Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

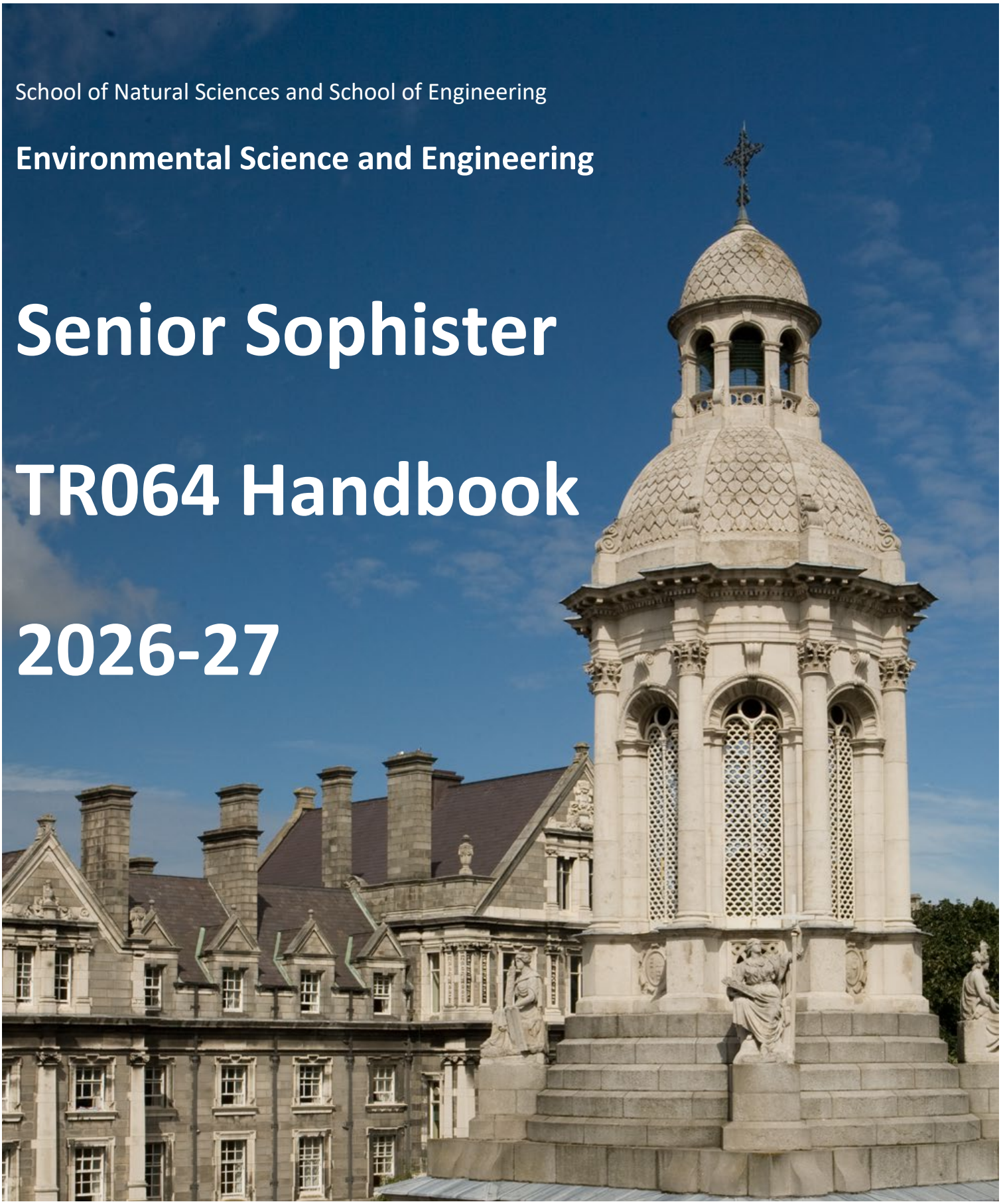
School of Natural Sciences and School of Engineering

Environmental Science and Engineering

Senior Sophister

TR064 Handbook

2026-27



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Welcome

It's Year 4 – your Senior Sophister Year! We are delighted again to congratulate you on successfully progressing. This year you will gain a unique opportunity to deepen your knowledge and skills in a new environment, and for many of you a different country, through industry placements and/or international student exchanges that take place in Semester 2. Trinity has collaborations with some of the world's leading universities and companies. For Trinity TR064 students, this means access to a network of more than 250 exchange opportunities across the globe and long-standing industry partnerships with the Schools of Engineering and Natural Sciences.

In Semester 1 there are four core modules in Environmental Engineering, Environmental Impact Assessment, Catchment Science and Data Handling. You will select 2 additional open modules from a broad selection ranging from Transport Engineering to Tropical Ecology. Streaming into Environmental Engineering or Applied Environmental Science takes place this year as your open module selection in Semester 1 and industry placement project/ international exchange topics in Semester 2 will have an engineering or environmental sciences focus. Despite this increasing specialization, the interdisciplinary spirit of this course will continue through core modules offered from both the School of Natural Science and the School of Engineering.

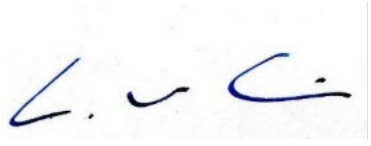
While there is a strong focus on scientific and technical content and problem solving in the syllabus, personal skills such as communication and teamwork are an integral part of your education, and you will have ample opportunities to apply these this year during your industry placement or through your international exchange. 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 Fresh and Junior 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 fourth 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 Leaning 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.

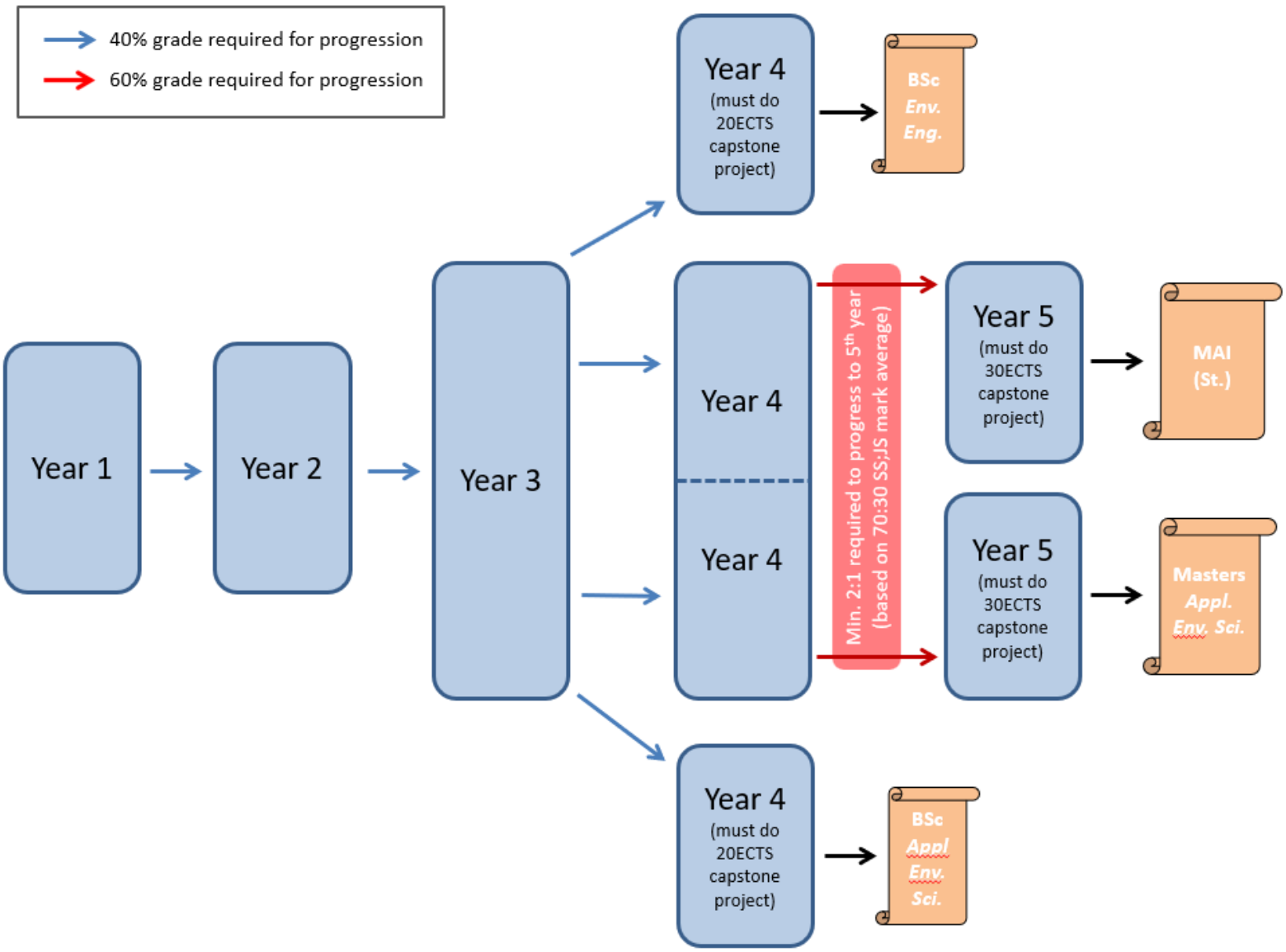
CLO4. Work effectively as an individual, in teams and in multi-disciplinary settings.

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 1-4:

Progression regulations Year 1 to Year 4 are standard (grade of 40 per cent or more to progress). However, in order to be eligible to undertake an industry internship or international exchange in Year 4, students must achieve a threshold grade of 60 per cent at the end of Year 3. Students who don't achieve 60 per cent in Year 3 may still progress to Year 4 with a grade of 40 per cent or above but they must take a capstone module in Year 4 and spend the full year in Trinity.

Year 5:

Progression will be 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

The rules for streaming into Environmental Engineering or Applied Environmental Science:

In Year 3 – **one out of the three** optional modules available must be modules associated with the student's chosen stream.

In Year 4 – if taking 30 ECTS Industry Internship or Erasmus/International Exchange, this should preferably be in the chosen stream (and also take at least **one 5 ECTS module** in the first semester affiliated with the chosen stream).

If spending the full year in Trinity, students must take the Capstone Project module which aligns with their chosen stream, in addition to at least **two optional modules** associated with their chosen stream.

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

Internships and Placements

In Year 4 (Senior Sophister), Semester 2, only students who are planning to progress to Year 5 and are not participating in an Erasmus or International Exchange will undertake a full-semester industry internship. This internship, worth 30 ECTS, must be in the student's chosen stream (Applied Environmental Sciences or Environmental Engineering) and offers valuable hands-on experience in a professional environment. Students who intend to exit with a BSc in Applied Environmental Science or Environmental Engineering at the end of Year 4 will not be eligible for the internship and will instead complete a research project in Semester 2. In order to be eligible to undertake an industry internship or international exchange in Year 4, students must achieve a threshold grade of 60 per cent at the end of Year 3 (Junior Sophister). More detailed information will be provided at the start of Year 4.

For more information you can contact the Global and Industry Engagement Officer for the School of Natural Sciences at SNSGlobal@tcd.ie

Erasmus and International Exchange

Students have the opportunity to go on Erasmus or International Exchange during the Semester 2 of Year 4 (Senior Sophister). The application process takes place in Semester 1 of Year 3 (Junior Sophister) and is competitive, based on academic results from the first two years of study. Offers are issued in Semester 2 of Year 3 (Junior Sophister). An information session outlining the process and options will be held at the start of Year 3. International Exchange is coordinated through a College-Wide procedure, while Erasmus places are managed within the School of Natural Sciences, with offers issued by the School's Global Officer.

More information on Studying Abroad here:

Where can I go - Trinity Global | Trinity College Dublin

How can I go - Trinity Global | Trinity College Dublin

Frequently Asked Questions - Engineering | Trinity College Dublin

For more information you can contact the Global and Industry Engagement Officer for the School of Natural Sciences at SNSGlobal@tcd.ie

Unitech

Environmental Science and Engineering students can apply for UNITECH. UNITECH is a prestigious year long programme that students can take in Year 4 (Senior Sophister). Semester 1 will be spent in a host university, and students will undertake an internship in Semester 2. There will be an information session organised at the start of Year 3.

More information here:

UNITECH - Engineering | Trinity College Dublin

For more information, you can contact the Global Officer for the School of Engineering at CHLOE.OCONNOR@tcd.ie.

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 B.Sc. capstone project is taken in 4th year by those students on the 'B.Sc. Environmental Engineering' or 'B.Sc. Applied Environmental Science' streams, while the Master's project is taken in 5th year by those on the 'MAI Environmental Engineering' or 'Master's in Applied Environmental Sciences' streams. 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

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 for BSc	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 – Senior Sophister (Year 4)

Core Modules

Semester 1	Semester 2
ZOU44092 – Environmental Impact Assessment (5 ECTS)	ESU44003 – Internship (30 ECTS)
ZOU44030 – Data Handling (5 ECTS)	ERASMUS – Semester 2 (30 ECTS)
CEU44A31 – Environmental Engineering 1 (5 ECTS)	UNITECH (Year Long if awarded)
ESU44002 – Catchment Science (5 ECTS)	ESU44004 – Research Project - Towards Climate Resilience in Ireland (20 ECTS)

Optional Modules

If taking 30 ECTS Industry Internship or International Exchange, this should preferably be in the chosen stream + 1 out of 2 optional modules in the chosen stream in S1 (Environmental Engineering or Applied Environmental Science)

If spending the full year in Trinity, students must take the Capstone Project module which aligns with their chosen stream, in addition to at least 2 optional modules associated with their chosen stream

Semester 1 – choose 2	Semester 2 – if doing the capstone choose 2
BOU44108 – Plant Environment Interactions (5 ECTS)	CEU44A01 - Civil Engineering Materials (5 ECTS)
CEU44A15 – Hydraulics and Hydrology – (5 ECTS)	CEU44A02 - Groundwater and Pollution Control (5 ECTS)
CEU44A16 – Transport Engineering & Modelling (5 ECTS)	CEU44E06 - Water Resource Planning and Climate Change (5 ECTS)
EEU33C01 – Signals & Systems (5 ECTS)	BOU44103 - Plant Conservation and Biodiversity (5 ECTS)
ZOU44021 – Tropical Ecology & Conservation (5 ECTS)	BOU44110 - Evolution of Plants and Plant-Atmosphere Interactions (5 ECTS)
BOU44111 – Restoration Ecology & Rewilding (5 ECTS)	GGU44977 - Environmental Governance 2 (5 ECTS)
	GGU44979 Living on the Edge: Estuaries and Coasts (5 ECTS)

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	
Core	Environmental Impact Assessment	5	Michaelmas
ZOU44092	Paula Murphy	50% FE 50% CW	
Core	Data Handling	5	Michaelmas
ZOU44030	Andrew Jackson	65% FE 35% CW	
Core	Environmental Engineering 1	5	Michaelmas
CEU44A31	Laurence Gill	75% FE 25% CW	
Core	Catchment Science	5	Michaelmas
ESU44002	Patrick Morrissey	70% FE 30% CW	
Optional	Plant Environment Interactions	5	Michaelmas
BOU44108	Matthew Saunders	50% FE 50% CW	
Optional	Hydraulics and Hydrology	5	Michaelmas
CEU44A15	Barnaby Dobson	75% FE 25% CW	
Optional	Transport Engineering & Modelling	5	Michaelmas
CEU44A16	Brian Caulfield	70% FE 30% CW	
Optional	Signals & Systems	5	Michaelmas
EEU33C01	Nicola Marchetti	70% FE 30% CW	
Optional	Tropical Ecology & Conservation	5	Michaelmas
ZOU44021	Ian Donohue	50% FE 50% CW	
Optional	Restoration Ecology & Rewilding	5	Michaelmas
BOU44111	Marcus Collier	50% FE 50% 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	
ESU44003	Trinity Partnership Project (Internship)	30	Hilary
	Silvia Caldararu	100% CW	
ESU44004	Research Project	20	Hilary
	Muhammad Ali	100% CW	
Optional	Civil Engineering Materials	5	Hilary
CEU44A01	Sara Pavia	80% FE 20% CW	
Optional	Groundwater and Pollution Control	5	Hilary
CEU44A02	David O'Connell	100% FE	
Optional	Water Resource Planning and Climate Change	5	Hilary
CEU44E06	David O'Connell	80% FE 20% CW	
Optional	Plant Conservation and Biodiversity	5	Hilary
BOU44103	TBC	50% FE 50% CW	
Optional	Evolution of Plants and Plant Atmosphere-Interaction	20	Hilary
BOU44110	Jennifer McElwain	70% FE 30% CW	
Optional	Environmental Governance 2	5	Hilary
GGU44977	Rory Rowan	100% CW	
Optional	Living on the Edge: Estuaries and Coasts	5	Hilary
GGU44979	Iris Moeller	100% CW	

ICA = In course Assessment – Formal Assessment in exam conditions

CW = Coursework

FE = Formal Examination in Annual Examination Period

Module Descriptions

Semester 1 – Core

Module Code	CEU44A31
Module Name	Environmental Engineering 1
ECTS Weighting[1]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Prof. Laurence Gill Prof. 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: 1. Categorise the difference in quality of water from different sources (such as groundwater and surface water). 2. Interpret a variety of different water quality parameters (physical, chemical and microbiological) with respect to likely waste source and pollution potential. 3. Analyse the degradation of biodegradable organic matter introduced into a watercourse with respect to time. 4. Calculate the dissolved oxygen sag in a water course downstream of an input of organic pollution. 5. Estimate the effect of increased phosphorous loading onto a water body with respect to eutrophic state. 6. Apply chemical engineering process design concepts to the design of a series of reactors for the treatment of both potable water and wastewater. 7. Calculate the size of unit processes for the treatment of potable water and wastewater on the basis of physical, chemical or biological environmental engineering concepts. In addition, be able to calculate the energy / chemical requirements and resultant by-products from such processes. 8. Demonstrate an awareness of the overall context of water and wastewater treatment with respect to national and international legislation and also human and environmental health. 9. Plan and prepare an overall design of a wastewater treatment plant from basic flow and load data.

[1] TEP Glossary

	10. Recognise a variety of atmospheric pollutants and their sources and analyse their dispersion from point sources under different meteorological conditions. **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Enhanced

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

- Water sources & characteristics
- Coagulation / Flocculation
- Filtration / Adsorption
- Disinfection
- Oxidation / catalytic ppt / ion exchange / membranes
- Sludge treatment

- Air Quality
  - Atmospheric pollutants and sources
  - Meteorology
  - Atmospheric stability and turbulence
  - Atmospheric dispersion – Gaussian model

Teaching and Learning Methods

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

Assessment Details[2] Please include the following:

- **Assessment Component**
- **Assessment description**
- **Learning Outcome(s) addressed**
- **% of total**

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Continuous Assessment 1	Group Design Project	LO2,3,4,6,7, 9	10%	12
Continuous Assessment 2	2 Laboratory Practicals	LO2,4,6,7	8%	7
Continuous Assessment 3	Air pollution Assignment	LO10	7%	12

[2] TEP Guidelines on Workload and Assessment

• **Assessment due date**	Examination	2-hour Written Examination	LO1-9	75%	End of semester exam

Reassessment Requirements	Re-assessment, if needed, consists of 100% Written Examination
Contact Hours and Indicative Student Workload[2]	**Contact hours:** 27 lectures, 1 x 3hr lab session, 3 x 2h project tutorial **Independent Study (preparation for course and review of materials):** 30 hrs **Independent Study (preparation for assessment, incl. completion of written assessment):** 60 hrs
Recommended Reading List	*Fundamentals of Environmental Engineering* – Mihelcic (Wiley) *Wastewater Engineering – Metcalf and Eddy (McGraw-Hill)* *Water Supply – Twort et al. (IWA)* *Environmental Engineering – Kiely (McGraw-Hill)*
Module Pre-requisite	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	ESU44002
Module Name	Catchment Science

ECTS Weighting[3]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Dr. Patrick Morrissey Lecturers: Dr. David O'Connell Prof. Laurence Gill
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. Understand and develop conceptual models for typical problems within the field of catchment science. LO2. Demonstrate an awareness of different processes in catchment science, which affects surface and groundwater quality. LO3. Undertake catchment characterisation and tracing studies. LO4. Develop soil erosion/sediment susceptibility maps models for agricultural catchments. LO5. Develop biogeochemical models from catchment processes. LO6. Identify and evaluate appropriate catchment management strategies. LO7. Design and implement a catchment management programme and river basin management plan. LO8. Develop models for catchment and river basin scale processes and management.
Module Content	This module aims to: (a) introduce the students to catchment science and the movement of water and associated materials across the landscape and how this drives river systems; (b) explain and provide understanding of the effect human activities have on catchment processes and river responses and; (c) provide hands on experience in quantitative and analysis techniques for catchment processes and fluxes. • **Catchment science/processes** - Hydrological processes - Nutrient biogeochemical processes and networks - Catchment characterisation techniques • **Geomorphological controls** - Fundamental relationships

[3] TEP Glossary

- Soil and sediment erosion and transport
- Catchment structure
- Drainage network development
- Landscape connectivity

- **River Basin Management**
- Managing extremes: Floods and droughts
- Land use change and intensification
- Catchment management and restoration
- Aquatic pollution
- Soil erosion and fine sediment transfer
- Protection/Management of aquatic ecosystems/habitats
- Catchment management implementation planning
- Management strategy evaluation/assessment
- Modelling catchment scale processes

Teaching and Learning Methods

Assessment Details[4] 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	Coursework		30%	
Examination	2 hour Written Examination		70%	End of semester

Reassessment Requirements

Re-assessment, if needed, consists of 100% Written Examination

[4] TEP Guidelines on Workload and Assessment

Contact Hours and Indicative Student Workload[2]	**Contact hours:** **Independent Study (preparation for course and review of materials):** **Independent Study (preparation for assessment, incl. completion of written assessment):**
Recommended Reading List	*From Catchment Management to Managing River Basins* *Science, Technology Choices, Institutions and Policy - M. Dinesh Kumar, V. Ratna Reddy, A. J. James* [Elsevier science] *Catchment and River Basin Management Integrating Science and Governance* - L Smith, K Porter, KM Hiscock, MJ Porter and D Benson [Earthscan] *Water quality modelling* – Steven Chapra [McGraw-Hill] *Soil Physics with Hydrus* – Radcliffe & Simunek [CRC Press] *Rainfall-runoff modelling* – 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.	**Admin contact:** Caroline Clabby – TR064 Course Administrator
Academic Start Year	September 2026
Academic Year of Date	2026-2027

Module Code	ZOU44030
Module Name	Data Handling

ECTS Weighting[5]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Prof. Andrew Jackson Additional lecturer(s): Dr. Thomas Connor
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students will be able to: • Summarise and communicate quantitative results graphically and textually to scientific standards. • Apply appropriate statistical analyses of commonly encountered data types. • Explain the context of the analyses within a hypothesis driven framework of scientific logic. • Use the R statistical computing language for data analysis. • Create R notebooks for documenting analyses and sharing with collaborators.
Module Content	Being able to form research questions and challenge our hypotheses by collecting and analysing data forms the basis of scientific inquiry. An understanding of data analysis is an essential skill set for all scientists. This module will consist of 2 to 3 tutorial sessions per week spanning all of semester 1 in a flipped-classroom format with an active-learning ethos. One of the tutorials each week will be used to develop class-directed questions relevant to current scientific thinking. As a class, we will form hypotheses, collect data and develop appropriate analytical techniques to answer our research questions. Concurrently, online material including video podcasts will be used to develop hands-on skills in the use of the very powerful and flexible statistics package R for data analysis. The module will start with basic probability theory, introduce different statistical distributions and culminate in learning how General Linear Models form a common framework for conceptualizing and analysing your data. At the end of the module, you will have analysed a wide variety of data types and will have used the transferable and widely applicable statistics package R to analyse your data.

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Teaching and Learning Methods

Assessment Details[6]
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	Coursework		35%	
Examination	Written examination		65%	End of semester

Reassessment Requirements

Contact Hours and Indicative Student Workload[2]

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	N/A
Module Co-requisite	N/A
Module Website	Blackboard Ultra

[6] 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, Zoology **Admin contact:** Caroline Clabby – TR064 Course Administrator Celine Egan – Executive Officer, Zoology
Academic Start Year	September 2026
Academic Year of Date	2026-2027

Module Code	ZOU44092
Module Name	Environmental Impact Assessment
ECTS Weighting[7]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Dr. John Rochford Prof. Paula Murphy
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module students will be able to: • Outline the development of the Environmental Impact Assessment process as a management and legislative tool from its inception in the 1960s to its present form. • Explain the stages in the process from initial screening to post-project monitoring and auditing. • Conduct a scoping exercise for a project and produce a draft Scoping Statement. • Critically evaluate Environmental Impact Assessment Reports prepared for a wide range of projects. • Compare and contrast the process of Environmental Impact Assessment with Strategic Environmental Assessment. • Describe Appropriate Assessment in the context of Natura 2000 sites.

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Module Content	This module involves an introduction to the principles and processes of Environmental Impact Assessment, particularly in relation to national and international requirements. All stages of the EIA process, from initial project screening to the final review, are covered, with the emphasis throughout on the role of the natural scientist. Strategic Environmental Assessment and Appropriate Assessment are also covered. In addition to the lectures, students carry out a group scoping exercise for a proposed development and conduct a quality review of an actual EIAR.
Teaching and Learning Methods	
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	Coursework		50%	
Examination	Written Examination		50%	End of semester

Reassessment Requirements	
Contact Hours and Indicative Student Workload[2]	**Contact hours:** **Independent Study (preparation for course and review of materials):** **Independent Study (preparation for assessment, incl. completion of written assessment):**

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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, Zoology **Admin contact:** Caroline Clabby – TR064 Course Administrator Celine Egan – Executive Officer, Zoology
Academic Start Year	September 2026
Academic Year of Date	2026-2027

Semester 1 – Optional

Module Code	BOU44108
Module Name	Plant-Environment Interactions
ECTS Weighting[9]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Dr. Matthew Saunders
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: • Demonstrate an understanding of how environmental factors influence the physiological performance of plants at various stages of growth and across multiple spatial scales (leaf, whole plant and ecosystem scale). • Identify suitable methodological approaches to monitor and quantify the impacts of key environmental drivers on physiological processes observed at the leaf, plant and ecosystem scale. • Understand how process-based models can be used to better understand experimental observations and how this information can

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be spatially extrapolated and used to better understand the impacts of future climatic variability.

- Show an understanding of how these concepts can be utilised in the development of sustainable land management practices.

Module Content

Plant growth is significantly influenced by the surrounding physical, chemical and biological environment. This module will address the key inter-related concepts of carbon assimilation and sequestration, plant water relations and energy balance components across the soil-plant-atmosphere continuum. The physiological response of plants to respond to a broad range of environmental conditions (light, temperature and water availability) including abiotic and biotic extreme events will be explored, and the implications for natural and production-based systems will be assessed. The practical exercises have been designed to emphasise the importance of making precise measurements of both environmental variables and associated plant responses and how the information derived from such experiments can be integrated with mathematical models to predict plant responses to environmental drivers.

Teaching and Learning Methods

Assessment Details[10] Please include the following:

- **Assessment Component**
- **Assessment description**
- **Learning Outcome(s) addressed**
- **% of total**

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Continuous Assessment	Coursework		50%	
Examination	Written Examination		50%	

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• **Assessment due date**	
Reassessment Requirements	
Contact Hours and Indicative Student Workload[2]	**Contact hours:** **Independent Study (preparation for course and review of materials):** **Independent Study (preparation for assessment, incl. completion of written assessment):**
Recommended Reading List	• Hall, D.O., Scurlock, J.M.O., Bolhar-Nordenkampf, H.R., Leegood, R.C. & Long, S.P. (eds) (1993). Photosynthesis and Production in a Changing Environment - A Field and Laboratory Manual, Chapman and Hall, London. • Jones, H.G. (2014) Plants and Microclimate - A Quantitative Approach to Environmental Plant Physiology. Cambridge University Press, Cambridge. • Lambers, H., Chapin, F.S., Pons, T.L. (2006). Plant physiological ecology. Springer, New York, USA. • Nobel, P.N. (2005). Physiochemical and environmental plant physiology. Elsevier Academic Press, Burlington, MA, USA. • Taiz, L., Zeiger, E. (2010). Plant Physiology. Sinauer Associates Inc., Sunderland, Massachusetts USA
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, Botany **Admin contact:** Caroline Clabby – TR064 Course Administrator Fiona Moloney – Undergraduate Administrative Coordinator, Botany
Academic Start Year	September 2026
Academic Year of Date	2026-2027

Module Code	BOU44111
Module Name	Restoration Ecology and Rewilding
ECTS Weighting[11]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Dr. Marcus Collier Additional lecturer(s): Ms. Jessica Leonard
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: • Understand the principals of restoration ecology as they apply in a modern context • Comprehend the nuanced nature of restoring ecosystems and habitats as well as re-introducing species in practice • Carry out restoration case study analysis • Understand the complex relationship between ecology, social values and policies • Evaluate the success of restored ecosystems and species
Module Content	Restoration ecology, like conservation biology, is a 'crisis' discipline, having emerged as a science/practice response to the social and ecological impacts directly and indirectly driven by human activities. Restoration ecology has proven to be highly effective in some cases but has also given rise to some controversy as well as policy difficulties. In recent years the phrase 'rewilding' has emerged as an umbrella concept that embodies ecological restoration but with more future-oriented targets. Rewilding and novel ecosystems are new and controversial areas within restoration ecology making it difficult to know how and when to intervene. This module will introduce you to the challenges and opportunities, failings and fallacies of the complex world of restoration ecology, rewilding, and the work of restoration ecologists. It will look at how rewilding could be the most efficient of nature-based solutions and asks if this is feasible in the modern world. As the

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	discipline struggles to navigate global climate issues, integrate with the social sciences, incorporate politics and economics, and derive policy actions, this module will draw on case studies of restoration globally to will challenge students to rethink ecology and ecosystems in the Anthropocene. It will also discuss areas of employment where students might consider after graduation, with some invited guests providing insight into the practice of restoration and rewilding.
Teaching and Learning Methods	
Assessment Details[12] 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	Coursework		50%	
Examination	Written Examination		50%	

Reassessment Requirements	
Contact Hours and Indicative Student Workload[2]	**Contact hours:**
	Independent Study (preparation for course and review of materials):
	Independent Study (preparation for assessment, incl. completion of written assessment):

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Recommended Reading List	• Aronson, J, Milton, S.J., & Blignaut, J. Eds. (2007) Restoring Natural Capital. Island Press • Carver, S., Convery, I., Hawkins, S., Beyers, R., Eagle, A., Kun, Z., . . . Soule, M. (2021). Guiding principles for rewilding. Conserv Biol, 35(6), 1882-1893. doi:10.1111/cobi.13730 • GLA (Greater London Authority). (2023). Rewilding London: Final Report of the London Rewilding Taskforce. • Higgs, E., Falk, D. A., Guerrini, A., Hall, M., Harris, J., Hobbs, R. J., . . . Throop, W. (2014). The changing role of history in restoration ecology. Frontiers in Ecology and the Environment, 12(9), 499-506. doi:10.1890/110267 • Hobbs, R. J., Higgs, E. S. & Hall, C. M. Eds. (2013) Novel Ecosystems. Wiley • Lorimer, J., Sandom, C., Jepson, P., Doughty, C., Barua, M., & Kirby, K. J. (2015). Rewilding: Science, Practice, and Politics. 40(1), 39-62. doi:10.1146/annurev-environ-102014-021406 • Marris, E. (2011) Rambunctious Garden. Bloomsbury • Monbiot, G. (2015) Feral. Penguin
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, Botany **Admin contact:** Caroline Clabby – TR064 Course Administrator Fiona Moloney – Undergraduate Administrative Coordinator, Botany
Academic Start Year	September 2026
Academic Year of Date	2026-2027

Module Code	CEU44A15
Module Name	Hydraulics & Hydrology

ECTS Weighting[13]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Dr. Barnaby Dobson
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: 1. Predict the performance of hydraulic prototypes from hydraulic models. 2. Demonstrate an understanding of open channel flow in relation to natural channels. 3. Categorise turbines and design the hydraulic aspects of a small-scale hydro-electric scheme. 4. Calculate the forces on sediment on the bed of a river and to design riverbank slope protection measures. 5. Analyse river hydrographs and relate the river response to rainfall data. 6. Interpret the results from a network of rain gauges and synthesise the data for use in a hydrological study of a river catchment. 7. Evaluate the translation and attenuation of a flood hydrograph down a river channel using hydrologic flood routing techniques. 8. Demonstrate an understanding of and formulate design solutions for problems involving unsteady flows. 9. Predict the transformation of waves using linear wave theory **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 a one semester module. It explains the use of dimensional analysis in predicting the performance of prototypes from model studies and in the analysis of significant variables in hydraulic experiments. The module reviews the important relationship of open channel flow in natural channels and uses these relationships to study the water profiles to be expected in various design situations. The module explains the concepts behind hydraulic turbines and categorises turbines in relation to the specific head and usage. The design of small-scale hydro schemes is also formulated. The module develops design methods for river protection measures by analysing the stability of sediment on the river-bed. The hydrology section of the

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course begins by describing how to quantify the water mass balance on a catchment by rainfall and evaporation measurement and analysis. The measurement of flow in rivers is then explained by various gauging methods before the concept of a hydrograph is detailed. The design technique of the Unit Hydrograph is then developed before finally explaining different methods which can be used to route a flood down through a river channel. The module also examines the behaviour of sea-water waves using linear wave theory, predicting their speed, power and energy among other factors. Students will be able to apply this theory to the design of coastal structures or wave energy devices. Finally, the module examines analysis of engineering problems involving unsteady flow, such as pressure transient in pipelines and quasi-steady flow problems.

Module content

- **Dimensional analysis and similarity**
  - Indicial method and Buckingham's theory
  - Prediction of the performance of prototypes from models
  - Simplification of experimental studies.
- **Open channel flow in Natural Channels**
  - Velocity Distributions in Natural Channels
  - Flow in Compound Channels
  - Conveyance
- **Turbines and hydro schemes**
  - Engineering characteristics of turbines
  - Analytical methods of predicting the performance of turbines
- **River protection**
  - Analysis of forces on sediment in rivers
  - Analytical methods of designing river protection systems
- **Hydrology**
  - Precipitation measurement and analysis
  - Evaporation measurement and calculation
  - River gauging and flow measurement
  - Hydrograph analysis
  - Unit Hydrograph
  - Flood routing.
- **Unsteady Flow**
  - Types of unsteady flow
  - Pressure Transients
  - Surge Towers
  - Quasi-steady flow
- **Linear Wave Theory**
  - Wave transformation processes

	○ Wave Energy
Teaching and Learning Methods	This module is taught by a combination of face-to-face lectures, laboratory classes and tutorials.

Assessment Details[14] **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	3 Laboratories and 1 Assignment	LO1-9	25%	
Examination	2-hour Written Examination	LO1-9	75%	End of semester

Reassessment Requirements	Re-assessment, if needed, consists of 100% Written Examination

Contact Hours and Indicative Student Workload[2]	**Contact hours:** 27 hrs lectures, 3 lab session
	Independent Study (preparation for course and review of materials): 30hrs
	Independent Study (preparation for assessment, incl. completion of written assessment): 60hrs
Recommended Reading List	*Hydraulics in civil and environmental engineering* - Chadwick & Morfett (E & FN Spon) *Hydrology in practice* – Shaw (Chapman & Hall)

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	Engineering Hydrology – Wilson (Scholium International) *Mechanics of Fluids* – Massey (Taylor & Francis)
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	CEU44A16
Module Name	Transport Engineering & Modelling
ECTS Weighting[15]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Prof. Brian Caulfield
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: 1. Discuss the factors affecting transport demand in Ireland; calculate cross and direct elasticities, equilibrium, and consumer surplus, and; draw the demand, supply, performance, average cost, marginal cost, total cost, fixed, variable, and cost curves. 2. Discuss road pricing in theory and practice such as electronic road pricing in London, alternatives to road pricing, pros and cons of road pricing, societal, economic, political, and environmental considerations of road pricing; state the assumptions of road pricing, and; compute marginal toll

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	3. Apply various appraisal methods to the evaluate Ireland transport projects and examine these projects under societal, economic, environmental, political, and ethical considerations. 4. Develop an understanding of the fundamental concepts and standard practices in sustainable transportation and how such practices can be implemented in Dublin. 5. Describe the transportation planning process, information required for transportation planning, and travel demand forecasting techniques, and discuss environmental, economic, societal, political, business and ethical issues in transportation planning using Ireland examples. 6. Discuss the factors affecting route, mode, and destination choices; derive the coefficients of regression models; judge whether a regression model is suitable for applications; identify the limitations and assumptions of the gravity model, the discrete choice model, and the user equilibrium model, and; forecast and estimate trip distribution, modal split, and route choice using these models. 7. Work as part of a team to identify, formulate, analyse and solve transport engineering problems by using existing transport software packages, and design transport systems. **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 intended to enable students to identify, formulate, analyse, and solve transportation engineering problems, to apply the theory and employ existing transport software packages to solve real world transport problems as well as to design transport systems, to analyse transport data, to improve their communication and teamwork skills, to work in groups to solve transportation engineering problems, to explain terminology used in practice, and to communicate effectively with the transportation engineering community. The emphasis is on the societal, economic, environmental, political, ethical and business aspects of transport problems. 1. Land use 2. Sustainable Transportation 3. Transport Economics and road pricing 4. Project appraisal 5. Transportation planning and demand forecasting 6. Some selected topics (if time allows)

Teaching and Learning Methods

Assessment Details[16] **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	Coursework	LO1-8	30%	
Examination	2-hour Written Examination	LO1-8	70%	End of semester

Reassessment Requirements

Re-assessment, if needed, consists of 100% Written Examination

Contact Hours and Indicative Student Workload[2]

Contact hours: 27 hrs lectures
Independent Study (preparation for course and review of materials): 60hrs
Independent Study (preparation for assessment, incl. completion of written assessment): 30hrs

Recommended Reading List

1. *Modeling Transport*. J. de D. Ortuzar and L. G. Willumsen. John Wiley & Sons. 1990
2. *Traffic Engineering* (2nd Edition), W.R. McShane and R.P. Roess, Prentice Hall, Inc. 1998.
3. *British Railway Track*, 6th Edition, Published by the Permanent Way Institution, 1993, ISBN 0 903489 03 1.

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	4. *Transport Economics*. Kenneth Button. Aldershot, Hants, England; Brookfield, Vt.: Elgar, 1993 5. *Transportation Engineering: An Introduction*. C. Jotin Khisty. Prentice Hall Inc. 1990
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	EEU33C01
Module Name	Signals and Systems
ECTS Weighting[17]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Prof. Nicola Marchetti
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On completion of this module the student will be able to: 1. Represent both continuous-time and discrete-time periodic signals as a Fourier series. 2. Use the Fourier transform and the Laplace transform to analyse continuous-time signals and systems. 3. Use the discrete-time Fourier transform and the z-transform to analyse discrete-time signals and systems. 4. Determine the impulse response, step response and frequency response of both continuous-time and discrete-time systems and determine the

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	response of the LTI system to any input signal. Determine the stability of a feedback system. **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Attained To develop continuously - Enhanced To communicate effectively - Enhanced
Module Content	Continuous-Time Signals and Systems: • Introduction to signals, convolution integral. • Continuous-time signals and their properties. Linear Time-Invariant (LTI) systems and their properties (causality, stability). • Fourier series and its properties. Response of LTI systems to complex exponentials. Frequency-selective filters. • Fourier transform and its properties. • Sampling of analogue signals: the sampling theorem. • Laplace transform, its region of convergence and properties. • Analysis of LTI systems using the Laplace transform. • Linear feedback systems. Second order systems. Discrete-Time Signals and Systems: • Introduction to discrete signals and systems, discrete convolution. • Infinite impulse response (IIR) and Finite impulse response (FIR) systems. • The discrete-time Fourier transform (DTFT); properties of the DTFT. • Stability in discrete-time systems. • z-transform, its region of convergence and properties. • Analysis of LTI systems using the z-transform. • Geometric evaluation of the DTFT from pole zero plot.
Teaching and Learning Methods	3 lectures and 1 tutorial per week.
Assessment Details[18]	

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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	50 minutes in-class test	1,2,4	15%	8
Continuous Assessment 2	Matlab-based laboratory report	1,2,4	15%	Report due 2 weeks after lab
Examination	2-hour Written Examination	1,2,3,4	70%	End of semester

Reassessment Requirements

The overall module mark at the supplemental examinations will be determined solely based on the written examination.

Contact Hours and Indicative Student Workload[2]

Contact hours: 44 hrs
Independent Study (preparation for course and review of materials): 60 hrs
Independent Study (preparation for assessment, incl. completion of written assessment): 21 hrs

Recommended Reading List

A.V. Oppenheim, A. S. Willsky with S. H. Nawab, “Signals and Systems,” 2nd Ed., Pearson, 2013

Module Pre-requisite

MAU22E01 Engineering Mathematics III
MAU22E02 Engineering Mathematics IV

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, Electronic Engineering

Admin contact:
Caroline Clabby – TR064 Course Administrator
Michael O'Riordan – Administrative Officer, Electrical Engineering

Academic Start Year

September 2026

Academic Year of Date

2026-2027

Module Code	ZOU44021
Module Name	Tropical Ecology and Conservation
ECTS Weighting[19]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Prof. Ian Donohue Additional lecturer(s): Dr. John Rochford Prof. Andrew Jackson Dr. Rebecca Rolfe Ms. Niamh McCartan
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this elective, the student will be able to: • Demonstrate holistic knowledge of East African geology, landscapes and ecosystems and the extent and nature of human interactions within them. • Understand the principles underpinning the ecology of tropical grasslands, forests, freshwaters and alkaline waters and be able to explain these to a layperson. • Evaluate the importance of natural background environmental fluctuations compared to those caused by human impact. • Synthesise and reconcile the conflicting arguments for the future of each of the ecosystems visited and be capable of integrating these arguments into sustainable management plans, which incorporate indigenous livelihoods. • Design a group research project on tropical ecosystem(s) of their choice. • Make a competent oral presentation, supported by a written synthesis, of their research proposal.

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Module Content	The module comprises a short lecture series followed by a ten-day residential field course in East Africa that will run during the reading week mid-end October. The module will focus on the ecology and biodiversity of a range of ecosystems and habitats (including tropical montane forest, aquatic ecosystems [freshwater rivers and lakes, wetlands and saline lakes] and grasslands) and the connectivities among them. Issues and problems to do with human impacts and the conservation and management of these diverse habitats will also comprise an important element of the module. Planning for the field course commences Semester 2 in Junior Sophister year and requires a deposit to secure a place. Students that are studying abroad for this semester should contact the module coordinator before leaving for study abroad.
Teaching and Learning Methods	
Assessment Details[20] Please include the following: • **Assessment Component** • **Assessment description** • **Learning Outcome(s) addressed** • **% of total** • **Assessment due date**	
Reassessment Requirements	
Contact Hours and Indicative Student Workload[2]	**Contact hours:**

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Continuous Assessment	Coursework		50%	
Examination	Written Examination		50%	

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	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	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, Zoology **Admin contact:** Caroline Clabby – TR064 Course Administrator Celine Egan – Executive Officer, Zoology
Academic Start Year	September 2026
Academic Year of Date	2026-2027

Semester 2 – Core

Module Code	ESU44003
Module Name	Industry Partnership Project
ECTS Weighting[21]	30 ECTS - Derogation
Semester taught	Semester 2
Module Coordinator/s	Dr. Silvia Caldararu

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Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On completion of this module, the student should: LO1. Be able to identify and use appropriate mathematical methods, numerical techniques and software tools for application to new and ill-defined environmental problems; LO2. Be able to integrate knowledge, handle complexity and formulate judgements with incomplete or limited information; LO3. Have the ability to redesign products, processes or systems in order to improve productivity, quality, safety and other desired needs; LO4. Have the ability to apply design methods, processes and techniques to unfamiliar, ill-defined problems, involving other disciplines; LO5. Be able to design according to codes of practice and industry standards; to identify limitations of codes of practice and the need for their application; LO6. Have the ability to investigate and define a need and identify constraints including health, safety and legal issues and the impact of environmental or engineering solutions in a societal and environmental context; LO7. Be able to make professional engineering/environmental judgements that take cognisance of the social, environmental, ethical, economic, financial, institutional and commercial considerations affecting the exercise of their specific environmental/engineering discipline; LO8. Have the ability to consult and work with experts in various fields in the realisation of a product or system; LO9. Have knowledge and understanding of concepts from a range of areas outside environmental science and/or engineering; LO10. Be able, via knowledge and understanding of group dynamics, to exercise leadership; LO11. Be able to select and apply appropriate communication tools and write technical papers and reports
Module Content	The Environmental Science & Engineering Project Internship (EPI) module is a practical internship in a professional setting. This setting can be a company, a government institution, research centre, clinic, etc as deemed appropriate. The School of Engineering and the School of Natural Sciences have selected hosts for the EPI which are already in collaboration with academics in both Schools or are forming new relationships of mutual benefit.

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 1	Scoping Report		5%	
Continuous Assessment 2	Midway Presentation		10%	
Continuous Assessment 3	Poster Presentation		10%	
Continuous Assessment 4	New Skills Report		20%	
Continuous Assessment 5	Research Report		55%	

Reassessment Requirements	
Contact Hours and Indicative Student Workload[2]	**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	N/A

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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	January 2027
Academic Year of Date	2026-2027

Module Code	ESU44004
Module Name	Research Project
ECTS Weighting[23]	20 ECTS - Capstone
Semester taught	Semester 2
Module Coordinator/s	Dr. Muhammad Ali
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: LO2.1. Contribute individually to the development of scientific/technological knowledge in one or more areas of their stream of Environmental Engineering or Applied Environmental Science/ possibly also with links to Arts, Humanities, and social sciences. LO2.2. Identify, assess and synthesize existing literature and research findings on an unfamiliar Climate Resilience-related issues. LO2.3. Define, elucidate and outline a climate resilience problem and develop tests and methodologies and a “recipe” for solution. LO2.4. Apply a range of standard and specialised research tools and techniques to provide innovative and appropriate solutions to complex climate system solutions related achieving Climate resilience in Ireland. LO2.5. Consider models for climate resilience in Irish climate socio-ecosystems.

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	LO2.6. Develop and apply theoretical, scientific and mathematical principles to effectively solve a defined climate resilience research problem. LO2.7. Analyse and interpret data relating to climate resilience. LO2.8. Discuss and critically evaluate the research findings and reflect on the strength and limitations of the research. LO2.9. Assess the implications of the project outcomes for engineering, policy and/or societal practice. LO2.10. Write a research dissertation with publication to professional and academic standards using appropriate graphics and references.
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. The main objective of this module: • To plan, execute and report on a Climate Science Project towards Climate Resilience in Ireland. A list of joint project topics/titles from the Schools of Engineering and Natural Sciences will be issued to students towards the end of the second semester of the Senior Sophister year. 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	
Assessment Details[24] Please include the following: • **Assessment Component** • **Assessment description**	

Assessment Component	**Assessment Description**	**LO Addressed**	**% of total**	**Week due**
Continuous Assessment 1	Interim report		5%	22 Feb 2027

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• **Learning Outcome(s) addressed** • **% of total** • **Assessment due date**	Continuous Assessment 2	Oral presentation		5%	7 April 2027
	Continuous Assessment 3	Full dissertation		90%	9 April 2027
	In addition, the students are required to attend Oral presentation.				
Reassessment Requirements					
Contact Hours and Indicative Student Workload[2]	**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					
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.	**Admin contact:** Caroline Clabby – TR064 Course Administrator				
Academic Start Year	January 2027				
Academic Year of Date	2026-2027				

Semester 2 – Optional

****Please note the below module is subject to change for the 2026-2027 Academic Year.**

Module Code	BOU44103
Module Name	Plant Conservation and Biodiversity
ECTS Weighting[25]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	TBC
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: • Identify key processes that lead to the development of higher plant diversity. • Explain how patterns of plant diversity have arisen. • Assemble, manipulate and critically analyse experimental data related to plant diversity. • Describe the processes that threaten plant diversity and evaluate the degree of threat. • Evaluate national legislation and policy related to plant diversity and its conservation. • Evaluate global and national initiatives to conserve plant diversity.
Module Content	Loss of biodiversity is one of the major problems facing humanity. The theoretical background to the evolution of plant diversity is firstly developed, and the principles of conservation are then used to develop approaches to conserve plant diversity. The module is taught through lectures and practical workshops.
Teaching and Learning Methods	

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Assessment Details[26]
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	Coursework		50%	
Examination	Written examination		50%	

Reassessment Requirements

Contact Hours and Indicative Student Workload[2]

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

Recommended Reading List

- Lomolino, M.V., Riddle, B.R. & Whittaker, R.J(2016). *Biogeography: Biological diversity across space and time.* Sinaur Associates.759pp.
- Sher, A.A. & Primack, R.B. (2019) *An Introduction to Conservation Biology*. Oxford University Press. 512 pp

Module Pre-requisite N/A

Module Co-requisite N/A

Module Website Blackboard Ultra

Are other Schools/Departments School of Natural Sciences, Botany

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involved in the delivery of this module? If yes, please provide details.	**Admin contact:** Caroline Clabby – TR064 Course Administrator Fiona Moloney – Undergraduate Administrative Coordinator, Botany
Academic Start Year	January 2027
Academic Year of Date	2026-2027

Module Code	BOU44110
Module Name	The Evolution of Plants and Plant-Atmosphere Interaction
ECTS Weighting[27]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Prof. Jennifer McElwain
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 describe plant evolution over the past 3,700 million years (with specific emphasis on land plant evolution over the past 500 million years based on the fossil plant record) • To evaluate fossil plant responses to environmental extremes associated with mass extinction events in Earth history • To describe how plant evolution influences the long-term carbon cycle, climate and atmospheric composition • To understand global, regional, local and individual level plant responses to past changes in climate and atmospheric composition • To use knowledge of plant-atmosphere responses in the deep geological past to evaluate the threat of ongoing anthropogenic global change
Module Content	We are currently experiencing major changes in our climatic and atmospheric environment. Conservative estimates project that the concentration of greenhouse gas carbon dioxide will double by the end of this century, and global temperatures are expected to rise by between 1- and 4-degrees C. A major issue facing the scientific and political community is understanding how these projected changes will influence natural ecosystems, plant and animal ecology and biodiversity. This module will explore the evolution of plants in the context of long-term changes in

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climate and atmospheric composition. Examples of plant-atmosphere and plant-climate interactions in the deep geological past will be the main focus of this module The course will provide a framework for understanding the nature and scale of evolution, adaptation and ecophysiological responses of plants to their atmospheric and climatic environment over the past 500 million years of Earth history.

Part 1 of this course lays the foundations for examining the evolution of plants and biosphere-atmosphere interactions over the past 450 million years of Earth history. We will examine different modes of plant fossil preservation from compression fossils to mummifications. Through your readings and lectures you will gain an understanding of the biases associated with the fossil record of plants and how paleobotanists address these uncertainties in their research. We will also explore the first 3 billion years of Earth history and life on the planet highlighting key events and biotic innovations that were important pre-requisites to the later evolution of complex multicellular land plants.

Part 2 of the course focuses on plant evolutionary events and critical biosphere-atmosphere interactions in the Paleozoic Era between 541 and 252 million years ago. Part 2 covers topics such as the evolution of land plants (embryophytes) and their conquest of the land, the emergence of the first forests with examples from famous Irish fossil forest localities, the evolution of the seed, leaf, roots and arborescence (woodiness). We examine fossil plant-based evidence for glacial-interglacial climate change during the Carboniferous period and the impact of atmospheric and climate change on plant diversity and extinction.

Part 3 of this course examines the rise of seed plants under a climate that is becoming increasingly arid from the Late Permian. There is a marked evolutionary transition in paleofloras between the Carboniferous and the Permian from 'Paleophytic' to 'Mesophytic'. We will explore how the paleoecology of Earth's vegetation changed over this time period by examining shifts in the geographic distributions of floras (paleo-biomes). The functioning of past ecosystems will be introduced through novel studies on fossil plant paleo-functional traits. Plant-climate and plant-atmosphere interactions will be studied across the Permian-Triassic and Triassic-Jurassic mass extinction events.

Part 4 of the course examines the Angiosperm Terrestrial Revolution - the origin and diversification of angiosperms (flowering plants), the most diverse extant plant group, the Cretaceous-Tertiary mass extinction events and the rise of our modern flora. The time period of study includes the past 145 million years (Cretaceous and Cenozoic). The role of atmospheric and climate change in major evolutionary innovations and ecological turnovers during this time period will be explored including the origin of modern neotropical rainforests, the origin and diversification of grasses and grass dominated ecosystems globally and the origin of C4 and CAM photosynthetic syndromes.

Teaching and Learning Methods	
Assessment Details[28] 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	Continual assessment will be through a programme of tutorials/debates and student reviews of primary research papers linked to lectures.		30%	
Examination	Written examination		70%	End of semester

Reassessment Requirements	
Contact Hours and Indicative Student Workload[2]	**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	N/A
Module Co-requisite	N/A
Module Website	Blackboard Ultra

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Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Natural Sciences, Botany **Admin contact:** Caroline Clabby – TR064 Course Administrator Fiona Moloney – Undergraduate Administrative Coordinator, Botany
Academic Start Year	January 2027
Academic Year of Date	2026-2027

Module Code	CEU44A01
Module Name	Civil Engineering Materials
ECTS Weighting[29]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Prof. Sara Pavia
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. Understand and practice the use and application of low carbon cement made with waste to lower carbon emissions. ○ LO2. Understand and practice the properties and application of geopolymers and supplementary cementitious materials to lower carbon emissions. ○ LO3. Select quality building material, compatible with existing fabrics and responsible towards the environment. ○ LO4. Identify and solve problems relating to the environmental impact and durability of building materials in construction. ○ LO5. Select the most appropriate materials needed to solve a problem or perform a function. ○ LO6. Critically interpret the results of engineering testing and scientific analysis of building materials. ○ LO7. Categorise non-structural cracking and corrosion phenomena in concrete and plan for their minimization or avoidance. ○ LO8. Develop a regime for investigation of materials problems and deterioration.

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	○ LO9. Interpret and effectively communicate the results of research and laboratory experimentation. ○ LO10. Practice high professional standards in relation to sustainable materials. ○ LO11. Practice high ethical standards concerning the selection of low-carbon, sustainable materials for construction. **Graduate Attributes: levels of attainment** To act responsibly – LO 11, 8, 3,1. To think independently – LO 7, 6, 5,2, 1. To develop continuously – LO 10, 4, 1. To communicate effectively – LO 9, 3,1.
Module Content	The module provides the student with essential knowledge on the properties, use, deterioration and repair of some of the most important materials used for building including stone and ceramic brick, insulations Portland cement (PC) concrete, lime and PC mortar, metal and timber. • Geopolymers and supplementary cementitious materials to lower the carbon emissions of construction. • Low carbon cements made with waste. Reactivity of silicate waste. Alkali activation. • Forensic engineering: analytical and survey techniques to diagnose problems and contamination. • Masonry mortars. Pozzolans. Repair mixes. • Durability, corrosion, cracking. Properties: strength, thermal and moisture movement. • Insulation materials: Lime-based renders, cork and hemp materials, aerogels and CSB. Thermal and hygric properties. Production and application. • Masonry. Historic masonry: properties and repair. Building limes. Testing. • Stone, clay brick/block. Composition and manufacturing technologies. Structural properties. Durability. • Timber: Cross Laminated Timber. Hardwoods and softwoods. Structural timber. Properties and durability.
Teaching and Learning Methods	Lectures, laboratories and site visits. The teaching strategy is a mixture of: • Lectures (27 hours), • laboratory practicals and site visits (12 hours), • research reports.

Assessment Details[30]
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	Four technical reports	LO8-LO11	20%	Week 10
Examination	2-hour written examination	LO1-LO7	80%	End of semester

Reassessment Requirements

Re-assessment, if needed, consists of 100% written examination (2 hours)

Contact Hours and Indicative Student Workload[2]

Contact hours: lectures 27 hours; laboratories and sites 12 hours
Independent Study (preparation for course and review of materials): 60 hours
Independent Study (preparation for assessment, incl. completion of written assessment): 30 hours

Recommended Reading List

- Download publications on cements, insulation etc. from: **https://www.tcd.ie/research/profiles/?profile=pavias**
- *Stone, Brick and Mortar*. S. Pavía and J. Bolton. (2000) Wordwell.
- *Permeability and Porosity of Hardened Concrete.* R. West. (1997). In: Concrete-an essential update. Module I: Essential characteristics of concrete. IEI and the Irish Concrete Society.
- *Thermal and Shrinkage Movements.* R. West. (1997). In: Concrete-an essential update. Module 2: Essentials of early age concrete. IEI and the Irish Concrete Society.

Module Pre-requisite

Basic knowledge on Chemistry / Materials

Module Co-requisite

N/A

Module Website

Blackboard Ultra

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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	CEU44A02
Module Name	Groundwater and Pollution Control
ECTS Weighting[31]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Dr. David O'Connell
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. 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

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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). **Module content** • Groundwater concepts [Asst. Prof. David O'Connell] o Aquifers, aquitards and aquicludes o Confined and unconfined aquifers o Aquifer properties • Groundwater flow [Asst. Prof. David O'Connell] o General flow equations o Methods of solution: flow nets, analytical solutions, numerical methods o Analytical solutions for regional flow in confined and unconfined aquifers o Radial flow to wells under steady state and transient conditions o Multiple wells: principle of superposition o Hydraulic boundary effects o Introduction to the use of distributed groundwater models • Groundwater exploration and development [Asst. Prof. David O'Connell] o Hydrogeological surveys o Geophysical techniques: resistivity, EM, seismic refraction o Exploratory drilling methods o Formation sampling and geophysical logging o Introduction to well design • Groundwater Organic Chemical Pollution [Asst. Prof David O'Connell] o Basic principles of organic chemistry, properties and phase transition o Vadose zone contaminant processes o Dissolution of NAPL source zones o Groundwater Organic Contaminant monitoring and pollution o Abiotic Organic Chemical Reactions o In-situ Groundwater Remediation Techniques o 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 Details[32] 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	LO1-4	100%	End of semester

Reassessment Requirements	Re-assessment, if needed, consists of 100% written examination
Contact Hours and Indicative Student Workload[2]	**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

[32] TEP Guidelines on Workload and Assessment

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. Misstear, 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.
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	CEU44E06
Module Name	Water Resource Planning and Climate Change
ECTS Weighting[33]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Prof. David O'Connell

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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 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 Details[34]
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 Workload[2]

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 Misstear 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

Module Pre-requisite

No specific pre-requisite, but previous engineering hydrology module helpful.

Module Co-requisite

N/A

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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	GGU44977
Module Name	Environmental Governance 2
ECTS Weighting[35]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Dr. Rory Rowan
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module students will be able to: • Understand and apply key theoretical concepts from the field of political ecology to contemporary environmental debates and issues; • Identify and critically discuss key sites of environmental contestation in Ireland today; • Explain why an in-depth understanding of environmental problems today requires an understanding of the political, economic and social contexts out of which they emerge and within which they are managed

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Module Content	There is little disagreement that far-reaching societal, technological, political, and economic transformations are required if we are to avoid the worst effects of global, anthropogenic environmental change. What form these transformations should take and who should take responsibility for them are, however, far from settled. This module considers some of the key conceptual debates and environmental conflicts arising in this context. Examination of these debates and conflicts will demonstrate the contested and uneven nature of environmental change and the measures sought to address these changes. The overall aim of the module is to help students develop a more nuanced, critical and multi-disciplinary understanding of environmental change and the different, often contested, ways of responding to such changes. The module will consist of weekly interactive lectures/seminars and set readings. Lectures will introduce students to key concepts and perspectives drawn from the broad field of political ecology. In this module students develop a semester-long research project focused on a key area of environmental contestation in Ireland through a political ecology lens. The projects will involve group work and individual work, written assignments, oral presentations, and primary research. Class attendance is essential.
Teaching and Learning Methods	
Assessment Details[36] 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	Coursework		100%	

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Reassessment Requirements	Re-assessment, if needed, consists of
Contact Hours and Indicative Student Workload[2]	**Contact hours**: Lectures = 20hrs **Independent Study (preparation for course and review of materials):** Lecture preparation = 60hrs; Reading = 60hrs **Independent Study (preparation for assessment, incl. completion of written assessment):** Assessment Preparation = 110 hrs
Recommended Reading List	• Bresnihan, P. & Milner, N. (2024) A*ll We Want is the Earth: Land, Labour and Movements Beyond Environmentalism*. Bristol: Bristol University Press. • Castree, N. & Braun, B. (2001) *Social nature theory, practice, and politics*. London: John Wiley & Sons. • Kaika, M. (2005) C*ity of Flows: Modernity, Nature, and the City.* London: Routledge. • Patel, R. & Moore, J. (2017) *A History of the World in Seven Cheap Things: A Guide to Capitalism, Nature, and the Future of the Planet*. Berkley, CA: University of California Press. • Robbins, P. (2012) *Political Ecology: a Critical Introduction* (2nd edition). London: Wiley.
Module Pre-requisite	GGU33931 Environmental Governance 1
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 – Geography Department **Admin contact:** Caroline Clabby – TR064 Course Administrator TBC – Executive Officer, Geography
Academic Start Year	January 2027
Academic Year of Date	2026-2027

Module Code	GGU44979
Module Name	Living on the Edge: Estuaries and Coasts
ECTS Weighting[37]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Prof. Iris Moeller
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module students will be able to: • Explain the theory behind estuarine and coastal morphodynamics. • Draw on specific examples to illustrate the societal importance of coastal morphodynamics in the context of human use of the coast. • Critically reflect on the importance of considering different temporal and spatial scales for an understanding of coastal change. • Discuss the key impacts of climate change on coastal landforms and ecosystems. • Carry out basic (bio)geomorphological assessments of estuarine and coastal landforms and associated ecosystems. • Assist the development of coastal management approaches that consider societal and biophysical aspects of how coasts and estuaries function and deliver ecosystem services. • Clearly and concisely present the results of their work in written and oral (presentation) form.
Module Content	Coastal regions are some of the most dynamic on Earth, not least because human and natural processes act in tight connection to each other. This dynamism poses one of the great societal challenges of the 21st Century: as coastal populations are increasing at three times the global rate, they are also experiencing an increasing threat of coastal flooding and erosion under climatic extremes (e.g. tropical and extratropical storm surges) and are 'locked into' accelerated sea level rise for centuries to come. Building upon a basic, foundational knowledge of ocean and coastal processes covered in relevant modules within the first and second year ('Spaceship Earth' and 'Physical Geography: Dynamic Earth'), students will gain wide ranging theoretical and practical skills required to address those challenges. The lectures and seminars take students on a journey that highlights how the natural processes operating within estuaries and on coasts are a function of external factors (past and present climate, geology, human influences) and feedbacks in which the landforms themselves affect the operation of processes

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	that shape the landforms. Equipped with this knowledge, and several examples from around the world, students will put their knowledge into practice. A day-field trip (please note this will take place during Study Week) and practical exercise will challenge students to apply what they have learnt to real-world coastal management problems. Working in groups, they will form 'coastal management consortia' that will navigate their way through the stages of problem definition to data acquisition and development of appropriate coastal management solutions. The assessed practical exercise will develop and enhance team-working, independent research, critical thinking, scientific and applied writing, and presentation skills.
Teaching and Learning Methods	***** NOTE: There will be a one-day field visit to the coast near Dublin in Study Week *****
Assessment Details[38] 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	Lecture content, course and tutorial reading		20%	
Continuous Assessment 2	Case study report		80%	

Reassessment Requirements	
Contact Hours and Indicative Student Workload[2]	**Contact hours**: 34 hours (Lectures = 16 hours, 2 x tutorials, field excursion (optional), lab practicals and student workshops/presentations)

[38] TEP Guidelines on Workload and Assessment

	Independent Study (preparation for course and review of materials): Lecture Preparation = 60hrs **Independent Study (preparation for assessment, incl. completion of written assessment):** Coursework preparation = 85hrs; examination preparation = 85 hours
Recommended Reading List	• Woodroffe, C.D. (2002) *Coasts: Form, process and evolution*. Cambridge: Cambridge University Press. • Masselink, G, Hughes, M., & Knight, J. (2011) *Introduction to Coastal Processes and Geomorphology*. London: Routledge.
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 – Geography Department **Admin contact:** Caroline Clabby – TR064 Course Administrator TBC – Executive Officer, Geography
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.

Laboratory timetables for Engineering modules will be forwarded to students via email and posted on the School of Engineering website.

My TCD

Year Four - Engineering | Trinity College Dublin

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 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.

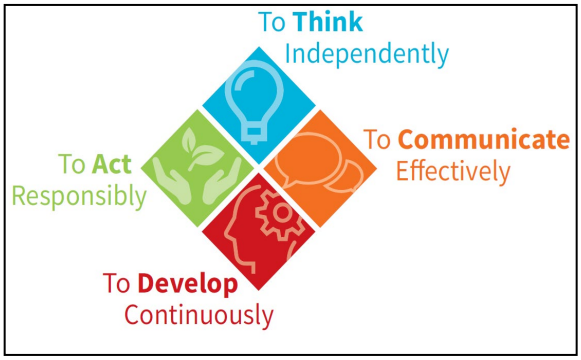
IMPORTANT NOTE: If any additional restrictions on the use of Generative Artificial Intelligence (GenAI) apply to a particular module, these will be stated in the module description on Blackboard or communicated to students by module coordinators.

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?

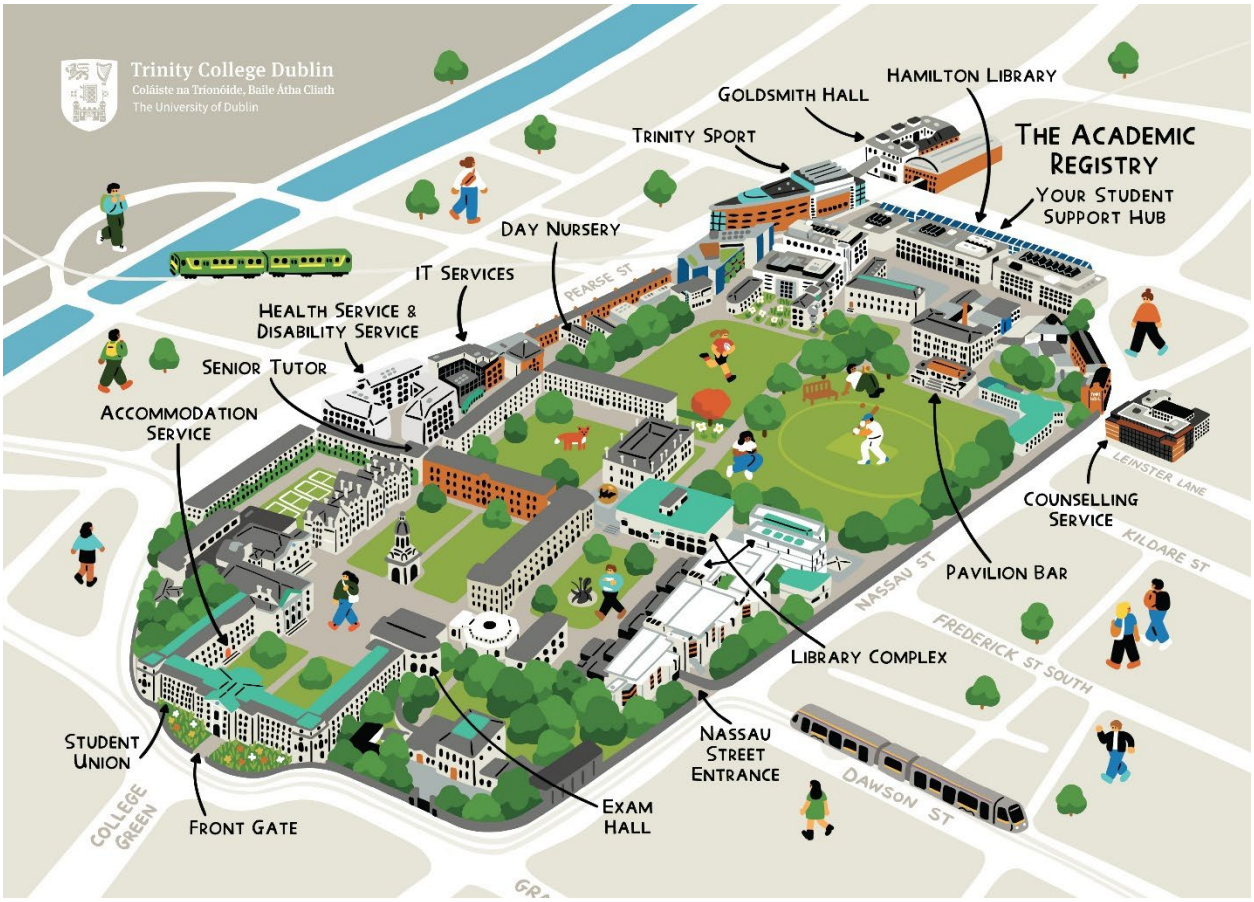
Many of the Graduate Attributes are 'slow learned', in other words, you will develop them over the four or five years of your programme of study.

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 is 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 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
ZOU44092 Dr. John Rochford, Zoology Professor Paula Murphy, Zoology	John.Rochford@tcd.ie paula.murphy@tcd.ie
ZOU44030 Professor Andrew Jackson, Zoology Dr. Thomas Connor, Zoology	a.jackson@tcd.ie connorth@tcd.ie
CEU44A31 Professor Laurence Gill, Civil Struct & Env. Eng.	laurence.gill@tcd.ie

ESU44002 Dr. Patrick Morrissey, Civil Struct & Env. Eng.	morrisp5@tcd.ie
ESU44003 Dr. Silvia Caldararu, Botany	CALDARAS@tcd.ie
ESU44004 Dr. Muhammad Ali, Civil Struct & Env. Eng.	Muhammad.ali@tcd.ie
BOU44108 Dr. Matthew Saunders, Botany	saundem@tcd.ie
CEU44A16 Professor Brian Caulfield, Civil Struct & Env. Eng.	brian.caulfield@tcd.ie
CEU44A15 Dr. Barnaby Dobson, Civil Struct & Env. Eng.	liwen.xiao@tcd.ie
EEU33C01 Professor Nicola Marchetti, Electronic & Elect. Engineering	marchetn@tcd.ie
ZOU44021 Professor Ian Donohue, Zoology	ian.donohue@tcd.ie
BOU44111 Dr. Marcus Collier, Botany	colliema@tcd.ie
CEU44A01 Professor Sara Pavia, Civil Struct & Env. Eng.	pavias@tcd.ie
CEU44A02 Dr. David O'Connell, Civil Struct & Env. Eng.	DAVID.OCONNELL@tcd.ie
CEU44E06 Dr. David O'Connell, Civil Struct & Env. Eng.	DAVID.OCONNELL@tcd.ie
BOU44103 TBC	
BOU44110 Professor Jennifer McElwain, Botany	jmcelwai@tcd.ie
GGU44977 Dr. Rory Rowan, Geography	rowanro@tcd.ie
GGU44979 Professor Iris Moeller, Geography	moelleri@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
Fiona Moloney **Undergraduate Administrative Coordinator**	School of Natural Sciences	FIMOLONY@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
TBC **Executive Officer Botany**	School of Natural Sciences	ZOBOES@tcd.ie
TBC **Executive Officer, Geology**	School of Natural Sciences	EARTH@tcd.ie
TBC **Executive Officer, Geography**	School of Natural Sciences	Geography@tcd.ie
Celine Egan **Executive Officer, Zoology**	School of Natural Sciences	ZOBOES@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	Calendar, Part II, General Regulations and Information,Section II, Item 12 Calendar, Part III, GeneralRegulations, Section I
Student Supports Co-curricular activities TCDSU, GSU & student representationstructures	Student Supports
Emergency Procedures	**Standard Text:** In the event of anemergency, **dial Security Serviceson 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 alwaystelephone 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 studentssave at least one emergency contact in their phone under ICE (In Case of Emergency).
Data Protection	Data Protection for StudentData
Research Ethics	Policy on Good ResearchPractice

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	Blackboard Academic Registry

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

Timetable for students	My TCD
Internships/ Placements forCredit	Internship and PlacementPolicy.
Programme Architecture	Trinity Education ProgrammeArchitecture and Pathways
Item	**Reference/Source**
Marking Scale	Calendar, Part B, General Regulations and Information
Progression Regulations	Calendar, Part II, General Regulations & Information Calendar, Part II, Part C Calendar, Part III, Section III 'Examinations, Assessment and Progression' and 'Assessment and ProgressionRegulations'
Awards	National Framework forQualifications Trinity PathwaysTrinity Courses
Professional and Statutory Body Accreditation	Provided by School/Discipline Handbooks where applicable
Careers Information &events	https://www.tcd.ie/Science/careers/
External Examiner	Procedure for the transfer ofstudents assessed work to external examiners
Capstone (UG Programmes)	Capstone website Policy on Good ResearchPractice
Attendance Requirements	Calendar, Part B, General Regulations and Information 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'
Feedback andEvaluation	Student Evaluation andFeedback Student Partnership Policy Procedure for the conduct ofFocus Groups