academic credit system based on the estimated student workload required to achieve the objectives of a module or programme of study. It is designed to enable academic recognition for periods of study, to facilitate student mobility and credit accumulation and transfer. The ECTS is the recommended credit system for higher education in Ireland and across the European Higher Education Area.

The ECTS weighting for a module is a **measure of the student input or workload** required for that module, based on factors such as the number of contact hours, the number and length of written or verbally presented assessment exercises, class preparation and private study time, laboratory classes, examinations, clinical attendance, professional training placements, and so on as appropriate. There is no intrinsic relationship between the credit volume of a module and its level of difficulty.

The European **norm for full-time study over one academic year is 60 credits**. 1 credit represents 20-25 hours estimated student input, so a 10-credit module will be designed to require 200-250 hours of student input including class contact time, assessments, and examinations.

ECTS credits are awarded to a student only upon successful completion of the course year. Progression from one year to the next is determined by the course regulations. Students who fail a year of their course will not obtain credit for that year even if they have passed certain component courses. Exceptions to this rule are one-year and part-year visiting students, who are awarded credit for individual modules successfully completed.

https://ec.europa.eu/education/resources-and-tools/european-credit-transfer-and-accumulation-system-ects_en

Important Information for TR064 Students

Capstone Project

The Capstone project is a significant level of independent research that you will carry out that will result in significant piece of original work in your final year. It will provide you with the opportunity to showcase the skills and knowledge which you have developed across a range of subject areas and across your years of study. The Master's project is taken in 5th year by those on the 'MAI Environmental Engineering' or 'Master's in Applied Environmental Sciences'. Please note that the internship project will NOT in any circumstances be deemed equivalent to a capstone project. College regulations require that all students must complete a capstone project to be eligible to graduate. The type of research that you will do will depend on your programme of study.

The Capstone project — though defined differently by different subjects — is the common element across all degree exit routes. It requires a significant level of independent research by the student.

The Capstone should:

- be an integrative exercise that allows students to showcase skills and knowledge which they have developed across a range of subject areas and across the four years of study
- result in the production of a significant piece of original work by the student
- provide students with the opportunity to demonstrate their attainment of the four graduate attributes: to think independently, to communicate effectively, to develop continuously and to act responsibly.

Students should refer to School and College policies and procedures with regards to research guidelines and ethical practices.

Prizes, Medals, and Other Scholarships

TR064 Programme Prizes

Environmental Science and Engineering annual prizes

Four prizes are awarded annually to the student achieving the highest overall mark in the Junior Fresh, Senior Fresh, Junior Sophister and Senior Sophister years of the Environmental Science and Engineering course respectively. Value of each prize, €200.

Simon Perry prize in Environmental Science and Engineering

This prize will be awarded annually to the student achieving the highest overall mark in the fifth year of the Environmental Science and Engineering course. Value, €300.

E3 prize in Environmental Science and Engineering

This prize will be awarded annually to the student in the fifth year of the Environmental Science and Engineering course achieving the highest mark in their research project dissertation. Value, €300.

Book Prizes

A prize of a book token to the value of €13 is awarded to candidates who obtain a standard equivalent to an overall first class honours grade (70% and above) at the first attempt of the semester 1 and semester 2 assessment. Book Prizes will be available for collection in November of the following academic year from the Academic Registry. These prizes are issued in the form of book tokens and can be redeemed at Hodges Figgis and Co. Ltd.

Academic Year Structure

Find the full academic year structure 2026-27 here: [academic-year-structure.pdf](https://www.tcd.ie/academicregistry/student-cases/)

Key Dates

Event(s)	Date(s)
Semester one starts	UG continuing years / PG all years: Classes start 14-Sept-26 UG new first years: - Orientation (JF UG) 14-Sept-26 - Classes start 21-Sept-26
Semester one ends	Week 15 - 07-Dec-26 - Revision / Assessment* * Semester 1 assessment session: December 11 to 22, 2026 inclusive (No assessment after Dec 22)
Semester one assessment session	Week 15 to Week 17 – 11-Dec-26 to 22-Dec-26
Semester two starts	Week 21 - 18-Jan-27
Semester two ends	Week 33 - 12-Apr-27 - Revision
Semester two assessments session	Week 34 and Week 35 - 19-Apr-27 to 30-Apr-27
Publication of results	End of May 2027 after the Court of Examiners
Reassessment Examinations	Week 52 - 23-Aug-27
Publication of Reassessment results	After Reassessment Court of Examiners early Sept 2027
Graduation	TBC – Scheduled yearly for autumn/winter

Assessment Regulations

All students must fulfil the course requirements of the school or department, as appropriate, with regard to attendance and course work. Where specific requirements are not stated, students may be deemed non-satisfactory if they miss more than a third of their course of study or fail to submit a third of the required course work in any term.

Further details of procedures for reporting a student as non-satisfactory are given on the College website at <https://www.tcd.ie/academicregistry/student-cases/>

Transcripts

Transcripts requests should be made to the course administrator: envscieng@tcd.ie

The School of Engineering and the Science Course Office are not responsible for issuing Environmental Science and Engineering transcripts.

Module List

Module Selection – Master’s (Year 5)

Core Modules

Semester 1	Semester 2
ES7047 – Research Project (30 ECTS)	
	ES7046 - Team Design (5 ECTS)

Optional Modules

Students must take the Independent Research Project module which aligns with their chosen stream (Environmental Engineering or Applied Environmental Science) in addition to at least three optional modules associated with their chosen stream.

Semester 1 – choose 3	Semester 2 – choose 2
CE7J02 - Solar Energy Conservation & Applications (5 ECTS)	CE7E05 - Water Quality and Hydrological Modelling (5 ECTS)
CE7J04 - Energy Policy and Energy Storage (5 ECTS)	CE7E06 - Water Resource Planning and Climate Change (5 ECTS)
CE7E07 - Sustainable Water Supply and Sanitation (5 ECTS)	CE7J01 - Wind Energy (5 ECTS)
CEP55E03 - Air Pollution: Monitoring, Assessment, Control (5 ECTS)	ES7027 - Environmental Policy (5 ECTS) - cap of 5
CE7E04 - Waste Management and Energy Recovery (5 ECTS)	CEP55E06 - Groundwater and Pollution Control (5 ECTS)
DP7023 - Climate Change: Science, Development and Justice (5 ECTS)	DP8017 – Smart-Eco Cities of the Future (5 ECTS) - cap of 6
CE7C05 - Advanced Spatial Analysis using GIS (5 ECTS)	BD7056 - Human Impact with Biodiversity (5 ECTS)
ES7057 - Navigating Complexity for Sustainable Futures (5 ECTS)	CSP7001 - Intro to Machine Learning (5 ECTS) *prerequisite EEU33C01 recommended but not required

Year Module Structure

Brief breakdown: Overview of core, approved, open, assessment modes and TEs modules for the year.

Michaelmas Term

Module code	Module title	ECTS	Term
	Module Coordinator	ICA/CW/FE	
ES7047	Research Project	30	Michaelmas and Hilary
	Muhammad Ali	100% CW	
CE7J02	Solar Energy Conservation & Applications	5	Michaelmas
	Sarah McCormack	60% FE 40% CW	
CE7J04	Energy Policy and Energy Storage	5	Michaelmas
	Sarah McCormack	75% FE 25% CW	
CE7E07	Sustainable Water Supply and Sanitation	5	Michaelmas
	Laurence Gill	70% FE 30%CW	
ES7057	Navigating Complexity for Sustainable Futures	5	Michaelmas
	Quentin Crowley	100% CW	
CEP55E03	Air Pollution: Monitoring, Assessment, & Control	5	Michaelmas
	John Gallagher	100% CW	
CE7E04	Waste Management and Energy Recovery	5	Michaelmas
	Liwen Xiao	70% FE 30%CW	
CE7C05	Advanced Spatial Analysis Using GIS	5	Michaelmas
	Patrick Morrissey	100% CW	
DP7023	Climate Change: Science Development and Justice	5	Michaelmas
	Susan Murphy & Conor Buggy	100% CW	

ICA = In course Assessment – Formal Assessment in exam conditions

CW = Coursework

FE = Formal Examination in Annual Examination Period

Hilary Term

Module code	Module title	ECTS	Term
	Module Coordinator	ICA/CW/FE	
ES7046	Team Design	5	Hilary
	Laurence Gill / TBC	100% CW	
CE7E05	Water Quality and Hydrological Modelling	5	Hilary
	Laurence Gill	70% FE 30% CW	
CE7E06	Water Resource Planning and Climate Change	5	Hilary
	David O'Connell	80% FE 20% CW	
CE7J01	Wind Energy	5	Hilary
	Breiffni Fitzgerald	70% FE 30% CW	
ES7027	Environmental Policy	5	Hilary
	Corentin Flament Loron	100% CW	
CEP55E06	Groundwater and Pollution Control	5	Hilary
	David O'Connell	100% FE	
DP8017	Smart-Eco Cities of the Future	5	Hilary
	Stephan Hugel	100% CW	
BD7056	Human Impact with Biodiversity	5	Hilary
	Rosie Mangan	100% CW	
	Intro to Machine Learning	5	Hilary

CSP7001	Giovanni Di Liberto	100% CW	
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ICA = In course Assessment – Formal Assessment in exam conditions

CW = Coursework

FE = Formal Examination in Annual Examination Period

Module Descriptions

Semester 1 and 2 – Core

Module Code	ES7047
Module Name	Research Project
ECTS Weighting¹	30 ECTS - Derogation
Semester taught	Semester 1 & 2
Module Coordinator/s	Dr. Muhammad Ali
<u>Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline</u>	On successful completion of this module, students should be able to: LO1. Investigate and Analyse: Formulate a complex engineering problem and contribute new knowledge by critically synthesising existing literature, applying systematic research methods, and evaluating the findings. LO2. Design and Solve: Devise an innovative solution to a complex engineering problem by applying advanced theoretical principles and utilising specialised experimental, computational, or analytical techniques. LO3. Evaluate Professional Impact: Assess the professional, ethical, societal, and environmental impact of the engineering work undertaken in the project. LO4. Communicate Effectively: Communicate the project's context, methodology, results, and conclusions on complex engineering activities effectively to diverse audiences through a formal written dissertation and an oral defence. LO5. Manage Project Independently: Plan, manage, and execute a substantial research project with a high degree of autonomy, demonstrating self-directed learning and the application of engineering management principles.
Module Content	This module allows the students to complete an individual research project on topics related to future climate resilience in the Irish context, in Engineering and Natural Sciences, interests in AHSS could be negotiated. The main objective of this module is to plan, execute and report on an individual engineering research project at a level appropriate level 9 required for accredited programme. A list of joint project topics/titles from the Schools of Engineering and Natural Sciences and potentially from Arts Humanities and Social Sciences will be issued to students towards the end of the second semester of the Senior Sophister year.

¹ [TEP Glossary](#)

Students will be asked to rank their project preferences from one to five, and allocations will be confirmed by the end of June of that year.

Teaching and Learning Methods

Each individual project will be supervised by an academic staff member in the Schools of Engineering and Natural Sciences. Occasionally, if deemed academically appropriate by the module coordinator, additional supervisors may be involved. The students must meet their assigned supervisor in week 1 of semester 1 at the latest, or as soon as they are assigned a project title. There are no formal timetabled hours associated with the project, but students are expected to spend the time it takes to make reasonable progress and to keep in regular contact with their supervisors. For a 30 ECTS project, this is approximately 25 hours per week over the two 12-week Semesters. It is recommended that students make a formal arrangement with their supervisors to meet on a regular basis. Note that students must take responsibility for their own engagement in the project.

Assessment Details²

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
Project Plan	5-minute Presentations including background to project, clear goal and proposed path forward. Followed with 5 minutes questions/feedback from academic/technical staff.	4,1,3,5	5%	Week 6 of Teaching in Sem1 (arranged by coordinator)

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

	Literature Review	Progress report with detailed literature review, showing a good grasp of the project background and motivation. Followed by feed-back from supervisor.	1,4,5	5%	6 Nov 2026
	Thesis	Masters-level thesis	1,2,3,4,5	90%	Last day of Teaching in Semester 2 (Week 32)
	Viva-Voce Presentation	Supervisor and second reader to attend. Supervisor and 2nd reader submit their independent thesis reports prior to the Viva. Final marks are agreed at Viva.	1,2,3,4,5	85%	Within Revision Week or Exam Period of Semester 2 (Organised with Supervisor)
	A handout detailing each assessment element will be shared with students. The thesis must use a template as directed by the module co-ordinator. The dissertation is examined independently by the project supervisor and a second examiner; with a third examiner and the external examiner providing moderation when required.				
Reassessment Requirements	Based on report only, with option to call for viva if supervisor or 2nd reader, or Module Coordinator require this.				
Contact Hours and Indicative Student Workload ²	Contact hours: Approximately 12-24 hours over the two Semesters is typical, depending on nature of the project, through meetings with supervisor.				

	Independent Study (preparation for course and review of materials): A total student effort of 25 hours a week on average is expected for the 30 ECTS project, over the course of the two Semesters of the MAI year Independent Study (preparation for assessment, incl. completion of written assessment): 750 student effort hours
Recommended Reading List	
Module Pre-requisite	
Module Co-requisite	N/A
Module Website	Blackboard Ultra
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Natural Sciences Admin contact: Caroline Clabby – TR064 Course Administrator
Academic Start Year	September 2026
Academic Year of Date	2026-2027

Semester 1 – Optional

Module Code	CEP55E03
Module Name	Air Pollution: Monitoring, Assessment & Control
ECTS Weighting³	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Dr. John Gallagher

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. Describe key concepts relating to air pollution science and its application to environmental engineering.
- LO2. Measure air pollution concentrations in practice and identify the advantages and limitations of differing monitoring approaches.
- LO3. Assess, apply and evaluate differing forms of air pollution models for the prediction of concentrations in the atmosphere.
- LO3. Appraise differing approaches to the control and mitigation of air pollution for outdoor and indoor settings and in urban and industrial settings.
- LO4. Discuss the development and application of national emissions inventories and projections.
- LO6. Critically evaluate an environmental impact assessment of new infrastructure developments or policy from an air pollution perspective.

Module Content

The module commences with an introduction to the field of air pollution science, identifying the current challenges in the field and key background knowledge in the provision of clean air for society and the environment.

The module explores the adoption of, and best practice in, air pollution monitoring and modelling, to help understand concentrations and exposure in various settings and to assess the impacts of policy changes, new technology or developments. The module also explores the control of air pollution in outdoor and indoor conditions from an environmental engineering perspective with a particular focus on sustainable approaches to air pollution mitigation or management. The development of national emissions inventories is examined and inform how to approach the projection of pollution into the future using forecasting techniques.

The module deals with the development of environmental impact assessment in relation to air pollution in infrastructure developments/policy, using case studies examples to demonstrate good and/or bad practice (e.g., incineration, construction projects, roads, etc).

Teaching and Learning Methods

All lectures will be delivered live from a lecture theatre (face-to-face) format, and complementary practicals will use the University campus, adjacent streets, and local park for data collection and observational assessments. This course will combine traditional lectures with case studies that inform problem-based and simulation-based learning, and this shapes the student's approach to assessment and promotes collaboration through peer-learning. The two field tutorials/practicals will provide hands-on experience of air quality science to ground fundamentals and context for some coursework and lecture material.

Coursework provides opportunity to demonstrate independent and group-based learning to developing new skills (air pollution monitoring) including using new tools (air quality dispersion and atmospheric modelling software), and competencies (critical thinking, systems thinking, strategic, and integrated problem-solving).

Assessment Details⁴

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
Personal Exposure monitoring and modelling	Personal exposure monitoring and modelling study including (25-page limit).	LO1-LO5	80%	Wk11
Improving air quality through design and policy (mitigation) interventions	In-class test	LO5-LO6	20%	Wk12

Reassessment Requirements

Resubmission of 100% extended coursework.

Contact Hours and Indicative Student Workload²

Contact hours: 30 hours Lectures – 3 hours per week for 9 weeks Tutorials/Practicals – 3 hours for 1 week
Independent Study (preparation for course and review of materials): 15 hours for review of lecture notes and suggested reading.
Independent Study (preparation for assessment, incl. completion of assessment): 80 hours (60 hours coursework and 20 hours revision) Data analysis using air pollution monitoring equipment, including evaluation of monitoring, modelling and control practices to inform improved air quality outcomes. Review of lecture content and study for in-class test on design and policy mitigation measures or interventions.

Recommended Reading List

Module Pre-requisite	N/A
Module Co-requisite	N/A
Module Website	
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Engineering, Civil Structural and Environmental Engineering Admin contact: Caroline Clabby – TR064 Course Administrator Liam McCarthy – Executive Officer, Civil Struct & Env. Eng.
Academic Start Year	September 2026
Academic Year of Date	2026-2027

Module Code	CE7E04
Module Name	Waste Management and Energy Recovery
ECTS Weighting⁵	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Dr. Liwen Xiao
<u>Module Learning Outcomes</u> with reference to the <u>Graduate Attributes</u> and how they are developed in discipline	On successful completion of this module, students should have LO1. An understanding of the nature of solid waste and the conceptual approaches to solving the problems of its management. LO2. An understanding of the theories and technologies of energy recovery from solid waste. LO3. An understanding of the best available technologies for waste treatment. LO4. An understanding of legislations and regulations relevant to waste management. LO5. An understanding of the relationships between waste management, climate change, circular economy and sustainable development. LO6. The capacity to collect and analyse data for waste management. LO7. The capacity to develop sustainable waste treatment strategies for a region or city. Graduate Attributes: levels of attainment

⁵ [TEP Glossary](#)

	To act responsibly - Enhanced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Enhanced																				
Module Content	This module will introduce (1) the definition of waste and approaches to the assessment, management and control of solid waste in its various forms, and (2) the theories and technologies of energy recovery from solid waste. • Solid waste: definitions and assessment, liquid, solid and gaseous. • Landfill/landspreading hydrology: processes and modelling. • Thermal treatment: Incineration, pyrolysis, gasification. • Contaminated land: investigation and remediation of contaminated soil and groundwater. Sampling and monitoring; legal issues; risk analysis. • Energy recovery: heat, electricity and combustible gases recovery from organic waste.																				
Teaching and Learning Methods	Lectures, tutorials, coursework and field visit																				
Assessment Details ⁶ Please include the following: • Assessment Component • Assessment description • Learning Outcome(s) addressed • % of total • Assessment due date	<table><tr><th>Assessment Component</th><th>Assessment Description</th><th>LO Addressed</th><th>% of total</th><th>Week due</th></tr><tr><td>Continuous Assessment 1</td><td>Tutorial and assignments</td><td>LO2, LO6</td><td>10%</td><td>Week 9</td></tr><tr><td>Continuous Assessment 2</td><td>Report and field visits</td><td>LO1-LO7</td><td>20%</td><td>Week 17</td></tr><tr><td>Examination</td><td>3-hour examination</td><td>LO1-LO7</td><td>70%</td><td>Week 16</td></tr></table>	Assessment Component	Assessment Description	LO Addressed	% of total	Week due	Continuous Assessment 1	Tutorial and assignments	LO2, LO6	10%	Week 9	Continuous Assessment 2	Report and field visits	LO1-LO7	20%	Week 17	Examination	3-hour examination	LO1-LO7	70%	Week 16
Assessment Component	Assessment Description	LO Addressed	% of total	Week due																	
Continuous Assessment 1	Tutorial and assignments	LO2, LO6	10%	Week 9																	
Continuous Assessment 2	Report and field visits	LO1-LO7	20%	Week 17																	
Examination	3-hour examination	LO1-LO7	70%	Week 16																	
Reassessment Requirements																					

⁶ [TEP Guidelines on Workload and Assessment](#)

Contact Hours and Indicative Student Workload²	Contact hours: 27 hours of lectures, 3 hours of tutorials and site visits (10 hours)
	Independent Study (preparation for course and review of materials): 30 hours; Researching journals; reading textbooks recommended in module booklist; reviewing lecture material and class notes
	Independent Study (preparation for assessment, incl. completion of written assessment): 30 hours; literature review, research methods development, data collection and analysis, completion of end of semester essay
Recommended Reading List	Textbooks include: Fetter, C.W. CONTAMINANT HYDROGEOLOGY, 1999, Prentice Hall La Grega, M.D., Buckingham, P.L., Evans, G.J., HAZARDOUS WASTE MANAGEMENT, 1994, McGraw-Hill Nathanail, C.P. and Bardos, R.P. RECLAMATION OF CONTAMINATED LAND, 2004, Wiley Tchobanoglous, G., Theisen, H., Vigil, S.A. INTEGRATED SOLID WASTE MANAGEMENT, 1993, McGraw-Hill Williams, P. WASTE TREATMENT AND DISPOSAL, 1997, Wiley
Module Pre-requisite	Chemistry and environmental engineering background
Module Co-requisite	N/A
Module Website	Blackboard Ultra
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Engineering, Civil Structural and Environmental Engineering Admin contact: Caroline Clabby – TR064 Course Administrator Liam McCarthy – Executive Officer, Civil Struct & Env. Eng.
Academic Start Year	September 2026
Academic Year of Date	2026-2027

Module Code	CE7J02
Module Name	Solar Energy Conversion & Applications
ECTS Weighting⁷	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Prof. Sarah McCormack
<u>Module Learning Outcomes</u> with reference to the <u>Graduate Attributes</u> and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Describe the function and design of different system types of (i) solar thermal including the flat plate, evacuated tube, thermosiphon and integrated collector store systems and (ii) photovoltaic including monocrystalline silicon, amorphous, thin film and multijunction modules and emerging technologies. LO2. Calculate optical properties of material for solar energy systems based on spectral measurements. LO3. Explain how the performance of solar energy systems varies annually and diurnally, depending on location, sky conditions, device and application type and load/user behaviour. LO4. Clarify which materials are best suited for use in solar panels as well as explain what surface treatments can be used to enhance thermal and electrical performance. LO5. Describe the function of the most important components necessary in a solar energy system. LO6. Describe the state of the art in thermal and photovoltaic technologies as well as show an insight into future trends and advances. LO7. Design of a solar farm for specific locations and applications Graduate Attributes: levels of attainment To act responsibly - Enhanced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Enhanced

⁷ [TEP Glossary](#)

Module Content	This module introduces a range of topics in the advanced physics and technology of solar energy conversion and materials, devices and applications. Participants will gain an in dept knowledge of current advances in solar energy, principles of operation of solar thermal and photovoltaic devices, technological challenges and their applications. The module also provides an introduction into next generation technologies. The aim of this module is to give the students an extended foundation of the main concepts of solar energy and to enable them to practically apply their knowledge in research and development.							
Teaching and Learning Methods	A combination of lectures, tutorials and laboratories.							
Assessment Details ⁸ 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	Group work – designing solar PV and thermal systems Presentation and report	LO1,3,5	40%	Week 6			
	Examination	3-hour examination	ALL	60%				
Reassessment Requirements	Re-assessment, if needed, consists of 100% written examination (3 hours), weighted at 50% to pass							
Contact Hours and Indicative Student Workload ²	<table><tr><td>Contact hours: 33 hours</td></tr><tr><td>Independent Study (preparation for course and review of materials): 45 hours</td></tr><tr><td>Independent Study (preparation for assessment, incl. completion of written assessment): 45 hours</td></tr></table>					Contact hours: 33 hours	Independent Study (preparation for course and review of materials): 45 hours	Independent Study (preparation for assessment, incl. completion of written assessment): 45 hours
Contact hours: 33 hours								
Independent Study (preparation for course and review of materials): 45 hours								
Independent Study (preparation for assessment, incl. completion of written assessment): 45 hours								

⁸ [TEP Guidelines on Workload and Assessment](#)

Recommended Reading List	Photovoltaic solar energy conversion. G. H. Bauer, (2015) Springer.
Module Pre-requisite	N/A
Module Co-requisite	N/A
Module Website	Blackboard Ultra
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Engineering, Civil Structural and Environmental Engineering Admin contact: Caroline Clabby – TR064 Course Administrator Liam McCarthy – Executive Officer, Civil Struct & Env. Eng.
Academic Start Year	September 2026
Academic Year of Date	2026-2027

Module Code	CE7J04
Module Name	Energy Policy and Energy Storage
ECTS Weighting⁹	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Prof. Sarah McCormack Additional lecturer(s): Dr. Mohammad Reza Ghaani
<u>Module Learning Outcomes</u> with reference to the <u>Graduate Attributes</u> and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Critically evaluate the objectives, challenges, and trade-offs inherent in energy policy. LO2. Analyse how energy resources, technologies, and geopolitical factors influence national energy systems and policy choices. LO3. Assess the effectiveness of energy policy instruments and market mechanisms in supporting energy transitions. LO4. Design and evaluate energy policy strategies, including implementation, monitoring, and feedback processes.

⁹ [TEP Glossary](#)

LO5. Critically examine the role of energy access, stakeholder engagement, and social acceptance in achieving equitable and sustainable energy transitions.

LO6. Compare and evaluate various energy storage technologies in terms of their strengths, limitations, and cost-effectiveness for different energy systems and applications.

LO7. Design energy storage systems to support grid stability, integrate renewable energy sources, and optimize energy dispatch and management.

LO8. Evaluate the environmental sustainability of energy storage technologies, considering factors like resource utilization, emissions, and end-of-life management.

Graduate Attributes: levels of attainment

To act responsibly - Introduced

To think independently - Attained

To develop continuously - Enhanced

To communicate effectively - Enhanced

Module Content

This module is an optional module which runs in the first semester. The module will develop knowledge in current energy policy and our energy storage options. It will include topics in energy economics, policy, energy storage options and circular economy and sustainability in storage systems will be addressed.

Teaching and Learning Methods

Core content via lectures
Individual assignments

Assessment Details¹⁰

Please include the following:

- Assessment Component
- Assessment description

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Continuous Assessment	Energy Storage Design Project	LO4-6	25%	Week 12
Examination	3-hour examination	ALL	75%	N/A

¹⁰ [TEP Guidelines on Workload and Assessment](#)

• Learning Outcome(s) addressed • % of total • Assessment due date				
Reassessment Requirements	Re-assessment, if needed, consists of 100% written examination (3 hours), weighted at 50% to pass			
Contact Hours and Indicative Student Workload ²	<table><tr><td>Contact hours: 30 hours</td></tr><tr><td>Independent Study (preparation for course and review of materials): 20 hours</td></tr><tr><td>Independent Study (preparation for assessment, incl. completion of written assessment): 75 hours</td></tr></table>	Contact hours: 30 hours	Independent Study (preparation for course and review of materials): 20 hours	Independent Study (preparation for assessment, incl. completion of written assessment): 75 hours
Contact hours: 30 hours				
Independent Study (preparation for course and review of materials): 20 hours				
Independent Study (preparation for assessment, incl. completion of written assessment): 75 hours				
Recommended Reading List	Sustainable energy systems engineering; P Gevorkian (2007) Storing Energy - with Special Reference to Renewable Energy Sources; Trevor Letcher (2022)			
Module Pre-requisite	N/A			
Module Co-requisite	N/A			
Module Website	Blackboard Ultra			
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Engineering, Civil Structural and Environmental Engineering Admin contact: Caroline Clabby – TR064 Course Administrator Liam McCarthy – Executive Officer, Civil Struct & Env. Eng.			
Academic Start Year	September 2026			
Academic Year of Date	2026-2027			
Module Code	CE7E07			

Module Name	Sustainable Water Supply and Sanitation
ECTS Weighting¹¹	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Prof. Laurence Gill Additional lecturer(s): Prof. Bruce Misstear
<u>Module Learning Outcomes</u> with reference to the <u>Graduate Attributes</u> and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Develop conceptual models to help to solve typical problems within the field of water supply and sanitation projects in developing countries. LO2. Explain the conceptual pathways for transition of water related infectious diseases and their link to sanitation related contaminants. LO3. Formulate the full suite of sanitation technologies that can be linked into compatible combinations to design a logical sanitation system. LO4. Evaluate the need and methods for successful health and hygiene education in parallel to water supply/ sanitation infrastructure development. LO5. Assess the adequacy of existing water schemes and plan new water systems, including estimating water demands for people, animals and crops. LO6. Evaluate different water supply options, including rainwater collection, Protected springs, hand-dug wells, drilled wells, river intakes and small dams. LO7. Design appropriate types of wells for different hydrogeological environments. LO8. Design appropriate soil-based and/or vegetated passive treatment systems for water resource protection. LO9. Elucidate the concepts of sustainable resource management within the urban water cycle. Graduate Attributes: levels of attainment To act responsibly - Enhanced To think independently - Attained To develop continuously - Enhanced To communicate effectively - Enhanced

¹¹ [TEP Glossary](#)

Module Content

This module aims to develop the students' comprehension of water supply and sanitation, particularly focussing on rural areas in developing countries. The students should understand the conceptual pathways for transmission of water-related infectious diseases and their link to contaminant transport and attenuation in relation to appropriate water supply and sanitation technologies. This will enable students to be able to devise appropriate conceptual models to solve typical problems within the field of sustainable water supply and sanitation projects.

- **Water and sanitation related diseases**
 - Water borne / Water washed / Water related vector
- **Sustainable Development Goals**
- **Planning a water scheme**
 - Reviewing existing schemes
 - Assessing water demand
 - Engaging the local community
- **Water supply technologies**
 - Rainwater collection / Protected springs / Hand-dug wells / Drilled wells / Infiltration galleries / River intakes / Small dams / Simple water treatment systems
- **Groundwater engineering**
 - Well design and construction
 - Pumps
- **Sanitation technologies**
 - Inputs (different waste streams) / User interface (toilets etc.) / Collection / storage / treatment / Conveyance / Semi-centralized systems / Re-use / disposal
- **Sustainable urban wastewater management**
 - Recovery of wastewater resources (water, organics, nutrients)
 - Rainwater as a resource
 - Design of Sustainable Urban Drainage Systems

Teaching and Learning Methods

This module is taught by a combination of lectures and tutorials during which the two assignments are discussed. The key information from the lecture presentations will be made available on-line. The first continuous assessment assignment, on an aspect of water supply, is handed out to the students in week 4 of the module. The second continuous assessment assignment, a group project on decentralised sanitation, is handed out to the students in week 7 of the module. Both completed assignments have to be submitted by the last day of the first semester. The projects are marked and returned to the students with comments.

Assessment Details¹² 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	Assignment 1 (Rural water supply)	LO5, LO6, LO7	15%	Week 9			
	Continuous Assessment 2	Assignment 2 (decentralised sanitation)	LO2, LO3, LO8	15%	Week 12			
	Examination	3-hour examination	LO1-LO9	70%	End of semester			
Reassessment Requirements	Re-assessment, if needed, consists of 100% written examination (3 hours)							
Contact Hours and Indicative Student Workload²	<table><tr><td>Contact hours: 27 hours</td></tr><tr><td>Independent Study (preparation for course and review of materials): 40.5 hours</td></tr><tr><td>Independent Study (preparation for assessment, incl. completion of written assessment): 32.5 hours</td></tr></table>					Contact hours: 27 hours	Independent Study (preparation for course and review of materials): 40.5 hours	Independent Study (preparation for assessment, incl. completion of written assessment): 32.5 hours
Contact hours: 27 hours								
Independent Study (preparation for course and review of materials): 40.5 hours								
Independent Study (preparation for assessment, incl. completion of written assessment): 32.5 hours								
Recommended Reading List	<i>Engineering in Emergencies</i> – Davis and Lambert [ITDG] <i>Compendium of Sanitation Systems & Technologies</i> – Tilley et al. [EAWAG] <i>Water wells and boreholes</i> – Misstear et al. [Wiley] The material from textbooks is supplemented by case studies and by a large number of references from international agencies and others, including the UN World Water Development reports.							
Module Pre-requisite	N/A							
Module Co-requisite	N/A							
Module Website	Blackboard Ultra							

¹² [TEP Guidelines on Workload and Assessment](#)

Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Engineering, Civil Structural and Environmental Engineering Admin contact: Caroline Clabby – TR064 Course Administrator Liam McCarthy – Executive Officer, Civil Struct & Env. Eng.
Academic Start Year	September 2026
Academic Year of Date	2026-2027

Module Code	DP7023
Module Name	Climate Change: Science, Development and Justice
ECTS Weighting¹³	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Dr. Susan Murphy Dr. Conor Buggy (UCD)

**Module Learning Outcomes
with reference to the
Graduate Attributes and
how they are developed in
discipline**

Having successfully completed this module a student should expect to:

- Understand the concepts of earth system science and planetary boundaries, particularly within the context of recent anthropogenic activity and climate change;
- Be conscious of relevant global climate processes and climate dynamics;
- Be conversant with current relevant climate and development discourses and negotiations;
- Be aware of the main organisations, mechanisms and legislative frameworks through which climate change is being mainstreamed within development strategies at international and national levels;
- Be aware of the potential role of climate in major areas of concern for development workers, including food security, public health, water availability and security;
- Understand concepts and conceptions of justice, human rights, and climate change in the light of sustainable development policy and practice;
- Demonstrate an understanding of climate justice debates;

¹³ [TEP Glossary](#)

- Understand the basics of computer-based modelling of climate change and of development-relevant climate change impacts; and
- Be able to communicate effectively the results of their research and project work to a wider audience.

Module Content

This module aims to provide students with an overview of the implications on sustainable development of various aspects of climate change, including social, economic, environmental, and moral dimensions. Students will also examine the strengths and weaknesses of approaches used to anticipate future climate change and its impacts. The science of Earth's systems which influence our climate are introduced and the scientific basis for climate change explored. The module also provides an examination of the moral dimensions of climate justice, human rights and development. Students on the module are, without exception, expected to read widely, to think deeply, to discuss fully and to analyse critically – and to work to a high standard both individually and as part of a group. Information on readings relevant to particular classes/discussions will be circulated in advance.

Teaching and Learning Methods

There will be guest lectures with leading-edge scientific researchers on topic related to climate modelling, measuring ecosystem services, just transitions, and the social and political dynamics of climate policy and actions.

Attendance at lectures is mandatory. Participation in the debate is mandatory. A debate protocol will be provided during the course of the module.

Assessment Details¹⁴

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
Written Examination	In-class 3000-word essay		70%	
Continuous Assessment 1	Class debate & write up		20%	
Continuous Assessment 2	Debate self-reflection		10%	

¹⁴ [TEP Guidelines on Workload and Assessment](#)

Reassessment Requirements			
Contact Hours and Indicative Student Workload ²	<table><tr><td>Contact hours: 25 to 30 hours teaching; 3-hour debate</td></tr><tr><td>Independent Study (preparation for course and review of materials, preparation for assessment, incl. completion of written assessment): 100 hours reading, specified learning activities (SLA’s)</td></tr></table>	Contact hours: 25 to 30 hours teaching; 3-hour debate	Independent Study (preparation for course and review of materials, preparation for assessment, incl. completion of written assessment): 100 hours reading, specified learning activities (SLA’s)
Contact hours: 25 to 30 hours teaching; 3-hour debate			
Independent Study (preparation for course and review of materials, preparation for assessment, incl. completion of written assessment): 100 hours reading, specified learning activities (SLA’s)			
Recommended Reading List			
Module Pre-requisite	N/A		
Module Co-requisite	N/A		
Module Website	Blackboard Ultra		
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Natural Sciences Admin contact: Caroline Clabby – TR064/MSc Smart and Sustainable Cities Course Administrator Elaine Elders – Postgraduate Administrative Coordinator, MDP		
Academic Start Year	September 2026		
Academic Year of Date	2026-2027		
Module Code	ES7057		
Module Name	Navigating Complexity for Sustainable Futures		
ECTS Weighting ¹⁵	5 ECTS		
Semester taught	Semester 1		
Module Coordinator/s	Prof. Quentin Crowley		

¹⁵ [TEP Glossary](#)

Module Learning Outcomes

**with reference to the
Graduate Attributes and
how they are developed in
discipline**

Upon successful completion of this module, students will be able to:

- **Apply Systems Thinking:** Demonstrate a comprehensive understanding of Systems Thinking principles and apply them to analyse complex environmental issues, recognising the interconnections between ecological, social, and economic systems.
- **Translate Science into Action:** Effectively translate scientific knowledge into practical, actionable solutions that address contemporary environmental and biodiversity challenges.
- **Collaborate:** Engage in interdisciplinary collaboration, working effectively within diverse teams to develop innovative solutions to complex challenges.
- **Enhance Science Communication:** Communicate complex scientific concepts clearly and effectively to a variety of audiences, utilising a systems perspective to enhance understanding and engagement.
- **Evaluate Systemic Impacts:** Critically evaluate the potential social, economic, and ecological impacts of proposed solutions, considering the broader implications for sustainability and resilience in natural systems.

Module Content

In this module, students will engage with the intricate challenges of our time through a Systems Thinking lens. The focus will be on translating scientific knowledge into actionable solutions that address pressing environmental and biodiversity issues. Using a Systems Thinking approach, the module explores the interconnectedness of ecological, social, and economic systems, gaining a holistic understanding of contemporary challenges such as climate change, habitat loss, and biodiversity decline. The module adopts an experiential learning framework which applies practical tools in real-world contexts. Innovative problem solving will be practiced through interdisciplinary collaboration and project-based learning. Competencies in systems innovation, science communication, and stakeholder engagement will be developed to enable effective communication of complex ideas to diverse audiences. Group work will focus on developing ideas aimed at transforming systems to drive sustainable change in relation to environmental sciences and biodiversity and conservation. Students will be empowered to navigate complexity to meaningfully contribute to sustainability efforts, making a positive impact on the environment and society.

Teaching and Learning Methods

Assessment Details¹⁶

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 work assessed on Miro		30%	
Continuous Assessment 2	Group work, live presentation and slides submitted on Blackboard.		20%	
Continuous Assessment 3	Learning log - written account of learning and self-reflection (submitted on Blackboard).		50%	

Reassessment Requirements

Contact Hours and Indicative Student Workload²

Contact hours:

Independent Study (preparation for course and review of materials):

Independent Study (preparation for assessment, incl. completion of written assessment):

Recommended Reading List

Module Pre-requisite

¹⁶ [TEP Guidelines on Workload and Assessment](#)

Module Co-requisite	
Module Website	
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Natural Sciences Admin contact: Caroline Clabby – TR064 Course Administrator George Oatridge – MSc Environmental Sciences Course Administrator
Academic Start Year	September 2026
Academic Year of Date	2026-2027

Module Code	CE7C05
Module Name	Advanced Spatial Analysis Using GIS
ECTS Weighting¹⁷	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Dr. Patrick Morrissey
<u>Module Learning Outcomes</u> with reference to the <u>Graduate Attributes</u> and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Investigate and solve Spatial Analysis problems by applying interdisciplinary approaches. LO2. Discuss and debate solutions to problems in the environment. LO3. Communicate effectively in technical and scientific writing, and present scientific/technical ideas concisely to a technical audience that may not be expert in the specific domain of the presentation. LO4. Use technical knowledge to address a spatial analysis problem. LO5. Identify and use appropriate mathematical methods, numerical techniques and GIS tools for application to new and ill-defined spatial analysis problems.

¹⁷ [TEP Glossary](#)

LO6. Consult and work with experts in various fields in the realisation of a product or system.

LO7. Have knowledge and understanding of concepts from a range of areas outside engineering.

LO8. Describe succinctly, the relevant advantages and disadvantages of various technologies to a lay audience, and to communicate effectively in public.

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 introduces students to the framework and methods used in real-life problems related to the field of Spatial Analysis by applying the theoretical knowledge gathered during the module to live project work. The module seeks to impart the necessary skills and knowledge to enable graduates to engage as team members and leaders in the types of large and complex sustainable environment projects that are increasingly being planned across the world.

It aims to help fill a major and increasingly obvious skills gap. A unique feature of this module is the use of Dublin and Ireland as learning laboratory, where the students will take responsibility of a real-life project. The introduction to Advanced Spatial Analysis using GIS module is designed to introduce the student to spatial analysis using a Geographic Information Systems (GIS) platform and guide him/her through the learning process of advanced tools dedicated to network analysis, spatial data mining and environmental phenomena modelling.

Teaching and Learning Methods

Teaching strategies

- Problem based learning.
- Computer Lab-based tutorials.
- Lectures.
- Project report

Assessment Details¹⁸ 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
	Project	Students are required to complete a report based upon the (group) work conducted for the project. The report should be approximately 3,000/4,000 words. Students will be provided with detailed guidance on writing the report.	all	90%	
	Test	In-class tests	4,5	10%	
Reassessment Requirements	Reassessment Coursework, weighted 100%				
Contact Hours and Indicative Student Workload²	Contact hours: 26 - Lectures – 6 hours - Tutorials – 20 hours				
	Independent Study (preparation for course and review of materials): 26 hours				
	Independent Study (preparation for assessment, incl. completion of written assessment): 70 hours				
Recommended Reading List	The following textbook is recommended: An Introduction to Geographical Information Systems, Ian Heywood, Sarah Cornelius, Steve Carver, 4th edition, Prentice Hall. LEN copies in Lecky Library. A list of recommended reading materials, standards, manuals, best practice documents is provided in the project section of the module. Each list is relevant to each specific project.				
Module Pre-requisite					
Module Co-requisite					

¹⁸ [TEP Guidelines on Workload and Assessment](#)

Module Website	Ideally, students should have access to a computer (Windows or Mac) to be able to run the latest stable version of the open-source software QGIS, but the software is also available on mytrinityapps.
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Engineering, Civil Structural and Environmental Engineering Admin contact: Caroline Clabby – TR064 Course Administrator Liam McCarthy - Executive Officer, Civil Struct & Env. Eng.
Academic Start Year	September 2026
Academic Year of Date	2026-2027

Semester 2 – Core

Module Code	ES7046
Module Name	Team Design
ECTS Weighting¹⁹	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Prof. Laurence Gill TBC
<u>Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline</u>	On successful completion of this module, students should be able to: LO1. Critically appraise and design solutions for environmental challenges including climate mitigation and climate adaptation based upon field data LO2. Evaluate and integrate nature-based approaches into the design solutions for environmental challenges LO3. Apply engineering and scientific knowledge gained in other modules to formulate solutions to multidisciplinary design problems LO4. Interpret the requirements from a design brief and formulate and appraise potential solutions

¹⁹ [TEP Glossary](#)

	LO5. Work successfully in small teams, clearly demonstrating group working, including task sub-division and integration of individual contributions from the team. LO6. Clearly communicate a design/solution to experts and non-experts using design statements, drawings, calculations, models, and other methods LO7. Clearly communicate a design/solution to experts and non-experts via face-to face presentation LO8. Demonstrate organised and concise report writing skills LO9. Apply basic thinking around the human-environment interaction and the ethical and environmental issues involved in design solutions to environmental challenges. Graduate Attributes: levels of attainment To act responsibly - Attained To think independently - Attained To develop continuously - Attained To communicate effectively - Attained				
Module Content	This module will be based on developing solutions to contemporary environmental problems. The contemporary environmental challenges for which design solutions will be required will mainly address different aspects of the overarching twin emergencies of climate change and biodiversity loss but will be defined from a list of ongoing research projects provided by academics in the Schools of Engineering and Natural Sciences. Such subjects could include renewable energy, coastal protection, wetland restoration, water and wastewater treatment, rewilding, air pollution, hydrology and flood protection, environmental policy etc. Students will work in interdisciplinary teams to develop design solutions to the challenges set by the lead academics, using both field data provided, and any new data / resources gathered by the teams during the design process.				
Teaching and Learning Methods	Field based and team-based teaching and learning. Associated laboratory/project/tutorial programme • 18 hours of lectures / tutorials • 2 half day field visits related to the design challenge • 1 group project				
Assessment Details²⁰	Assessment Component	Assessment Description	LO Addressed	% of total	Week due

²⁰ [TEP Guidelines on Workload and Assessment](#)

Please include the following: • Assessment Component • Assessment description • Learning Outcome(s) addressed • % of total • Assessment due date	Continuous Assessment 1	Scoping Report	LO1, 4, 5,9	10%	3
	Continuous Assessment 2	Project Design Report	LO1 to LO9	65%	12
	Continuous Assessment 3	Mock planning hearing to challenge the solution	LO1 to 9	10%	12
	Continuous Assessment 4	Group Presentations	LO5, 6, 7	15%	12
Reassessment Requirements	Resit module				
Contact Hours and Indicative Student Workload²	Contact hours: 28 hours in class guidance and field visits				
	Independent Study (exercises, preparation for assessment, incl. completion of written assessment): 70				
Recommended Reading List	Wilding by Isabella Tree; Energy at the End of the Word by Laura Watts				
Module Pre-requisite	n/a				
Module Co-requisite	n/a				
Module Website	Blackboard				
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Natural Sciences School of Engineering Admin contact: Caroline Clabby – TR064 Course Administrator				
Academic Start Year	January 2027				
Academic Year of Date	2026-2027				

Semester 2 – Optional

Module Code	DP8017
Module Name	Smart-eco cities of the future
ECTS Weighting²¹	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Dr. Stephan Hugel
<u>Module Learning Outcomes</u> with reference to the <u>Graduate Attributes</u> and how they are developed in discipline	This module is highly interdisciplinary and interactive, and uses the tools of geography, planning, politics and sustainability science to accomplish the following objectives: • Understand and evaluate mainstream models of sustainable urban development such as the smart city and the eco-city • Reflect over the meaning of the idea of urban sustainability • Undertake a critical analysis of projects for smart and eco-cities from a sustainability perspective
Module Content	The world is entering an urban age. There is a direct correlation between global development challenges such as climate change, poverty and resource scarcity, and urban issues. The way cities are designed, planned, governed and experienced, has a direct impact not only on local societies, economies and environments, but also on the planet. However, while cities are responsible for the majority of the environmental, social and economic problems of the twenty-first century, they can also be drivers of change and steer the development of nations towards a condition of sustainability. Today, it is clear that current cities have to evolve, but how and when this will happen are questions which are still surrounded by a veil of mystery. In this module, we will examine the main models of sustainable urbanism currently under development across the world. We will learn how projects for smart cities and eco-cities are developed, drawing upon a number of case studies from different continents. We will explore new and existing cities in Southeast Asia, the Middle East and Europe, in order to evaluate how the idea of urban sustainability is cultivated and implemented across geographical spaces, seeking to discover a formula for sustainable city-making.

²¹ [TEP Glossary](#)

Teaching and Learning Methods					
Assessment Details ²² 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	Online test (mix of open and close ended questions)		100%	
Reassessment Requirements					
Contact Hours and Indicative Student Workload ²	Contact hours: 24 Teaching Hours Independent Study (preparation for course and review of materials, preparation for assessment, incl. completion of written assessment): 100 hours reading				
Recommended Reading List	Cugurullo, F. (2021). <i>Frankenstein urbanism: Eco, smart and autonomous cities, artificial intelligence and the end of the city</i> . Routledge.				
Module Pre-requisite	N/A				
Module Co-requisite	N/A				
Module Website	Blackboard Ultra				

²² [TEP Guidelines on Workload and Assessment](#)

Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Natural Sciences Admin contact: Caroline Clabby – TR064/MSc Smart and Sustainable Cities Course Administrator Elaine Elders – Postgraduate Administrative Coordinator, MDP
Academic Start Year	January 2027
Academic Year of Date	2026-2027

Module Code	BD7056
Module Name	Human Interactions with Biodiversity
ECTS Weighting²³	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Dr. Rosie Mangan
<u>Module Learning Outcomes</u> with reference to the <u>Graduate Attributes</u> and how they are developed in discipline	On successful completion of this module students will be able to: • LO1: Critically evaluate the relationships between biodiversity, ecosystem functioning, and human wellbeing in the context of the biodiversity and climate crises. • LO2: Explain the objectives and implementation challenges associated with Ireland's National Biodiversity Action Plan and related international biodiversity frameworks. • LO3: Assess the major drivers of biodiversity loss, including habitat destruction, climate change, pollution, invasive species, and overexploitation, and evaluate approaches to mitigation and restoration • LO4: Critically evaluate the strengths and limitations of ecosystem service and natural capital approaches in biodiversity conservation and environmental decision making. • LO5: Analyse biodiversity conflicts and trade-offs across urban, agricultural, marine, and conservation contexts, including issues relating to human-wildlife interactions and public perception. • LO6: Evaluate the role of restoration ecology, nature-based solutions, sustainable agriculture, and cross-sector collaboration in supporting biodiversity conservation.

²³ [TEP Glossary](#)

- LO7: Interpret and communicate biodiversity-related scientific, policy, and societal issues using evidence-based written, oral, and discussion-based approaches
- LO8: Develop interdisciplinary perspectives on biodiversity conservation by integrating ecological, social, economic, and policy considerations

Module Content

This module explores the interactions between human society and biodiversity, with a particular focus on the causes, consequences, and responses to global biodiversity loss. Framed around Ireland’s National Biodiversity Action Plan (2023–2030), the module examines biodiversity conservation as a scientific, societal, economic, and policy challenge.

Topics covered include:

- The biodiversity crisis and national biodiversity policy;
- Ecosystem services, valuing nature, and natural capital approaches;
- Habitat restoration and protection;
- Climate change mitigation and nature-based solutions;
- Sustainable agriculture and biodiversity-friendly land management;
- Pollution and environmental impacts on biodiversity;
- Invasive species and biosecurity challenges;
- Overexploitation of natural resources;
- Urban biodiversity conflicts and human-wildlife interactions;
- Public perception and biodiversity conflict case studies;
- Marine conservation and development pressures;
- Cross-sector approaches to biodiversity conservation and restoration.

The module incorporates Irish and international case studies, guest lectures from researchers and practitioners, discussion-based learning, and field-based learning activities, including a field trip component. Emphasis is placed on critically evaluating real-world biodiversity challenges and communicating practical, evidence-based solutions across scientific, policy, and societal contexts.

Teaching and Learning Methods

Assessment Details²⁴

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	Applied Biodiversity Challenge Presentation (group mark)		30%	
Continuous Assessment 2	Policy Note on Human–Biodiversity Issues (Individual Assignment)		30%	
Continuous Assessment 3	Written Communication Piece (Individual Assignment)		40%	

Reassessment Requirements**Contact Hours and Indicative Student Workload²**

Contact hours:

Independent Study (preparation for course and review of materials, preparation for assessment, incl. completion of written assessment):

Recommended Reading List

https://www.npws.ie/sites/default/files/files/4th_National_Biodiversity_Action_Plan.pdf

Module Pre-requisite

N/A

Module Co-requisite

N/A

Module Website

Blackboard Ultra

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

School of Natural Sciences

Admin contact:

Caroline Clabby – TR064 Course Administrator

George Oatridge – MSc Biodiversity and Conservation Course Administrator

²⁴ [TEP Guidelines on Workload and Assessment](#)

Academic Start Year	January 2027
Academic Year of Date	2026-2027

Module Code	CSP7001
Module Name	Introduction to Machine Learning
ECTS Weighting²⁵	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Dr. Giovanni Di Liberto
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	• MLO1 Configure a programming environment suitable for exploring ML techniques • MLO2 Prepare datasets for ML processing, visualise the data, and understand the consequences of decisions made in cleaning data Module Content • MLO3 Utilise standard machine learning techniques to perform classification, regression, or clustering tasks • MLO4 Critically evaluate the outputs of a ML pipeline • MLO5 Communicate with ML experts and non-experts: Explain goals and requirements of a project, interpret the outcomes of typical ML analyses, present results to non-experts. • MLO6 Assess the cost/benefit of distinct ML methodologies and explain what makes one approach more suitable than another one for a given task • MLO7 Understand challenges involving data sharing, storage, and privacy • MLO8 Collaborate in a multidisciplinary group setting
Module Content	Introduction to Machine Learning is designed to offer an introduction to the basics of ML, specifically with a hands-on curriculum aimed at developing knowledge and skills in establishing ML pipelines with state-of-the-art languages and toolkits. This module is designed for students with limited prior experience of programming. It will introduce the fundamentals of programming, with a focus on setting up an effective pipeline for processing datasets to execute common ML techniques such as Support Vector Machines and Linear Regression. Students will be assessed both on the acquired technical skills and on their ability to understand the ML pipeline and results and communicate effectively with experts and non-experts.

²⁵ [TEP Glossary](#)

Teaching and Learning Methods	Lectures, tutorials, group project, guest lecture/seminar, classroom discussion				
Assessment Details²⁶ 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
	Engagement and Communication	Group project presentation	LO2-5	10	Second last week
	Technical (coding & ML) skills	Individual laboratory assignments	LO1-3	25	Weeks 3, 6, 9
	Communication, presentation, group work	Group assignment (written report)	LO2-6	25	Final week
	Written Test	2h written test	LO2-6	40	Final week
Reassessment Requirements	100% written examination				
Contact Hours and Indicative Student Workload²	Contact hours: 28h (1 lecture per week, 1 lab hour per week)				
	Independent Study (preparation for course and review of materials, this includes flipped classroom tutorials):				
	Independent Study (preparation for assessment, incl. completion of assessment):				
Recommended Reading List	• (recommended reading before the start of the module) Python Crash Course: A Hands-On, Project-Based Introduction to Programming, Eric Matthes (eBook available in the TCD library) • (recommended) Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, 2nd Edition, O'Reilly Media (first half of the book)				

²⁶ [TEP Guidelines on Workload and Assessment](#)

	(optional) “Fundamentals of machine learning for predictive data analytics”, By John D. Kelleher, Brian Mac Namee, and Aoife D’Arcy
Module Pre-requisite	Prerequisite EEU33C01 recommended but not required
Module Co-requisite	
Module Website	Blackboard.
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Computer Science Admin contact: Caroline Clabby – TR064 Course Administrator Kate Molloy – Executive Officer, Computer Science
Academic Start Year	January 2027
Academic Year of Date	2025-26

Module Code	ES7027
Module Name	Environmental Policy
ECTS Weighting²⁷	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Dr. Corentin Flament Loron
<u>Module Learning Outcomes</u> with reference to the <u>Graduate Attributes</u> and how they are developed in discipline	On successful completion of the module, including attendance at lectures and completion of research activities, students will be able to: - Demonstrate broad knowledge of environmental law and policy and principles relevant to its application - Describe the legal framework within which environmental law in Ireland operates and identify the scheme of environmental regulation at national, European and International level - Advise management on compliance with the requirements of key environmental legislation, regulation and policy

²⁷ [TEP Glossary](#)

Module Content	This module is designed to provide a high-level overview of environmental law & policy – it is an introduction to the fundamentals of law that govern how society interacts with the environment. As future environmental scientists, consultants, sustainability officers and conservationists it will be impossible to successfully deliver research or projects without careful attention to how environmental law is applied i.e. the legal framework protecting the environment. The module seeks to provide you with foundations of both theoretical and empirical knowledge of environmental law & policy, as well as equipping you with an understanding of the contemporary debates, critical issues, and perspectives on, environmental regulation.																								
Teaching and Learning Methods																									
Assessment Details²⁸ Please include the following: • Assessment Component • Assessment description • Learning Outcome(s) addressed • % of total • Assessment due date	<table border="1"> <thead> <tr> <th>Assessment Component</th> <th>Assessment Description</th> <th>LO Addressed</th> <th>% of total</th> <th>Week due</th> </tr> </thead> <tbody> <tr> <td>Continuous Assessment 1</td> <td>Essay</td> <td></td> <td>45%</td> <td></td> </tr> <tr> <td>Continuous Assessment 2</td> <td>Group work</td> <td></td> <td>40%</td> <td></td> </tr> <tr> <td>Continuous Assessment 3</td> <td>In-class quiz</td> <td></td> <td>15%</td> <td></td> </tr> </tbody> </table>					Assessment Component	Assessment Description	LO Addressed	% of total	Week due	Continuous Assessment 1	Essay		45%		Continuous Assessment 2	Group work		40%		Continuous Assessment 3	In-class quiz		15%	
Assessment Component	Assessment Description	LO Addressed	% of total	Week due																					
Continuous Assessment 1	Essay		45%																						
Continuous Assessment 2	Group work		40%																						
Continuous Assessment 3	In-class quiz		15%																						
Reassessment Requirements																									
Contact Hours and Indicative Student Workload²	Contact hours:																								

²⁸ [TEP Guidelines on Workload and Assessment](#)

	Independent Study (preparation for course and review of materials, preparation for assessment, incl. completion of written assessment):
Recommended Reading List	
Module Pre-requisite	N/A
Module Co-requisite	N/A
Module Website	Blackboard Ultra
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Natural Sciences Admin contact: Caroline Clabby – TR064/MSc Smart and Sustainable Cities Course Administrator George Oatridge – MSc Environmental Sciences Course Administrator
Academic Start Year	January 2027
Academic Year of Date	2026-2027

Module Code	CE7E05
Module Name	Water Quality & Hydrological Modelling
ECTS Weighting ²⁹	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Prof. Laurence Gill Dr. Liwen Xiao Dr. David O'Connell

²⁹ [TEP Glossary](#)

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. Develop conceptual models for typical problems within the field of environmental engineering.
- LO2. Demonstrate an awareness of different approaches to hydro(geo)logical modelling.
- LO3. Calculate the dissolved oxygen sag in a water course downstream of an input of organic pollution.
- LO4. Develop complex water quality models for natural processes such as eutrophication and nitrification.
- LO5. Develop kinetic microbiological models for wastewater treatment processes.
- LO6. Elucidate the different conceptual flow paths through karst systems.
- LO7. Construct a numerical model of a lowland karst system using conceptual pipes and tanks.
- LO8. Interpret soil water potential curves for different soil types.
- LO9. Develop numerical equations for both steady water flow and transient Flow through saturated & unsaturated soils.

Graduate Attributes: levels of attainment

To act responsibly - Enhanced

To think independently - Attained

To develop continuously - Attained

To communicate effectively - Enhanced

Module Content

This module aims to develop the students' comprehension of the relevance and usefulness of mathematical modelling in both water quality and hydrological scenarios. This will enable students to be able to devise a conceptual model to solve typical problems within the field of environmental engineering.

- **Modeling approaches in hydrology**
 - Physical, mathematical and analogue modelling
 - Aquifer testing
 - Groundwater flow modeling
 - Surface hydrological modeling
- **Water quality modelling**
 - Fundamental relationships
 - Numerical methods
 - Streeter-Phelps Dissolved Oxygen Model
 - Eutrophication model
 - Nitrification model
 - Activated Sludge Model
- **Karst hydrology**
 - Karst generation / landforms

- Karst hydrogeology
- Modelling karst conduit networks

- **Modelling the vadose zone**

- Overview & fundamentals of soil science
- Soil water potential & retention curves
- Steady water flow in saturated & unsaturated soils
- Unsteady water flow in saturated & unsaturated soils
- Solute transport
- Evaporation and transpiration

Teaching and Learning Methods

This module is taught by a combination of lectures and tutorials during which two assignments are discussed. Copies of the lecture presentations are given to the students just before the beginning of each lecture. The first continuous assessment, on modelling nitrogen transport through the unsaturated zone, is handed out to the students in week 4 of the module. The second continuous assessment, on modelling a constructed wetland treatment process, is handed out to the students in week 7 of the module. Both completed assignments have to be submitted by the last day of the second semester. The projects are marked and returned to the students with constructive comments.

Assessment Details³⁰

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	Modelling Assignment (unsaturated flow)	LO4, LO8, LO9	15%	Week 9
Continuous Assessment 2	Modelling Assignment (constructed wetland)	LO1, LO5	15%	Week 12
Examination	3-hour examination	LO1-LO9	70%	End of semester

³⁰ [TEP Guidelines on Workload and Assessment](#)

Reassessment Requirements	Re-assessment, if needed, consists of 100% Written Examination (3 hours)			
Contact Hours and Indicative Student Workload ²	<table><tr><td>Contact hours: 27 hrs</td></tr><tr><td>Independent Study (preparation for course and review of materials): 40.5 hrs</td></tr><tr><td>Independent Study (preparation for assessment, incl. completion of written assessment): 32.5 hrs</td></tr></table>	Contact hours: 27 hrs	Independent Study (preparation for course and review of materials): 40.5 hrs	Independent Study (preparation for assessment, incl. completion of written assessment): 32.5 hrs
Contact hours: 27 hrs				
Independent Study (preparation for course and review of materials): 40.5 hrs				
Independent Study (preparation for assessment, incl. completion of written assessment): 32.5 hrs				
Recommended Reading List	<i>Water quality modelling</i> – Steven Chapra [McGraw-Hill] <i>Soil Physics with Hydrus</i> – Radcliffe & Simunek [CRC Press] <i>Introduction to Soil Physics</i> – Hillel [Elsevier] <i>Rainfall-runoff modelling</i> – The Primer – Beven [Wiley]			
Module Pre-requisite	N/A			
Module Co-requisite	N/A			
Module Website	Blackboard Ultra			
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Engineering, Civil Structural and Environmental Engineering Admin contact: Caroline Clabby – TR064 Course Administrator Liam McCarthy – Executive Officer, Civil Struct & Env. Eng.			
Academic Start Year	January 2027			
Academic Year of Date	2026-2027			

Module Code	CE7E06
Module Name	Water Resource Planning and Climate Change
ECTS Weighting³¹	5 ECTS

³¹ [TEP Glossary](#)

Semester taught	Semester 2
Module Coordinator/s	Dr. David O'Connell Additional lecturer(s): Dr. Paul Nolan
<u>Module Learning Outcomes</u> with reference to the <u>Graduate Attributes</u> and how they are developed in discipline	On successful completion of this module, students should be able to evaluate a range of water resources problems in different hydrological environments. Specifically, students will gain an understanding of: LO1. Combined use of surface and groundwater resources, including river augmentation schemes and artificial recharge. LO2. Water resource planning in large river basins, especially the Nile basin. LO3. Arid zone hydrology, with emphasis on the Middle East. LO4. Protecting groundwater from pollution. LO5. Climate dynamics, including human-induced global warming and the models used to make projections of future climate scenarios. LO6. Environmental impact assessment and the preparation of Environmental Impact Assessment Reports, with particular emphasis on water schemes. Graduate Attributes: levels of attainment To act responsibly - Enhanced To think independently - Attained To develop continuously - Attained To communicate effectively - Attained
Module Content	To introduce students to a range of current water resource planning issues, in both temperate and arid regions. Module content: • Conjunctive use of surface and groundwater • Managed aquifer recharge • Low river flow analysis and river augmentation • Bankside well schemes • River basin management, taking the Nile as an example • Water resource planning in arid zones • Groundwater protection strategies in UK and Ireland • Climate change, energy balance, global warming, global and regional climate models • Environmental impact assessment

Teaching and Learning Methods

This module is taught by a combination of lectures and tutorials, along with one assignment, which is linked to one of the module topics. The completed assignment has to be submitted by the end of week 6 of the second semester. The projects are marked and returned to the students with constructive comments.

Assessment Details³²

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	Assignment related topics from one of LO1-6	Annually dynamic LO1-6	20%	Week 6
Examination	3-hour examination	LO1-LO6	80%	End of semester

Reassessment Requirements**Contact Hours and Indicative Student Workload²**

Contact hours: 27 hrs

Independent Study (preparation for course and review of materials): 40.5 hrs

Independent Study (preparation for assessment, incl. completion of written assessment): 32 hrs

Recommended Reading List

A comprehensive reading list is provided at the beginning of the course. Texts cited include 'Hydrology in practice' by Shaw et al. (2011), 'The hydrology of the Nile' by Sutcliffe & Parks (1999), 'Hydrogeology: Principles and Practice' by Hiscock & Bense (2014), 'Water wells and boreholes' by Mistlear et al. (2017), 'Water sustainability: A global perspective' by Jones (2011) and 'Introduction to Environmental Impact Assessment' by Glasson et al (2012). In addition, the module includes many case study examples, with an extensive reading list of published papers.

³² [TEP Guidelines on Workload and Assessment](#)

Module Pre-requisite	No specific pre-requisite, but previous engineering hydrology module helpful.
Module Co-requisite	N/A
Module Website	Blackboard Ultra
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Engineering, Civil Structural and Environmental Engineering Admin contact: Caroline Clabby – TR064 Course Administrator Liam McCarthy – Executive Officer, Civil Struct & Env. Eng.
Academic Start Year	January 2027
Academic Year of Date	2026-2027

Module Code	CE7J01
Module Name	Wind Energy
ECTS Weighting³³	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Dr. Breiffni Fitzgerald
<u>Module Learning Outcomes</u> with reference to the <u>Graduate Attributes</u> and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Explain the impact of surface roughness and orography on wind speed profiles. LO2. Calculate wind speed at a given height using the log law and power Laws. LO3. Carry out siting assessment. LO4. Derive the Betz equation for wind power extraction using an idealized Wind turbine. LO5. Calculate power curve to analyse the impact of various control systems in a wind turbine. LO6. Explain concepts related to wind turbine design. LO7. Carry out analysis for stresses generated and fatigue design. LO8. Demonstrate ability to carry out aerodynamic analysis for a wind

³³ [TEP Glossary](#)

turbine.

LO9. Describe and explain wake effects for wind farms.

Graduate Attributes: levels of attainment

To act responsibly - Attained

To think independently - Enhanced

To develop continuously - Enhanced

To communicate effectively - Enhanced

Module Content

To develop a detailed foundation of the issues associated with the development of wind energy for electrical energy supply. The module will focus on the current state of wind energy technology domestically and internationally and will consider the future development of wind resources. Content will include:

- Overview of wind energy and introduction to wind flow.
- Fluid mechanics for wind energy
- Wind resources and siting
- Ideal wind turbines and practical constraints. Power Curves
- Turbine design (tower, blades, gearbox, foundations)
- Aerodynamics and aeroelasticity
- Wake effects and wind farm design
- Controls in wind turbines
- Offshore wind turbines, Joint wind and wave effects

Teaching and Learning Methods

Teaching strategies:

- Lectures
- Coursework
- Mini projects

Assessment Details³⁴

Please include the following:

- Assessment Component
- Assessment description

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Continuous Assessment 1	Problem sheet	LO1-LO4	5%	Week 4
Continuous Assessment 2	Data analysis	LO2-LO3	25%	Week 10

³⁴ [TEP Guidelines on Workload and Assessment](#)

• Learning Outcome(s) addressed • % of total • Assessment due date	Examination	3-hour written examination	All	70%	End of semester			
Reassessment Requirements	Reassessment Examination, 3 hours written exam, weighted 100%							
Contact Hours and Indicative Student Workload²	<table><tr><td>Contact hours: 36 hrs</td></tr><tr><td>Independent Study (preparation for course and review of materials): 20 hrs</td></tr><tr><td>Independent Study (preparation for assessment, incl. completion of written assessment): 70 hrs</td></tr></table>					Contact hours: 36 hrs	Independent Study (preparation for course and review of materials): 20 hrs	Independent Study (preparation for assessment, incl. completion of written assessment): 70 hrs
Contact hours: 36 hrs								
Independent Study (preparation for course and review of materials): 20 hrs								
Independent Study (preparation for assessment, incl. completion of written assessment): 70 hrs								
Recommended Reading List	Wind Energy Explained: Theory, Design and Application (2009) Manwell, McGowen and Rogers, Wiley, 2nd Edition. Wind Energy Handbook (2001) Burton, Sharpe, Jenkins, Bossyani, John Wiley, New York							
Module Pre-requisite	N/A							
Module Co-requisite	N/A							
Module Website	Blackboard Ultra							
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Engineering, Civil Structural and Environmental Engineering Admin contact: Caroline Clabby – TR064 Course Administrator Liam McCarthy – Executive Officer, Civil Struct & Env. Eng.							
Academic Start Year	January 2027							
Academic Year of Date	2026-2027							

Module Code	CEP55E06
Module Name	Groundwater and Pollution Control
ECTS Weighting³⁵	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Dr. David O'Connell
<u>Module Learning Outcomes</u> with reference to the <u>Graduate Attributes</u> and how they are developed in discipline	On successful completion of this module, students should be able to: • LO1. Solve mathematical problems concerned with groundwater flow, geophysical surveys, rock discontinuities and slope stability. • LO2. Question the assumptions underlying common methods of groundwater analysis, particularly in the context of the heterogeneous nature of the bedrock aquifers found in Ireland. • LO3. Develop a conceptual model of an aquifer system and plan a groundwater investigation programme, including identification of suitable drilling, geophysical and other investigation techniques. • LO4. Appraise organic groundwater pollution in a variety of contexts, such as how to identify and then manage and remediate the groundwater system contaminated Graduate Attributes: levels of attainment To act responsibly - Enhanced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Enhanced
Module Content	This is an applied geology module aimed at civil engineers, geologists and environmental scientists. The hydrogeology component covers the analysis of groundwater flow, both regional flow and radial flow to wells, with an emphasis on teaching the student to compare and evaluate different methods of analysis, and to critically examine the underlying assumptions. Students are introduced to various techniques in groundwater investigation, borehole drilling, geophysical logging methods, well design, profile sampling. Students are also taught how to plan groundwater investigations in a systematic manner, with the aid of case studies. The groundwater pollution component deals with the analysis of organic pollutant properties and their application to groundwater contamination problems (as such, this module component is complementary to compulsory modules in the students third and fourth years which focus on water flow and quality issues).

³⁵ [TEP Glossary](#)

Module content

- Groundwater concepts [Asst. Prof. David O'Connell]
 - Aquifers, aquitards and aquicludes
 - Confined and unconfined aquifers
 - Aquifer properties
- Groundwater flow [Asst. Prof. David O'Connell]
 - General flow equations
 - Methods of solution: flow nets, analytical solutions, numerical methods
 - Analytical solutions for regional flow in confined and unconfined aquifers
 - Radial flow to wells under steady state and transient conditions
 - Multiple wells: principle of superposition
 - Hydraulic boundary effects
 - Introduction to the use of distributed groundwater models
- Groundwater exploration and development [Asst. Prof. David O'Connell]
 - Hydrogeological surveys
 - Geophysical techniques: resistivity, EM, seismic refraction
 - Exploratory drilling methods
 - Formation sampling and geophysical logging
 - Introduction to well design
- Groundwater Organic Chemical Pollution [Asst. Prof. David O'Connell]
 - Basic principles of organic chemistry, properties and phase transition
 - Vadose zone contaminant processes
 - Dissolution of NAPL source zones
 - Groundwater Organic Contaminant monitoring and pollution
 - Abiotic Organic Chemical Reactions
 - In-situ Groundwater Remediation Techniques
 - Civil engineering-based remediation

The module outcomes are targeted at analysis and evaluation, and the implications of this evaluation for engineering design and practice. It aims to motivate students to develop an interest in the subject matter, but also to enhance their skills in critical thinking within an engineering context. The applications to engineering practice consider the social and business context.

Teaching and Learning Methods

Lectures, tutorials, demonstrations and in-class labs.

Assessment Details³⁶

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
Examination	2 hour written examination	All	100%	End of semester

Reassessment Requirements

100% written examination

Contact Hours and Indicative Student Workload²

Contact hours: 32 hours lectures including lectures, tutorials, labs.

Independent Study (preparation for course and review of materials): 40 hours; Researching journals; reading textbooks recommended in module booklist; reviewing lecture material and class notes; practice calculations.

Independent Study (preparation for assessment, incl. completion of written assessment): 30 hours; literature review, review of lectures and tutorial questions.

Recommended Reading List**Groundwater and Pollution**

Fetter, CW (2001). *Applied Hydrogeology*. Fourth edition. Macmillan.

Hiscock, KM & Bense, V (2014). *Hydrogeology: Principles and Practice*. Second edition. Wiley-Blackwell.

Missteart, BDR, Banks, D & Clark, L. (2006) *Water Wells and Boreholes*. Wiley

Reynolds, JM (2011). *An introduction to Applied and Environmental Geophysics*. Second edition. Wiley.

C. W. Fetter, Thomas Boving, David Kreame. Contaminant Hydrogeology, Third Edition.

³⁶ [TEP Guidelines on Workload and Assessment](#)

Module Pre-requisite	N/A
Module Co-requisite	N/A
Module Website	Blackboard Ultra
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Engineering, Civil Structural and Environmental Engineering Admin contact: Caroline Clabby – TR064 Course Administrator Liam McCarthy – Executive Officer, Civil Struct & Env. Eng.
Academic Start Year	January 2027
Academic Year of Date	2026-2027

School Policies and Procedures

Health and Safety

Health

Please inform either the Programme Director of medical conditions or other problems that may require special attention from staff. In case of illness, students may attend the Student Health Centre (House 47).

Accidents

All accidents must be reported to the Safety Officer (Alison Boyce ext: 3506) as soon as possible after they occur. Victims should be escorted to the Student Health Centre for treatment if necessary. An ambulance should be called in the event of a serious accident (9-999 on phones with outside lines and inform the security office). Victims should not be taken to hospital in a private car or taxi.

Fire Safety

Fire extinguishers and copies of the College General Fire Notice are displayed at various locations in the campus. These are normally located in hallways. Fire extinguishers provided are water, powder, carbon dioxide or a fire blanket.

Help to prevent fires from starting or spreading by the following:

- Do not store flammable materials in corridors and other open-access areas.
- Exercise caution when using flammable materials and electrical equipment.
- Do not place smouldering items in bins
- Keep filing cabinets and presses closed when not in use
- Turn off and switch off at the socket (or unplug) electrical equipment that is not in use.

The college buildings are equipped with fire alarms. On hearing the alarm, leave the building quickly and in an orderly manner, and assemble at the designated meeting point for that building.

Bomb Alerts

Watch out for suspicious packages at all times and, if one is observed, alert a staff member immediately. If there is a bomb alert, follow the same procedures as for a fire alert.

Risk Assessment

A risk assessment must be carried out for research activities such as field work. Risk assessment forms are available from the Safety Officer and will also be available on Blackboard. Detailed safety guidelines on fieldwork are available from the department's Safety Officer and should be consulted before fieldwork is undertaken. A risk assessment should be completed BEFORE conducting fieldwork.

IMPORTANT NOTE: Failure to complete the relevant forms may prevent you from undertaking fieldwork or participating in field trips and can result in you forfeiting marks for associated.

Labs and Field Courses

Certain modules have laboratory experiments attached to them. Students are expected to keep a logbook recording the details of every experiment performed and to write a technical report about each experiment. Each student is required to submit her/his report neatly presented and by the date specified to avoid penalty. Guidelines as to the required length and format of each report will be specified by the lecturer concerned.

Laboratory groups and timetable for Engineering modules will be published at the beginning of the semester. Please note that you must attend the particular laboratory sessions to which you have been assigned. Students cannot swap sessions because of the complexity of the timetable, the large numbers in the year and the limited accommodation available.

A no show at a lab results in a zero mark even if a report is submitted. No report submitted means a zero mark even if the lab was attended. Labs cannot be taken in the summer/autumn periods if missed during the year.

Attendance

All students should enter residence in or near Dublin and must begin attendance at the College not later than the first day of teaching term and may not go out of residence before the last day of teaching term unless **they have previously obtained permission from the Senior Lecturer through their tutor.**

Students must attend College during the teaching term. They must take part fully in the academic work of their class throughout the period of their course. Lecture timetables are published through my.tcd.ie, and on school or discipline noticeboards or in Blackboard before the beginning of Michaelmas teaching term. The onus lies on students to inform themselves of the dates, times and venues of their lectures and other forms of teaching by consulting these timetables.

The requirements for attendance at lectures and tutorials vary between the different faculties, schools, and disciplines. The school, discipline, or course office, whichever is relevant, publishes its requirements for attendance at lectures and tutorials on noticeboards, and/or in handbooks and elsewhere, as appropriate.

Marking

Guidelines on Grades for Essays and Examination Answers

	Criteria
90-100	EXCEPTIONAL ANSWER; This answer will show original thought and a sophisticated insight into the subject, and mastery of the available information on the subject. It should make compelling arguments for any case it is putting forward and show a rounded view of all sides of the argument. In exam questions, important examples will be supported by attribution to relevant authors, and while not necessarily giving the exact date, should show an awareness of the approximate period. In essays, the referencing will be comprehensive and accurate, supported by attribution to relevant authors, and while not necessarily giving the exact date, should show an awareness of the approximate period. In essays, the referencing will be comprehensive and accurate.
80-89	OUTSTANDING ANSWER; This answer will show frequent originality of thought and make new connections between pieces of evidence beyond those presented in lectures. There will be evidence of awareness of the background behind the subject area discussed, with evidence of deep understanding of more than one view on any debatable points. It will be written clearly in a style which is easy to follow. In exams, authors of important examples may be provided. In essays all important examples will be referenced accurately.
70-79	INSIGHTFUL ANSWER; showing a grasp of the full relevance of all module material discussed and will include one or two examples from wider reading to extend the arguments presented. It should show some original connections of concepts. There will be only minor errors in examples given. All arguments will be entirely logical, and well written. Referencing in exams will be sporadic but referencing should be present and accurate in essays
65-69	VERY COMPREHENSIVE ANSWER; good understanding of concepts supported by broad knowledge of subject. Notable for synthesis of information rather than originality. Evidence of relevant reading outside lecture notes and module work. Mostly accurate and logical with appropriate examples. Occasionally a lapse in detail.
60-64	LESS COMPREHENSIVE ANSWER; mostly confined to good recall of module work. Some synthesis of information or ideas. Accurate and logical within a limited scope. Some lapses in detail tolerated. Evidence of reading assigned module literature
55-59	SOUND BUT INCOMPLETE ANSWER; based on module work alone but suffers from a significant omission, error or misunderstanding. Usually lacks synthesis of information or ideas. Mainly logical and accurate within its limited scope and with lapses in detail.

50-54	INCOMPLETE ANSWER; suffers from significant omissions, errors and misunderstandings, but still with understanding of main concepts and showing sound knowledge. Several lapses in detail.
45-49	WEAK ANSWER; limited understanding and knowledge of subject. Serious omissions, errors and misunderstandings, so that answer is no more than adequate.
40-44	VERY WEAK ANSWER; a poor answer, lacking substance but giving some relevant information. Information given may not be in context or well explained, but will contain passages and words, which indicate a marginally adequate understanding.
30-39	MARGINAL FAIL; inadequate answer, with no substance or understanding, but with a vague knowledge relevant to the question.
0-29	UTTER FAILURE; with little hint of knowledge. Errors serious and absurd. Could also be a trivial response to the misinterpretation of a question.

Guidelines on Marking Projects/Dissertation Assessment

Mark Range	Criteria
90 - 100%	Exceptional project report showing broad understanding of the project area and exceptional knowledge of the relevant literature. Exemplary presentation and analysis of results, logical organisation and ability to critically evaluate and discuss results coupled with insight and novelty/originality. Overall an exemplary project report of publishable quality (e.g. peer reviewed scientific journal/patent application).
80 - 89%	An excellent project report clearly showing evidence of wide reading far above that of an average student, with excellent presentation and in-depth analysis of results. Clearly demonstrates an ability to critically evaluate and discuss research findings in the context of relevant literature. Obvious demonstration of insight and novelty/originality. An excellently executed report overall of publishable quality (e.g. short peer reviewed conference paper such as IEEE) with very minor shortcomings in some aspects.
70 - 79%	A very good project report showing evidence of wide reading, with clear presentation and thorough analysis of results and an ability to critically evaluate and discuss research findings in the context of relevant literature. Clear indication of some insight and novelty/originality. A very competent and well-presented report overall but falling short of excellence in some aspects. Sufficient quality and breadth of work similar to the requirements for an abstract at an international scientific conference.
60 - 69%	A good project report which shows a reasonably good understanding of the problem and some knowledge of the relevant literature. Mostly sound presentation and analysis of results but with occasional lapses. Some relevant

	interpretation and critical evaluation of results, though somewhat limited in scope. General standard of presentation and organization.
50 - 59%	A moderately good project report which shows some understanding of the problem but limited knowledge and appreciation of the relevant literature. Presentation, analysis and interpretation of the results at a basic level and showing little or no novelty/originality or critical evaluation.
40 - 49%	A weak project report showing only limited understanding of the problem and superficial knowledge of the relevant literature. Results presented in a confused or inappropriate manner and incomplete or erroneous analysis. Discussion and interpretation of result severely limited, including some basic misapprehensions, and lacking any novelty/originality or critical evaluation. General standard of presentation poor.
20 - 39%	An unsatisfactory project containing substantial errors and omissions. Very limited understanding, or in some cases misunderstanding of the problem and very restricted and superficial appreciation of the relevant literature. Very poor, confused and, in some cases, incomplete presentation of the results and limited analysis of the results including some serious errors. Severely limited discussion and interpretation of the results revealing little or no ability to relate experimental results to the existing literature. Very poor overall standard of presentation.
0 - 19%	A very poor project report containing every conceivable error and fault. Showing virtually no understanding or appreciation of the problem and of the literature pertaining to it. Chaotic presentation of results, and in some cases incompletely presented and virtually non-existent or inappropriate or plainly wrong analysis. Discussion and interpretation seriously confused or wholly erroneous revealing basic misapprehensions.

Assessment: Procedures for the non-submission of coursework and absence from examinations

All students must fulfil the course requirements of the school or discipline, as appropriate, with regard to attendance and course work. Where specific requirements are not stated, students may be deemed non-satisfactory if they miss more than a third of their course of study or fail to submit a third of the required course work in any term.

TR064 Follows the same examination regulations as in the School of Engineering. Full regulations on examination can be found via the following:

[B.A.I., Engineering with Management and M.A.I. \(St.\)](#)

At the end of the teaching term, students who have not satisfied the school or department requirements may be reported as non-satisfactory for that term. Students reported as non-satisfactory for the Michaelmas and Hilary terms of a given year may be refused permission to take their semester two assessment/examinations and may be required by the Senior Lecturer to repeat their year.

8.3.1 Submission guidelines

Please pay attention to the guidelines for submission. These may vary from module to module. Ensure that you submit on time and, where appropriate, that your submission has been logged. It is good practice to keep a digital copy of your submissions.

The work you submit must be your own. College has very strict guidelines concerning plagiarism. Please ensure you read Section 13.3 of this handbook.

8.3.2 Policy on late submission

Coursework and assessment is an essential part of a student's learning to reinforce aspects of module content. You are enrolled on an accredited professional programme and are expected to submit work on time. Submitting work late is a habit you should avoid. It is never too early in your career to start to plan your work so you meet your deadlines. Late submissions delay feedback and in group work you risk incurring a penalty on the other members of your group.

Late submissions may be penalized or not accepted. Submission dates may be extended in exceptional and extenuating circumstances. In such circumstances, students must apply directly (via email) to the module coordinator requesting an extension and provide an explanation and/or evidence for such (e.g. medical cert). Please note that the module coordinator reserves the right to refuse granting of an extension.

8.3.3 Policy on participation in continuous assessment-based modules

Students who are absent from a third of their lectures, tutorials, or labs of a continuous assessment-based module or who fail to submit a third of the required coursework will be deemed non-satisfactory.

Students reported as non-satisfactory for both semesters of a given year may be refused permission to take their examinations and may be required by the Senior Lecturer to repeat the year.

Further details of procedures for reporting a student as non-satisfactory are given on the College website at <https://www.tcd.ie/academicregistry/student-cases/>

Further details on the conduct of examinations and submission of assessed work in the College Calendar, Part II, pages 35-37, 39 [General Regulations and Information](#).

Access to Scripts and Other Assessed Work

All students have a right to discuss their examination and assessment performance with the appropriate members of staff. This right is basic to the educational process. Students are entitled to view their scripts and other assessments when discussing their performance. For work completed during semester one students should note that all results are provisional until moderated by the court of examiners in Trinity term. In Trinity term, students' performance cannot be discussed with them until after the publication of the end-year results.

Written assessment components and assessment components which are recorded by various means (e.g. video, audio) are retained by schools and departments for thirteen months from the date of the meeting of the court of examiners which moderates the results in question and may not be available for consultation after this time period.

Re-check/Re-mark of Examination Scripts and Other Assessed Work

Having received information about their final results at the court of examiners in Trinity term and having discussed these and their performance with the Director of Teaching and Learning (Undergraduate) or the head of discipline and/or the appropriate staff, students may ask that their results be reconsidered if they have reason to believe:

- (a) that the grade is incorrect because of an error in calculation of results;
- (b) that the examination paper or other assessment specific to the student's course contained questions on subjects which were not part of the course prescribed for the examination or other assessment; or
- (c) that bias was shown by an examiner in marking.

In the case of (a) above, the request should be made through the student's tutor to the Director of Teaching and Learning (Undergraduate) or course director as appropriate.

In the case of (b) and/or (c) above, the request should be made through the student's tutor to the Senior Lecturer. In submitting such a case for reconsideration of results, students should state under which of (b) and/or (c) the request is being made.

Requests for re-check or re-mark should be made as soon as possible after discussion of results and performance and no later than twelve months from the date of the meeting of the court of examiners which moderated the marks in question.

Once a result has been formally published following the court of examiners it cannot be amended without the permission of the Senior Lecturer.

Any student who makes a request for re-check or re-mark that could have implications for their degree result is advised not to proceed with degree conferral until the outcome of the request has been confirmed.

Plagiarism

To ensure that you have a clear understanding of what plagiarism is, how Trinity deals with cases of plagiarism and how to avoid it, you will find a repository of information at <https://libguides.tcd.ie/academic-integrity>

We ask you to take the following steps:

Visit the online resources to inform yourself about how Trinity deals with plagiarism and how you can avoid it at <https://libguides.tcd.ie/academic-integrity>. You should also familiarize yourself with the 2023/24 Calendar entry on plagiarism located on this website and the sanctions which are applied.

Complete the 'Ready, Steady, Write' online tutorial on plagiarism at <https://libguides.tcd.ie/academic-integrity/ready-steady-write>. Completing the tutorial is compulsory for all students.

Familiarise yourself with the declaration that you will be asked to sign when submitting course work at <https://libguides.tcd.ie/academic-integrity/declaration>.

Contact your College Tutor, your Course Director, or your Lecturer if you are unsure about any aspect of plagiarism.

Guidance on the Use of AI and Generative-AI in College

The advent of commonly available artificial intelligence tools is disruptive in both positive and negative ways. Before using them in your studies it is important that you familiarise yourself with College policies on its use. Unless otherwise instructed for particular modules or assessments, **the default expectation would be that you do not submit AI generated content as an attempt at an assessment.**

Below is some basic overview of the College policy on AI and GenAI. This has been taken from the more detailed policy which is informative and wide ranging. You are expected to have read and familiarised yourself with this policy.

https://www.tcd.ie/academicpractice/resources/generative_ai/

Artificial Intelligence (AI)

Artificial intelligence is generally understood to be a set of technologies that enable computers to perform a variety of functions usually perceived as requiring human intelligence – for example, understanding speech, recognising objects in images, composing written answers and problem reasoning. A more formal definition of an AI system from the European Union AI Act (2024) is:

...a machine-based system designed to operate with varying levels of autonomy and that may exhibit adaptiveness after deployment and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments[.] (EU AI Act 2024)

Generative Artificial Intelligence (GenAI)

Generative AI is the sub-area of AI, involving AI systems which generate content — for example, human dialogue, speech, images and video. GenAI systems are capable of generating such content based on a user's request or instruction. More formally, GenAI is defined by UNESCO as **"an artificial intelligence (AI) technology that automatically generates content in response to prompts written in natural-language conversational interfaces" (UNESCO 2023).**

AI and GenAI in Trinity

As Ireland's leading university and as a world leader in AI research, Trinity recognises that AI and GenAI offer new opportunities for teaching, learning, assessment and research. We also recognise that these technologies present challenges and risks, including to academic integrity, ethics, privacy, impartiality, intellectual property and sustainability.

Acknowledging these opportunities and challenges, Trinity commits to supporting the opportunity for students and staff to become AI literate and fluent, thereby helping them to navigate and respond to the challenges and risks of AI and GenAI in order to harness the potential of (Gen)AI to enhance teaching, learning, assessment and research – and to be prepared for future challenges as these technologies evolve. We also commit to providing ongoing resources and guidance to support students and staff to use AI and GenAI in ways that are appropriate, responsible and ethical – and to ensure that academic integrity is maintained in its usage.

College aspires to develop best practice guidelines in this area. In addition to the resources and supports that College provides and recognising that appropriate uses of AI and GenAI tools vary across academic disciplines, Schools will have some flexibility to customise their own discipline-specific practices in line with this institutional statement, other institutional policies as they develop, and national and international regulation. The College goal is to enable overall consistency in the regulation of GenAI usage, while also respecting where disciplines or degree programmes require specific restrictions in GenAI usage in assessment preparation and execution.

Thus, where disciplines or degree programmes wish to refine specific regulations on student use of GenAI for learning, general as well as programme-specific regulations should be communicated in the relevant discipline/degree programme handbook.

Such regulation could range from how student GenAI usage is acknowledged or cited within student assessment submissions, to prohibition of GenAI usage in the production of student assessment submissions.

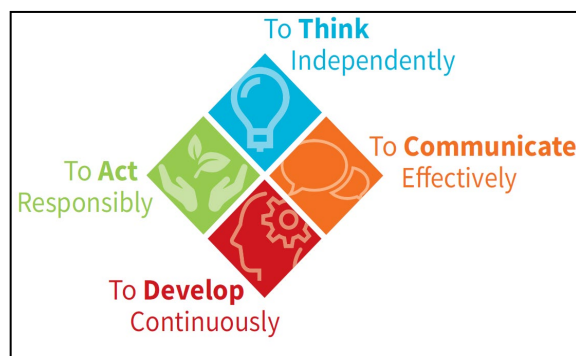
IMPORTANT NOTE: If any additional restrictions on the use of Generative Artificial Intelligence (GenAI) apply to a particular module, these will be stated in the module description on Blackboard or communicated to students by module coordinators.

Graduate Attributes

The Trinity Graduate Attributes represent the qualities, skills, and behaviours that you will have the opportunity to develop as a Trinity student over your entire university experience, in other words, not only in the classroom, but also through engagement in co- and extra-curricular activities (such as summer work placements, internships, or volunteering).

The four Trinity Graduate Attributes are:

- To Think Independently
- To Act Responsibly
- To Develop Continuously
- To Communicate Effectively



Why are the Graduate Attributes important?

The Trinity Graduate Attributes will enhance your personal, professional, and intellectual development. They will also help to prepare you for lifelong learning and for the challenges of living and working in an increasingly complex and changing world.

The Graduate Attributes will enhance your employability. Whilst your degree remains fundamental, also being able to demonstrate these Graduate Attributes will help you to differentiate yourself as they encapsulate the kinds of transversal skills and abilities, which employers are looking for.

How will I develop these Graduate Attributes?

Many of the Graduate Attributes are 'slow learned', in other words, you will develop them over the four or five years of your programme of study.

They are embedded in the curriculum and in assessments, for example, through undertaking independent research for your final year project, giving presentations and engaging in group work.

You will also develop them through the co-curricular and extra-curricular activities. If you help to run a club or society you will be improving your leadership skills, or if you play a sport, you are building your communication and team-work skills.

Important Information

Student Services



For general information on the Supports and Services available to Trinity Students please visit: <https://www.tcd.ie/students/supports-services/>

This is a comprehensive site which breaks down the different categories of support and services available to students in an intuitive manner.

Follow on to the next page for a breakdown of some of our key supports and services.

Trinity Tutorial Service (Undergraduate Students)

The Tutorial Service is unique, confidential, and available to all undergraduate students offering student support in all aspects of College life. The Tutorial Service is supported and coordinated by the Senior Tutor's Office which is located on the ground floor in House 27.

Opening Hours and Appointments

The Senior Tutor's Office is open for student appointments between 10.30am - 12.30pm and 2.30pm - 4.00pm Monday to Friday ONLY (email stosec@tcd.ie to arrange an appointment).

What is a Tutor?

A Tutor is a member of the academic staff who is appointed to look after the general welfare and development of the students in his/her care. Whilst the Tutor may be one of your lecturers, this is not always the case as the role of the College Tutor is quite separate from the teaching role.

When should I go to see my Tutor?

You should visit your Tutor whenever you are worried or concerned about any aspect of College life or indeed your personal life, especially if it is affecting your academic work. The conversation with your Tutor takes place in strictest confidence. Unless you give him/her permission to do so, s/he will not divulge information given to them to anybody, whether a member of College or to anyone outside College (to your parents/family for example). Your Tutor can only help you if s/he knows you are facing difficulties, so if you are worried about anything go and see your Tutor before things get out of hand.

Further information on the Senior Tutors Office and College Tutors may be found via the following webpage: **Senior Tutor Services-** <https://www.tcd.ie/seniortutor/students/undergraduate/>

Disability Services

The Disability Service aims to provide appropriate advice, support and information to help students and staff with disabilities. The Disability Service has in place a range of supports to ensure that students with disabilities have full access to the same facilities for study and recreation as their peers. Most students registering with the Disability Service request access to a range of supports that help the student reach their full potential while studying. Most students' needs are accommodated through these supports. The student decides what level of support they require.

For contact information or to make an appointment please contact the Disability Services – contact details are available via the following webpage: <https://www.tcd.ie/disability/contact/>

Student Learning Development

Student Learning Development offers support in a variety of study and learning skills including essay writing, exam preparation, study skills, self and time-management and note taking. Mechanisms of support are workshops, individual appointments and drop-in clinics.

For new students: <https://www.tcd.ie/sld/your-student-journey/new-to-trinity/>

For Undergraduate Students: <https://www.tcd.ie/sld/your-student-journey/undergraduate-students/>

For Postgraduate Students: <https://www.tcd.ie/sld/your-student-journey/postgraduate-students/>

For general information on all resources and supports available visit: <https://www.tcd.ie/sld/>

Student Health and Wellbeing

College Health Service

Trinity Health Services have GP services available for the following Opening Hours: Please contact us on 01 8961556 or 01 8961591 between 9am and 1pm and from 2-4:30pm

You can email collegehealth@tcd.ie, but please note that this email is NOT FOR ANY MEDICAL/CLINICAL enquiries and is not manned to manage clinical/medical enquiries, strictly only admin.

The Physiotherapist operates daily between 09.00 and 13.00 and also Monday/Tuesday afternoons during term time.

For further information visit: <https://www.tcd.ie/collegehealth/>

Student Counselling

The Student Counselling Service is here to help you to manage any difficulties you are experiencing so you can enjoy and fully participate in your time here at College.

If you wish to make an appointment with the Student Counselling Service, please consider one of the options below. If you have any other queries you can call into reception on the 3rd floor of 7-9 South Leinster Street or contact us on:

Phone: (01) 896 1407

Email: student-counselling@tcd.ie

For further information visit the following webpage: <https://www.tcd.ie/StudentCounselling/>

Student Life

Student life offers information on Supports and Services, Clubs and Societies, Student Unions etc., <https://www.tcd.ie/students/>

Academic Registry

The Academic Registry is responsible for services that support the complete student lifecycle of Trinity College Dublin – from application to graduation.

For information on Registration, Fees, Grants, ID Cards etc. visit the Academic Registry (AR). AR is located in the Watts Building, on the first floor, or visit the AR website: <https://www.tcd.ie/academicregistry/>

Queries can be emailed to academic.registry@tcd.ie, or you can telephone 01 896 4500 during office hours.

Student Accommodation

CAMPUS: The Accommodation Office is open Monday to Friday from 8.30am to 1pm and 2pm-5pm each day. Queries can be emailed to residences@tcd.ie, or you can telephone 01 896 1177 during office hours.

After hours you can contact Front Gate at 01 896 3978 in case of difficulties or key problems. In Goldsmith Hall attendants are on duty in the residential area at weekends and overnight and they will assist with local problems.

In the event of a serious emergency, particularly where you require the attendance of ambulance, fire or police services please telephone College Security at 01 896 1999 (internal 1999). To ensure a co-ordinated response please do not call these services directly. We recommend that you programme these numbers into your mobile phone using the prefix “01” before the number. <https://www.tcd.ie/accommodation/>

Contacts

Module Coordinators

Staff	Email
Course Director Dr. Silvia Caldararu, Botany	caldaras@tcd.ie
Course Director Professor Laurence Gill, Civil Struct & Env. Eng.	laurence.gill@tcd.ie
ES7047 Dr. Muhammad Ali, Civil Struct & Env. Eng.	Muhammad.ali@tcd.ie
ES7046 Professor Laurence Gill & TBC	laurence.gill@tcd.ie
CE7J02 Professor Sarah McCormack, Civil Struct & Env. Eng.	sarah.mccormack@tcd.ie
CE7J04 Professor Sarah McCormack, Civil Struct & Env. Eng.	sarah.mccormack@tcd.ie

CE7E07 Professor Laurence Gill, Civil Struct & Env. Eng.	laurence.gill@tcd.ie
ES7057 Professor Quentin G Crowley, Geology	crowleyq@tcd.ie
CEP55E03 Dr. John Gallagher, Civil Struct & Env. Eng.	j.gallagher@tcd.ie
CE7E04 Dr. Liwen Xiao, Civil Struct & Env. Eng.	liwen.xiao@tcd.ie
DP7023 Dr. Susan Murphy, Geography & Dr. Conor Buggy (UCD)	susan.p.murphy@tcd.ie conor.buggy@ucd.ie
CE7C05 Dr. Patrick Morrissey, Civil Struct & Env. Eng.	morrisp5@tcd.ie
CE7E05 Professor Laurence Gill, Civil Struct & Env. Eng.	laurence.gill@tcd.ie
CE7E06 Dr. David O'Connell, Civil Struct & Env. Eng.	DAVID.OCONNELL@tcd.ie
CE7J01 Dr. Breiffni Fitzgerald, Civil Struct & Env. Eng.	breiffni.fitzgerald@tcd.ie
ES7027 Dr. Corentin Flament Loron, Botany	loronc@tcd.ie
CEP55E06 Dr. David O'Connell, Civil Struct & Env. Eng	DAVID.OCONNELL@tcd.ie
DP8017 Dr. Stephan Hugel, Geography	shugel@tcd.ie
BD7056 Dr. Rosie Mangan, Botany	romangan@tcd.ie
CSP7001 Dr. Giovanni Di Liberto, Computer Science	gdiliber@tcd.ie

Discipline Staff and Admins

Administrative staff	School	Email
Caroline Clabby TR064 Course Administrator	School of Natural Sciences	envscieng@tcd.ie
James Higgins School Manager	School of Natural Sciences	schoolofnaturalsciences@tcd.ie
Patricia Hughes School Manager	School of Engineering	engineering@tcd.ie
Zara Cassidy-Coss Administrative Officer, School Office	School of Engineering	ZCASSIDY@tcd.ie

Liam McCarthy Executive Officer, Civil Structural and Environmental Engineering	School of Engineering	lmccart4@tcd.ie
George Oatridge Administrative Officer Postgraduate	School of Natural Sciences	OATRIDGG@tcd.ie
Elaine Elders Postgraduate Administrative Coordinator	School of Natural Sciences	elderse@tcd.ie
Julie Boustie Global and Industry Engagement Officer	School of Natural Sciences	SNSGlobal@tcd.ie
Chloe O'Connor Global Officer (UNITECH)	School of Engineering	CHLOE.OCONNOR@tcd.ie

School Website: <https://www.tcd.ie/naturalsciences/>

Link to School course page:

[Undergraduate - School of Natural Sciences | Trinity College Dublin](#)

[Postgraduate - School of Natural Sciences | Trinity College Dublin](#)

[Environmental Science and Engineering - Courses | Trinity College Dublin](#)

[Environmental Science and Engineering \(TR064\) - School of Natural Sciences | Trinity College Dublin](#)

Appendix 1

Item	Reference/Source
Statement on General Regulations	<u>Calendar, Part II, General Regulations and Information, Section II, Item 12</u> <u>Calendar, Part III, General Regulations, Section I</u>
Student Supports Co-curricular activities TCDSU, GSU & student representation structures	<u>Student Supports</u>
Emergency Procedures	Standard Text: In the event of an emergency, dial Security Services on extension 1999 Security Services provide a 24-hour service to the college community, 365 days a year. They are the liaison to the Fire, Garda and Ambulance services and all staff and students are advised to always telephone extension 1999 (+353 1 896 1999) in case of an emergency. Should you require any emergency or rescue services on campus, you must contact Security Services. This includes chemical spills, personal injury or first aid assistance. It is recommended that all students save at least one emergency contact in their phone under ICE (In Case of Emergency).
Data Protection	<u>Data Protection for Student Data</u>
Research Ethics	<u>Policy on Good Research Practice</u>

Key Locations for students: Include Programme Offices, Laboratories, Online Learning Environments, Libraries, Academic Registry, Places of Faith/Prayer Rooms, Photocopiers and any relevant introductory information on these locations	<u>Blackboard Academic Registry</u>
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Item	Reference/Source
Plagiarism & Referencing Guidance	<u>Calendar, Part B, General Regulations and Information</u> <u>Calendar, Part III, General Regulations & Information, Section I 'Plagiarism'</u> <u>Plagiarism Policy</u>
Health and Safety Statements	Faculty of Science Engineering, Mathematics and Science website - https://www.tcd.ie/stem/undergraduate/health-safety.php
Foundation Scholarships	<u>Calendar, Part II, Foundation and Non-Foundation Scholarships</u>
Absence from Examinations	<u>Calendar, Part B, General Regulations and Information</u> <u>Calendar, Part III, Section III, 'Examinations, Assessment and Progression'</u> <u>Academic Policies</u>
Reference to Relevant University Regulations	<u>Academic Policies</u> <u>Student Complaints Procedure</u> <u>Dignity and Respect Policy - Equality, Diversity and Inclusion Trinity College Dublin (tcd.ie)</u>
May include Programme Offices, Laboratories, Online Learning Environments, Libraries, Academic Registry, Places of Faith/Prayer Rooms, Photocopiers and any relevant introductory information on these locations	<u>Blackboard Academic Registry</u>

Timetable for students	<u>My TCD</u>
Internships/ Placements for Credit	<u>Internship and Placement Policy.</u>
Programme Architecture	<u>Trinity Education Programme Architecture and Pathways</u>
Item	Reference/Source
Marking Scale	<u>Calendar, Part B, General Regulations and Information</u>
Progression Regulations	<u>Calendar, Part II, General Regulations & Information</u> <u>Calendar, Part II, Part C</u> <u>Calendar, Part III, Section III 'Examinations, Assessment and Progression' and 'Assessment and Progression Regulations'</u>
Awards	<u>National Framework for Qualifications</u> <u>Trinity Pathways Trinity Courses</u>
Professional and Statutory Body Accreditation	Provided by School/Discipline Handbooks where applicable
Careers Information & events	<u>https://www.tcd.ie/Science/careers/</u>
External Examiner	<u>Procedure for the transfer of students assessed work to external examiners</u>
Capstone (UG Programmes)	<u>Capstone website</u> <u>Policy on Good Research Practice</u>
Attendance Requirements	<u>Calendar, Part B, General Regulations and Information</u> <u>Calendar, Part III, General Regulations and Information, Section I 'Attendance and Off-Books'; Section II 'Attendance'; Section III 'Attendance, Registration, Extensions'; Section IV 'Attendance and Examinations'</u>
Feedback and Evaluation	<u>Student Evaluation and Feedback</u> <u>Student Partnership Policy</u> <u>Procedure for the conduct of Focus Groups</u>