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

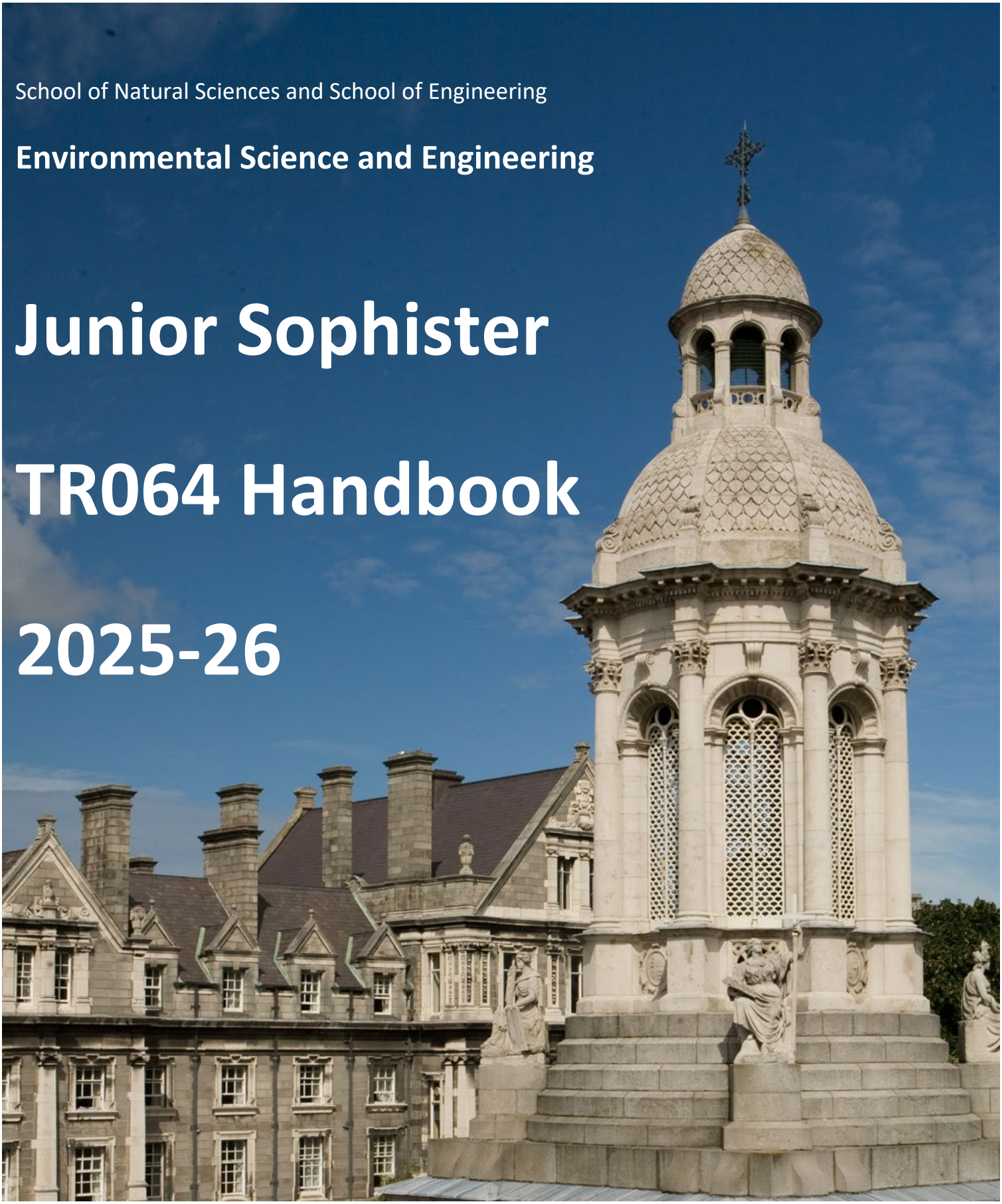
School of Natural Sciences and School of Engineering

Environmental Science and Engineering

Junior Sophister

TR064 Handbook

2025-26



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Welcome

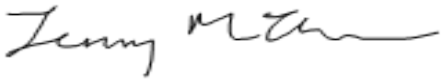
Congratulations to you all for completing the Freshman years of the Environmental Science and Engineering Programme and on your successful progression to Sophister years where you will be able to choose modules offering an increasing level of specialism. You will continue to have small cohort dedicated modules for the Environmental Science and Engineering Programme in Process Engineering, Sustainable Energy Cycle and Team Design. These will be complemented by compulsory modules taught through the Schools of Engineering and Natural Sciences on topics such as soil science, environmental monitoring, hydrology and groundwater quality, experimental design and analysis and surveying and geospatial analysis. This year you will also have the opportunity in the first semester to take a "Trinity Elective" of your choice from across a wide range of subject areas taught across different schools in Trinity College. Again, we encourage you to think broadly in your choice of elective and to be adventurous. You will also need to select 3 optional modules (one for the first semester and two for the second semester) from a wide suite of other relevant subjects taught by the Schools of Natural Sciences and Engineering at Junior Sophister level (see Module descriptors later).

The two 'sophister' years offer increasing specialisation in either Applied Environmental Science or Environmental Engineering. Admission to the Master's level is subject to performance in the Junior Sophister and Senior Sophister years. 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. These skills are crucial in promoting an approach to lifelong learning, particularly important in today's dynamic world. The curriculum is revised on an ongoing basis and we hope that you will find it stimulating and intellectually rewarding. You will be given the opportunity to provide us with considered feedback of your experience during each year of your studies.

Remember, the College has a great deal to offer besides the formal academic programme, including the cultural, recreational and sporting activities of the many student clubs and societies. You are strongly encouraged to participate in the breadth of College life in a balanced way. In Semester 1 this year you will have an opportunity to apply for study abroad options including International Exchange, ERASMUS and UNITECH in Semester 2 of the Senior Sophister year. This is a great opportunity for you to broaden your education and experience of other cultures and universities. Further details and deadlines can be found later in the handbook.

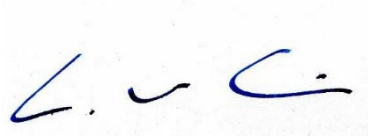
Finally, be aware that College offers a wide range of support services. If you are experiencing problems or need to seek advice (personal, financial, health, career or academic), there are a number of sources of help available: these are listed later in this booklet. Do not hesitate to call on these 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 third year at University.

Professor Jennifer McElwain



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.

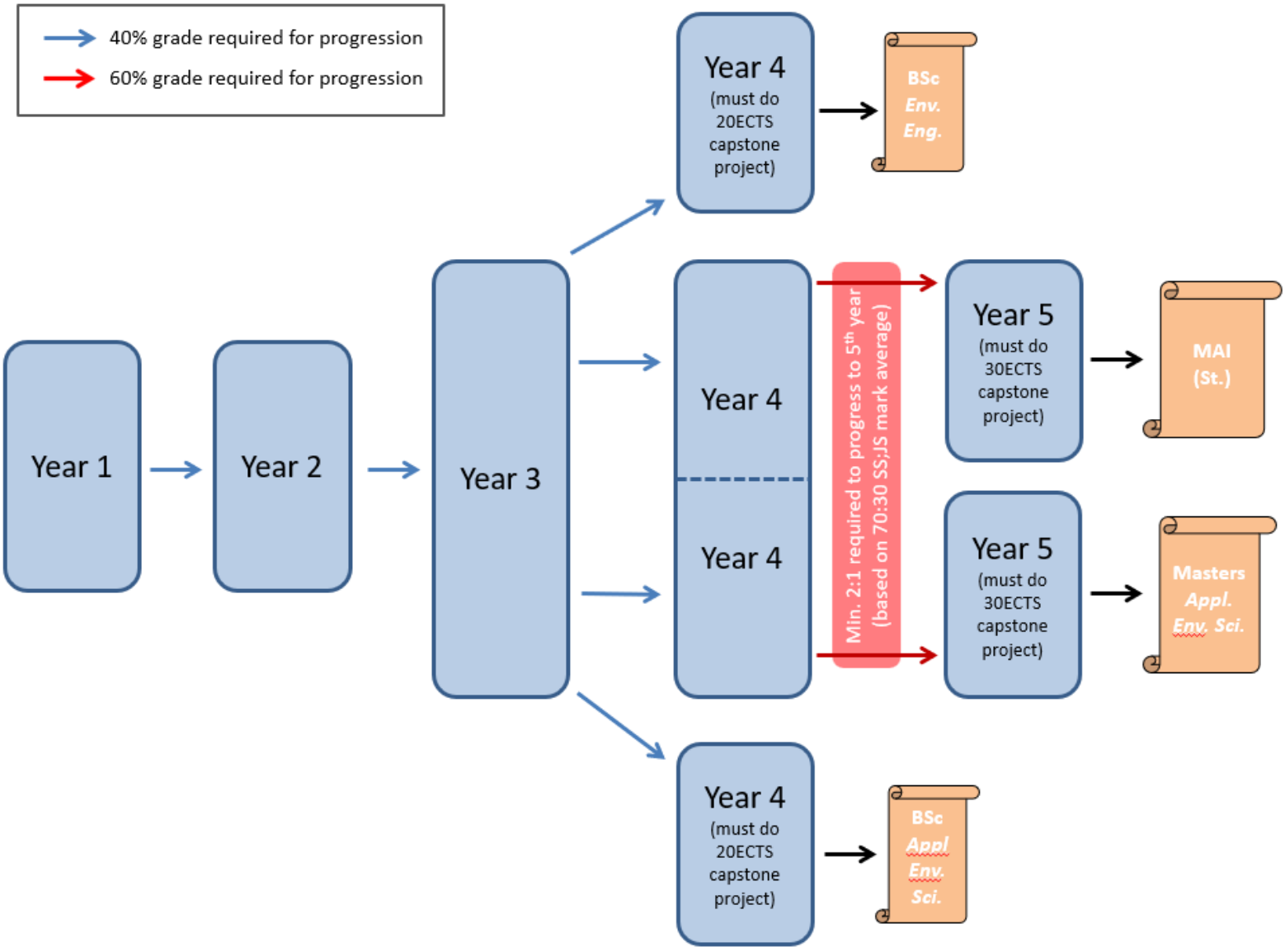
CLO4. Work effectively as an individual, in teams and in multi-disciplinary settings.

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 5ECTS 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

Trinity Electives

The Trinity Electives are a unique feature of your Trinity Education. They are stand alone, College-wide 5 credit modules. They cover a broad range of topics in the arts, humanities, sciences, health and social science, and technology. They are designed to allow students to study topics outside of their core discipline and thus provide breadth in their education. Environmental Sciences and Engineering students will take one two Trinity Electives in the course of their studies: one in Semester 2 of Year 2 (Senior Freshman) and one in Semester 1 of Year 3 (Junior Sophister).

Choosing your Trinity Elective

The choice of Trinity Elective is student driven. Almost all Trinity Electives are open to all students. However, students of some moderatorships may be precluded from taking certain Trinity Electives (e.g. the module 'From Planets to the Cosmos' is not available to TR063 Physical Sciences students, as this topic is part of their core discipline,). The list of exemptions is outlined in the Trinity Electives webpage: https://www.tcd.ie/trinity-electives/

Selection of Trinity Electives will be made through online enrolment which will open in July, after publication of examination results and allocation of moderatorship places. You will be asked to list your choice(s) of Trinity Elective on a first come first served basis via Online Module Enrolment.

The Trinity Electives website provides full details of each of the Trinity Electives. A list of the Trinity Electives can be found at https://www.tcd.ie/trinity-electives/

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.

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? - Study - Trinity College Dublin

How To Apply? - Study - Trinity College Dublin

Frequently Asked Questions - Engineering | Trinity College Dublin

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

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.S.c capstone project is taken in 4th year by those students on the 'B.s.c Environmental Engineering' or 'B.s.c Applied Environmental Science' tracks, while the Master's project is taken in 5th year by those on the 'MAI Environmental Engineering' or 'Master's in Applied Environmental Sciences'. Please note that the internship project will NOT in any circumstances be deemed equivalent to a capstone project. College regulations require that all students must complete a capstone project to be eligible to graduate. The type of research that you will do will depend on your programme of study.

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

The Capstone should:

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

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

Prizes, medals and other scholarships

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 honors 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 2025-26 here: academic-year-structure.pdf

Dates to note:

Event(s)	Date(s)
Semester one starts	**UG continuing years / PG all years:** Classes start 15-Sept-25
Semester one ends	Week 16 - 08-Dec-25 - Revision / Assessment* * Semester 1 assessment session: December 11 to 22, 2025 inclusive (No assessment after Dec 22nd)
Semester one assessment session	Week 17 and Week 18 – 15-Dec-25 to 24-Dec-25
Semester two starts	Week 22 19-Jan-26
Semester two ends	Week 34 - 13-Apr-26 - Revision
Semester two assessments session	Week 35 and Week 36 20-Apr-26 to 03-May-26
Publication of results	End of May 26 after the Court of Examiners
Reassessment Examinations	Week 53 24-Aug-26
Publication of Reassessment results	

Examination Information

Winter Assessment Period – Weeks 17 and 18 (contingency dates in Week 16)

Annual Assessment Period – Week 35 and week 34 (contingency dates in Week 34)

Reassessment Period – Week 53 (end of August)

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/

Modules and Module Descriptions

Module Selection – Junior Sophister (Year 3)

Core Modules

Semester 1	Semester 2
BOU33123 – Soil Science (5 ECTS)	GLU33009 – Hydrology and Groundwater Quality (5 ECTS)
ESU33040 – Environmental Monitoring (5 ECTS)	ZOU33070 – Exp. Design and Analysis (5 ECTS)
CEU33A13 – Process Engineering for Environmental Applications (5 ECTS)	CEU33A10 – Surveying and Geospatial Planning (5 ECTS)
CEU33A14 – Sustainable Energy (5 ECTS)	ESU33006 – Team Design: monitoring nature-based solutions (5 ECTS)
Trinity Elective (5 ECTS)	

Optional Modules

1 out of the 3 optional modules available must be modules associated with the student's chosen stream **Environmental Engineering** or **Applied Environmental Sciences**

Semester 1 – choose 1	Semester 2 – choose 2
ZOU33010 Fundamentals of Ecology (5 ECTS)	CEU33A11 Fluids and Environment (5 ECTS)
GSU33003 Ice Age Earth (5 ECTS)	GGU33931 Environmental Governance 1 (5 ECTS)
CEU33A05 Soil Mechanics (5 ECTS)	GGU33915 Globalisation and Geopolitics (5 ECTS)
GLU33002 Blue Earth: Understanding the Function of Marine Ecosystems (5 ECTS)	CEU33A08 Geology for Engineers (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 Module Coordinator	ECTS ICA/CW/FE	Term
Core BOU33123	Soil Science Matthew Saunders	5 50% CW 50% FE	Michaelmas
Core ESU33040	Environmental Monitoring Jay Piggott	5 100% CW	Michaelmas
Core CEU33A14	Sustainable Energy Mohammad Reza Ghaani	5 100% CW	Michaelmas
Core CEU33A13	Process Engineering for Environmental Applications Muhammad Ali	5 50% CW 50% FE	Michaelmas
	Trinity Elective 	5 100% CW	Michaelmas
Optional ZOU33010	Fundamentals of Ecology Ian Donohue	5 50% CW 50% FE	Michaelmas
Optional GSU33003	Ice Age Earth Robin Edwards	5 100% CW	Michaelmas
Optional CEU33A05	Soil Mechanics Brendan O'Kelly	5 80% FE 20% CA	Michaelmas

Optional GLU33002	Blue Earth: Understanding the Function of Marine Ecosystems	5	Michaelmas
	Carlos Rocha	100% CW	

ICA = In course Assessment – Formal Assessment in exam conditions

CW = Coursework

FE = Formal Examination in Annual Examination Period

Hilary Term

Module code	Module title Module Coordinator	ECTS ICA/CW/FE	Term
Core GLU33009	Hydrology and Groundwater Quality	5	Hilary
	Alex Cabral	50% CW 50% FE	
Core ZOU33070	Experimental Design and Analysis	5	Hilary
	Silvia Caldararu	100% CW	
Core CEU33A10	Surveying and Geospatial Planning	5	Hilary
	Julie Clarke	50% CW 50% FE	
Core ESU33006	Team Design: monitoring nature-based solutions	5	Hilary
	Peter Moonlight	100% CW	
Optional CEU33A11	Fluids and Environment	5	Hilary
	Aonghus Mc Nabola	60% FE 40% CW	

Optional GGU33931	Environmental Governance 1 Rory Rowan	5 100% CW	Hilary
Optional GGU33915	Globalisation and Geopolitics Padraig Carmody	5 50% CW 50% FE	Hilary
Optional CEU33A08	Geology for Engineers Sara Pavia	5 100% FE	Hilary

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	BOU33123
Module Name	Soil Science
ECTS Weighting[1]	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: • Describe the nature of soil and the terms used to describe the major physical and chemical characteristics of soil. • Understand how soils are formed and how they are influenced by natural and anthropogenic processes. • Compare and contrast the role of soils in plant productivity such as through plant water relations and mineral nutrition. • Appraise the issues of sustainable soil management and the impacts of intensive land use on soil quality and fertility. • Demonstrate an understanding of biogeochemical cycling within soil systems and the role of soils in the mitigation of climate change.
Module Content	Soils are important for plants as they provide the key resources required for growth and also essential structural support. This module will provide an overview of the fundamental concepts of soil formation and characterisation; how soil characteristics influence plant distribution and productivity through water and nutrient availability; how soil organisms (bacteria, fungi) interact with plants and how soils influence global biogeochemical cycles (carbon and nitrogen). Particular focus will be given to the role

[1] TEP Glossary

	of soils in the production of food, fuel and fibre and how sustainable land management practices are required to ensure the long-term health and fertility of soil systems.
Teaching and Learning Methods	
Assessment Details[2] Please include the following: • **Assessment Component** • **Assessment description** • **Learning Outcome(s) addressed** • **% of total** • **Assessment due date**	

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Continuous Assessment	Coursework		50%	
Examination	Written examination 1.5 hours		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):

[2] TEP Guidelines on Workload and Assessment

Recommended Reading List	Indicative Reading: Foth, HD. (1990). Fundamentals of soil science. Wiley, Chichester. Hartlemink, AE., McBratney, AB., White, RE. (Eds) (2009). Soil Science, Earthscan, London. Lal, R. (2006). Encyclopedia of soil science. Taylor and Francis. Oxford. McLaren, RG., Cameron, KC. (1996). Soil science: sustainable production and environmental protection. Oxford University Press, Oxford. Weil, RR., Brady, NC. (2016). The nature and properties of soil. Pearson, London. White, RE. (2006). Principles and practice of soil science: the soil as a natural resource. Blackwell Science, Oxford.
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:** Julie Boustie – TR064 Course Administrator Lou Bondehemier – Executive Officer, Botany
Academic Year of Date	2024/2025

Module Code	CEU33A13
Module Name	Process Engineering for Environmental Applications
ECTS Weighting[3]	5 ECTS

[3] TEP Glossary

Semester taught	Semester 1
Module Coordinator/s	Dr Muhammad Ali Dr Patrick Morrissey
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	LO1: Create conceptual models of reactor-based solutions for environmental engineering processes. LO2: Apply mass-balance principles to simulate process dynamics in engineered systems. LO3: Demonstrate a thorough understanding of reaction kinetics and how to use them in natural and engineered systems. LO4: Calculate the reactor size and dimensions needed to treat a flow of contaminated water accurately. LO5: Develop water quality reactor models for natural processes, such as eutrophication and nitrification, with a focus on improving water quality. LO6: Develop reactor models for wastewater treatment processes to improve the quality of effluent discharged into the environment. LO7: Explain the various conceptual flow paths that can be achieved by different combinations and types of reactors in series and/or parallel. LO8: Identity, formulate and analyse different types of flow regimes that can occur within chemical/process engineering systems, considering their effect on reactor performance. LO9: Apply the concepts of physicochemical processes to natural and engineered systems to solve problems in environmental engineering. LO10: Interpret residence time distribution (tracer study) data to determine the degree of mixing in a reactor combination accurately.

Module Content	This module aims to develop the students' comprehension of the relevance and usefulness of biological/physico/chemical processes in both natural and engineered water-based systems. Through this module, students will learn how to develop conceptual models and devise numerical solutions to solve typical environmental engineering/science problems. The principles taught in this class have extensive applications in various fields beyond environmental engineering. Therefore, the focus will be on fundamental concepts, stimulating students' critical thinking, promoting discussions, and nurturing creativity to apply these concepts in a wide range of settings. **Introduction; Reactor Types, Mass Balances; Reaction Kinetics;** - Reactor Types; Batch Reactor, Continuously Stirred Tank Reactors (CSTR), Plug Flow Reactor (PFR) - Modelling ideal batch, CSTR, and PFR systems at Stead-state - Kinetics of reactions; Reaction order; Concentration dependent; Temperature dependent; Microbial (substrate limited) **Flow patterns** - Basics of non-ideal flow - Residence Time Distributions (RTD), Convection - Dispersion Model: Axial dispersion, Correlations, Chemical reaction & dispersion - Compartment Models - Tanks-in-series model: Pulse response & RTD, Chemical conversion - Convection model: Convection model & RTD, Chemical conversion in laminar flow reactors - Self-mixing of a single fluid, mixing of two miscible fluids **Biological processes for Environmental Applications** - Oxidation fundamentals - Aeration tank design, sizing and dimensioning - Anaerobic treatment and design **Physical processes for Environmental Applications** - Screening, Grit removal - Solid: Liquid Separation Process

- Gravity-Based Separation; Coagulation, Flocculation, Sedimentation, Sand Filtration
- Membrane Filtration
- Adsorption

Chemical processes for Environmental Applications

- Disinfection/Chlorination
- Ion Exchange

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 1	Multiple choice test		15%	
Continuous Assessment 2	Laboratories		15%	
Continuous Assessment 3	Design of a treatment system		20%	
Examination	Written Examination 3h exam		50%	End of semester

Reassessment Requirements

Contact Hours and Indicative Student Workload[2]

Contact hours:

[4] TEP Guidelines on Workload and Assessment

	Independent Study (preparation for course and review of materials): **Independent Study (preparation for assessment, incl. completion of written assessment):**
Recommended Reading List	Unit Operations and Processes in Environmental Engineering - Reynolds & Richards [CL Engineering] Wastewater Engineering – Metcalf & Eddy [McGraw-Hill] Water Quality Modelling – Steven Chapra [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 School of Natural Sciences **Admin contact:** Julie Boustie – TR064 Course Administrator
Academic Year of Date	2024/2025

Module Code	CEU33A14
Module Name	Sustainable Energy
ECTS Weighting[5]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Dr. Mohammad Reza Ghaani; Dr. Sarah McCormack

[5] TEP Glossary

Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	LO1. Evaluate and discuss the principle technologies that may be applied to conserve energy in buildings/ industry and transport. LO2. Explain the different methods of storing mechanical, electrical, chemical, nuclear, and thermal energy LO3. Evaluate the economic and energy performance of sustainable energy installations LO4. Compare the various energy forms and sources available on the market today LO5. Undertake a Life Cycle Assessment (LCA) which captures embodied and operational carbon and resource burdens in the context of sustainability and the circular economy
Module Content	This module will introduce concepts of energy management and efficiency as well as sustainable energy generation. Energy demand will be detailed sectorally in terms of energy in buildings; transport, agriculture and industry as well as measures for energy reduction and energy efficiency. Introductory lectures on energy generation and conversion will be given followed by topics in renewable energy generation. Renewable energy technologies will include lectures on wind, wave, tidal, biomass, biofuels, geothermal, hydro, solar, waste to energy. Low carbon technologies will be addressed such as nuclear energy, hydrogen, fuel cells. Grid integration and energy storage will be detailed. The future of fossils including clean coal and carbon capture and storage will be discussed.
Teaching and Learning Methods	
Assessment Details[6]	

[6] TEP Guidelines on Workload and Assessment

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	Feasibility of energy efficiency application		20%	
	Continuous Assessment 2	Individual Report - Technoeconomic Analysis of Energy Conservation implementation		25%	
	Continuous Assessment 3	Individual Report - Site visit report and calculations		25%	
	Continuous Assessment 4	Presentation of Group Report - Software Based Assignment		30%	
Reassessment Requirements	Re-assessment, if needed, consists of 100% Reassessment Project				
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	Sustainable energy systems engineering; P Gevorkian (2007)				
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 School of Natural Science Admin contact: Julie Boustie – TR064 Course Administrator				
Academic Year of Date	2024/2025				

Module Code	ESU33040
Module Name	Environmental Monitoring
ECTS Weighting[7]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Professor Jeremy Piggott
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module you will be able to: • Explain the tools and sampling approaches used to characterize and monitor the quality of the environment • Select appropriate procedures for the collection and analysis of environmental samples (chemical and biological samples) • Carry out a range of analysis procedures in the field and laboratory • Present and interpret results of chemical/biological analyses and application to relevant environmental quality indices
Module Content	This module covers the tools and sampling approaches, both traditional and novel, used to characterize and monitor the quality of the environment across Europe. Students will be provided with relevant background information to understand the principles and applications of monitoring programmes. Techniques taught encompass the collection and analysis of chemical and biological samples and their application to environmental quality indices. Students will have the opportunity to apply some of these techniques during two field trips (freshwater and marine) and to a range of sample types (water, sediment, invertebrates) in subsequent laboratory sessions. Field trips will conclude with a written report, detailing student's findings in a scientific format.

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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		100%	

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

[8] 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, Environmental Sciences **Admin contact:** Julie Boustie – TR064 Course Administrator Lou Bondehemier – Executive Officer, Environmental Sciences
Academic Year of Date	2024/2025

Semester 1 – Optional

Module Code	CEU33A05
Module Name	Soil Mechanics
ECTS Weighting[9]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Associate Professor Brendan O'Kelly
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. Explain the significant aspects considered when describing and classifying soils. LO2. Analyse the compaction characteristics of a soil to assess its suitability as engineering fill. LO3. Explain the concept of effective stress and its relationship with shear strength. LO4. Explain the methods of shear strength and permeability measurement for soils. LO5. Estimate the total head, pore-water pressures and discharges expected in a variety of engineering design situations. LO6. Estimate the capacity of soil deposits to support shallow foundations. LO7. Estimate the stresses induced in the ground and resulting settlements based on elastic analysis. LO8. Estimate the stability of earth slopes for the undrained condition.

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	LO9. Develop a site investigation strategy pertinent to a range of ground engineering works. **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Enhanced
Module Content	The Soil Mechanics module provides students with a basic knowledge of fundamental concepts of soil behaviour, and gives an introduction into general geotechnical engineering. The module describes the relationship between soils and their geological origin, and demonstrates the significance of the soil's particle-size distribution and mineralogy on its engineering behaviour. Soil description and classification methods are covered. The effects of the compaction process on the engineering properties of soil are discussed, and methods are developed to allow students to design engineering fills. The module explains the principles involved in the flow of water through soils, including methods of analyses and measurement. The important concept of effective stress is described, and examples of its significance in geotechnical engineering are developed. The module discusses the shear strength of soils, its measurement, and presents methods for applying this knowledge in the analysis of the short- and long-term bearing capacities for shallow foundations. The module presents methods of elastic analyses for predicting the in-situ stresses induced by applied surface loading, and the resulting settlements. Methods for analysing the short-term stability of soil slopes are presented. Ground investigation and in-situ testing techniques are described for use in the development of ground models, and the determination/interpretation of relevant soil parameter values for geotechnical design. Module content • Description and classification of soils • Compaction fundamentals and technology

	• Effective-stress concept and calculation examples • Seepage theory and measurement • Shear strength fundamentals and measurement • Bearing capacity of shallow foundations • In-situ stress and settlement calculation using elastic theory • Slope stability for the undrained condition • Ground investigation and in-situ testing
Teaching and Learning Methods	Lectures, and three laboratory practical experiments
Assessment Details[10] 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	Laboratory practicals (3) attend laboratory practical sessions and produce reports		20%	
Examination	Two-hour written examination	LO1–LO9	80%	End of semester

Reassessment Requirements	Re-assessment, if needed, consists of 100% written examination
Contact Hours and Indicative Student Workload[2]	**Contact hours:** 33 scheduled lectures, 3 Laboratory Practical Sessions
	Independent Study (preparation for course and review of materials):

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	Independent Study (preparation for assessment, incl. completion of written assessment):
Recommended Reading List	Craig's Soil Mechanics. Jonathan Knappett and R.F. Craig. CRC Press
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:** Liam McCarthy - Executive Officer, Civil Struct & Env. Eng. Julie Boustie – TR064 Course Administrator
Academic Year of Date	2024/2025

Module Code	GLU33002
Module Name	Blue Earth: Understanding the Function of Marine Ecosystems
ECTS Weighting[11]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Dr Carlos Rocha
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	The course will prepare students for related courses, field and laboratory work in the marine, earth, and environmental sciences and careers in the marine & environmental sector

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Module Content	This is an introductory course in marine biogeochemistry. The ocean plays a central role in Earth's climate system, and marine biogeochemical processes regulate the impact of human activity on the global environment. Marine biogeochemistry hence provides a working knowledge of how the earth system functions and reacts to human activity, providing insights into how life formed, evolved, is sustained, and is endangered on Earth. This knowledge provides an understanding of how to adapt to climate and environmental change, enhance food production, manage fisheries and aquaculture, mitigate pollution, and innovate by developing new products including more sustainable food and decarbonation technologies. This module concentrates on the marine biogeochemical phenomena that regulate the earth's climate and control the diversity, distribution, and productivity of marine life. Topics covered include the physical, biological, geological, and chemical processes that control the creation, distribution, and fate of organic matter in the marine environment, the composition of seawater and the atmosphere, and the formation and preservation of marine sediments. The course will prepare students for related courses, field and laboratory work in the marine, earth, and environmental sciences and careers in the marine & environmental sector
Teaching and Learning Methods	
Assessment Details[12] Please include the following: • **Assessment Component** • **Assessment description**	

Assessment Component	**Assessment Description**	**LO Addressed**	**% of total**	**Week due**
Continuous Assessment	Coursework		100%	

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• **Learning Outcome(s) addressed** • **% of total** • **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	
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:** Julie Boustie – TR064 Course Administrator Débora Dias – Executive Officer, Geology
Academic Year of Date	2024/2025

Module Code	GSU33003
Module Name	Ice Age Earth

ECTS Weighting[13]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Robin James Edwards
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: • Explain why global climates have varied dramatically over the last 2.6 million years. • Describe the spatial and temporal variation in past climate change. • Describe the long -term impact of climate change on ecosystems. • Describe the techniques used to reconstruct past climates. • Describe the techniques used to reconstruct past ecosystems. • Evaluate the contribution of climate and human activity to ecosystem dynamics. • Relate the relevance to past ecosystem change to current and future ecosystem function
Module Content	The last 2.6 million years of Earth history have witnessed dramatic climatic and environmental changes. This module provides an overview of these major environmental changes, their causes, and their significance for human development. It contrasts 'glacial' and 'interglacial' worlds, examines the nature of the transitions between them, explores some potential causes of change, and illustrates their environmental impacts. In the process, a range of key environmental records are considered, along with the "proxies" used to develop them.
Teaching and Learning Methods	

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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	Coursework - Laboratory and online practical exercises		50%	
Examination	Written Examination 2h		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):

Recommended Reading List

Bradshaw, R.H.W. & Sykes, M. (2014). Ecosystem Dynamics: From the Past to the Future. Wiley Blackwell. 334pp. Located in Botany Library.

Roberts, N. (2014). The Holocene. An Environmental history. (3rd Edition). Wiley Blackwell. 376pp. Located in Botany Library.

Ruddiman, W.F. (2014) Earth's Climate Past and Future. 3rd Ed. WH Freeman & Co. 445 pp. Located in the Freeman Library

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:** Julie Boustie – TR064 Course Administrator Débora Dias – Executive Officer, Geology
Academic Year of Date	2024/2025

Module Code	ZOU33010
Module Name	Fundamentals of Ecology
ECTS Weighting[15]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Prof. Ian Donohue
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. Define what we mean by ecology and describe its principles and practice. 2. Show a firm methodological and theoretical understanding of the study of the distribution and abundance of species. 3. Describe and evaluate unifying concepts of distributions and ecological processes (e.g. feeding strategies, interspecific interactions, etc.). 4. Show, through practical exercises, a good approach to project work. 5. Show enhanced communication skills through a variety of techniques.

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Module Content

This module examines the factors that affect the distribution, growth and survival of plant and animal communities. It describes how organisms interact with their environment and the role that they have in ecosystem and community structure. There is an introduction to the concepts and models that help to explain and predict organism distributions and interactions. The module comprises interrelated components of lectures, practical sessions and fieldwork. It has been designed to provide a foundation to ecological theory and its application.

Module learning aims

To provide students with a thorough understanding of the factors that affect the distribution, interactions and abundances of plant and animal populations and communities.

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		50%	
Examination	Written examination 1.5 hours		50%	End of semester

Reassessment Requirements

Re-assessment, if needed, consists of

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Contact Hours and Indicative Student Workload[2]	**Contact hours:** 35 hours **Independent Study (preparation for course and review of materials):** **Independent Study (preparation for assessment, incl. completion of written assessment):**
Recommended Reading List	Begon, M. & Townsend, C.R. (2021) Ecology: from Individuals to Ecosystems. Fifth edition. Blackwell Publishing
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:** Julie Boustie – TR064 Course Administrator TBC – Executive Officer, Zoology
Academic Year of Date	2024/2025

Semester 2 – Core

Module Code	GLU33009
Module Name	Hydrology and Groundwater Quality
ECTS Weighting[17]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Alex Cabral

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Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	
Module Content	This module aims to provide students with an understanding of hydrological processes, following the different pathways of water through the terrestrial part of the hydrological 24 cycle. It also aims to familiarise students with the factors affecting groundwater quality, and to develop an understanding of groundwater quality issues in the context of integrated catchment management. The hydrology component of this module includes the following topics: the hydrological cycle and catchment water balances; rainfall and evapotranspiration; soil water and hillslope hydrology; river flow; hydrogeology; groundwater – surface water interaction. The groundwater quality component includes groundwater chemistry and natural groundwater quality problems; groundwater quality issues in rural and industrial settings; groundwater vulnerability and protection. The interaction of groundwater and surface water quality is also considered.
Teaching and Learning Methods	
Assessment Details[18] Please include the following:	

Assessment Component	Assessment Description	LO Addressed	% of total	Week due

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• **Assessment Component** • **Assessment description** • **Learning Outcome(s) addressed** • **% of total** • **Assessment due date**	Continuous Assessment	Data practical's 1-2 (Water balances, surface water hydrology)		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):**
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, Geology **Admin contact:** Débora Dias – Executive Officer, Geology Julie Boustie – TR064 Course Administrator
Academic Year of Date	2024/2025

Module Code	ZOU33070
Module Name	Experimental Design and Analysis
ECTS Weighting[19]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Dr. Silvia Caldararu
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, the student will be able to: 1. Understand the fundamentals of experimental design and data collection 2. Use hypothesis testing to answer biological questions. 3. Explore and analyse data within the context of research design. 4. Use basic statistical tests as appropriate for different research questions and understand the requirements and limitations of each test 5. Learn how to use the programming language R for statistical analysis and plotting
Module Content	This module will aim to put data collection and analysis in the context of research design and will be an important foundation for the Senior Sophister research project. The emphasis will be practical with a more 'hands on' approach rather than the theory of statistics. Initially students will be taught about experimental design, data collection and sampling. This will lead on to preliminary data exploration and issues of normality. Emphasis will be placed upon the importance of visually exploring the data prior to the use of statistical tests. Summary statistics, including measures of centre and spread, skewness, kurtosis, percentiles and boxplots, will be covered. Then the module will move on to explore the concept of hypothesis testing and the need to compare two or more means. This will involve the use of t-tests and analysis of variance. Other types of data will also be introduced including the analysis of frequencies. The relationship between two variables in the context of regression analysis will also be explored. Finally, a data set will be used to bring the entire process together starting with simple

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	data exploration through summary statistics to more complex analyses. The module will also cover fundamentals of big data in ecology.
Teaching and Learning Methods	
Assessment Details[20] 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	Designing an experiment, data analysis exercise, figure design, practical attendance and completion		100%	

Reassessment Requirements	
Contact Hours and Indicative Student Workload[2]	**Contact hours:** 28 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	Ruxton, Graeme D. and Colegrave, Nick. 2011. Experimental design for the life sciences (3rd edition) Publisher – Oxford University Press, Oxford (ISBN 9780199569120).
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:** Julie Boustie – TR064 Course Administrator TBC – Executive Officer, Zoology
Academic Year of Date	2024/2025

Module Code	CEU33A10
Module Name	3A10 Surveying and Geo-Spatial Planning
ECTS Weighting[21]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Patrick Morrissey / Julie Clarke
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. Design and organise levelling, total station and global positioning survey (GPS) surveys, including estimation of probable errors. LO2. Undertake reconnaissance exercises to establish best possible surveying methods to be used in different stages of engineering projects.

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	LO3. Perform instrument checks to ensure the equipment meets specifications for quality assurance of surveying tasks. LO4. Learn how to use different surveying instruments by undertaking basic surveying procedures. LO5. Collate and map different forms of geo-spatial data using Geographical Information System (GIS) software to support surveying activities. LO6. Analyse, report, and where appropriate, distribute, the survey errors. **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively – Attained
Module Content	Surveying and geo-spatial planning is a single semester module that will help you gain a foundation understanding of the principles of surveying and planning practices, intermediate knowledge of the methods and procedures used on site, and familiarity with a full range of geospatial surveying equipment and tools. This module will give students the ability to plan and manage surveying projects in a wide range of contexts and environments. Students will gain an appreciation of the importance of accuracy and precision when translating detailed plans when setting out any civil engineering project. This will include addressing the challenges faced for surveyors working in different construction environments and consider the impact of spatial design changes during project development. This practical work will be grounded by mathematical theory of analysing for possible errors that may occur in both surveying instrumentation and the methods used for calculating spatial-related data. The following topics are covered. • Levelling • Totals Stations • Linear and Angular Measurement

	• Setting Out • Horizontal & Vertical Curves • Global Positional Systems (GPS) • Geospatial Mapping and Modelling • Remote Sensing
Teaching and Learning Methods	During the practicals and computer laboratories, students will work on independent and team tasks relating to the different life cycle stages of an engineering project: from site investigations to preliminary design, and through to construction and development checks. These tasks are designed to enable students develop a competency in operating surveying equipment and use surveying data for different project planning and development activities covered during the lectures: ▪ Levelling survey ▪ Totals Station survey and traverse ▪ GPS survey ▪ Geo-spatial planning assignments using GIS Coursework practicals requires the submission of a report containing tabular result, sketch, error reporting, and commentary on the methods used
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**
Examination	2 hours written examination	LO 1-6	50%	End of semester
Continuous Assessment 1	Individual: 2No. geo-spatial planning (GIS) laboratory assignments	LO2&5	10%	Week 5
Continuous Assessment 2	Individual: 3No. basic survey demonstrations and reports	LO1,4&6	10%	Week 8
Continuous Assessment 3	Group: 3 Advanced surveying practicals and group project	LO1-6	30%	Week 12

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Reassessment Requirements	Re-assessment, if needed, consists of 100% written examination
Contact Hours and Indicative Student Workload[2]	**Contact hours:** 48 (27 hours of lectures; 15 hours of surveying practicals; 6 hours of geospatial planning tutorials) **Independent Study (preparation for course and review of materials):** 20 hours **Independent Study (preparation for assessment, incl. completion of written assessment):** 57 hours
Recommended Reading List	**Relevant textbook** Uren & Price, Surveying for Engineers, Palgrave Publ. 5 th Ed. Schofield & Breach, Engineering Surveying, 6th Ed. Banister, Raymond & Baker Surveying, Longman Wolf & Ghilani, Elementary Surveying, Prentice Hall Publ.
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:** Liam McCarthy - Executive Officer, Civil Struct & Env. Eng. Julie Boustie – TR064 Course Administrator
Academic Year of Date	2024/2025

Module Code	ESU33006
Module Name	Team Design: Monitoring Nature-based Solutions
ECTS Weighting[23]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Dr. Peter Moonlight/Dr. Patrick Morrissey
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Develop an understanding of the environmental and legal framework for environmental monitoring LO2. Demonstrate a rounded knowledge of the process of monitoring nature-based solutions LO3. Design and critically evaluate a hydrological and water quality monitoring scheme LO4. Implement an environmental monitoring scheme and analyse the results LO5. Demonstrate an ability to communicate effectively to a non-academic audience LO6. Work safely, efficiently, and effectively in a group in the field
Module Content	Team Design: Environmental Monitoring of Nature Based Solutions is an E3 module that brings together expertise from the Schools of Engineering and Natural Sciences. This module aims to develop the students' understanding of the process of designing and implementing programs to monitor the success of nature-based engineering solutions from both an engineering and environmental point of view. It combines a lecture series and design workshops with a residential field trip to the Lower River Otter Restoration Project in Devon, England. Through the lecture series, students will be introduced to the background and rationale to the project from both an engineering and an environmental point of view. Students will work in groups to develop a plan for monitoring the hydrology and water quality of the scheme. During the field course, students will be introduced to and get hands on experience in ongoing environmental

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	monitoring efforts. Each group will follow established environmental monitoring protocols and be asked to critically evaluate the success of the project with respect to biodiversity and carbon sequestration. The final assessment will be a presentation, aimed at informing the local community of progress at the site to date.
Teaching and Learning Methods	
Assessment Details[24] 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%	

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	*Background and documentation for the lower river otter project:* https://www.lowerotterrestorationproject.co.uk/ Wheater, C.P., Bell, J.R., Cook, P.A. (2011) Practical Field Ecology: A Project Guide. Wiley Blackwell Shaw, E.M., Beven, K.J., Chappell, N.A., & Lamb, R. (2011). Hydrology in Practice (4th ed.). CRC Press. https://doi.org/10.1201/9781315274904 Mihelic, J. R., (1999). Fundamentals of Environmental Engineering.
Module Pre-requisite	N/A
Module Co-requisite	N/A
Module Website	Blackboard Ultra
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Natural Sciences **Admin contact:** Julie Boustie – TR064 Course Administrator
Academic Year of Date	2024/2025

Semester 2 – Optional

Module Code	CEU33A08
Module Name	3A8 Geology for Engineers
ECTS Weighting[25]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Sara Pavia/ Sean Mc Clenaghan

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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:

LO1. Recognise standard terminology, including basic classification systems for geological materials, and terminology applied to important plate tectonic, surface and climatic processes.

LO2. Describe the formation and internal structure of planet Earth and describe plate tectonic theory.

LO3. Explain how natural hazards such as earthquakes, tsunamis and volcanoes relate to plate tectonic processes, and explain difficulties in predicting natural disasters.

LO4. Explain the generation of hydrocarbons within sedimentary basins, use simple exploration techniques, and compare technologies for hydrocarbon exploration and extraction.

LO5. Describe the roles of glacial, fluvial, hill slope, coastal and submarine processes in forming the natural environment, and appraise whether engineering solutions are appropriate in managing surface processes.

LO6. Explain the major controls on global climate, describe evidence for natural climate change in the geological record, and assess the engineer's role in managing anthropogenic climate change

LO7. Explain the sources and distribution of radon in Ireland, describe engineering solutions to alleviate high indoor radon levels.

LO8. Solve mathematical problems concerned with geophysical surveys, rock discontinuities and slope stability.

LO9. Appraise rock behaviour in a variety of contexts, such as how to identify and then deal with the occurrence of karst features in construction.

Graduate Attributes: levels of attainment

To act responsibly - Enhanced

To think independently - Introduced

To develop continuously - Attained

To communicate effectively - Introduced

Module Content	Geology for Engineers provides an introduction to several areas of Earth Sciences that impact the engineer, including geological materials, earth surface processes, hydrocarbon exploration and production, natural disasters and climate change. Engineers often need to work with geologists. This module will enable the student to operate effectively in such a team by explaining terminology and concepts in the fields stated above. The module also provides the engineer with a natural, regionalscale context in which to place site-specific questions. Financial and time pressures on the engineer necessarily force him/her to concentrate on the site-specific aspects of geology, such as the mechanical properties of the ground and the local risk of natural hazards like flooding, subsidence or earthquakes. This module provides examples of how such local-scale phenomena can be better predicted using knowledge of regional-scale geological processes. The student will learn the kind of questions that geologists can answer, allowing him/her to better assess how much time/money to spend on geological investigations for any given project. More information here CEU33A08---3A8-GEOLOGY-FOR-ENGINEERS-24.25.pdf
Teaching and Learning Methods	Lectures, seminars, online learning via VLE, field trips, laboratories, practicals.
Assessment Details[26] Please include the following: • **Assessment Component** • **Assessment description** • **Learning Outcome(s) addressed** • **% of total**	

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Examination	Written examination 2 hours	LO 1-8	100%	End of semester

[26] TEP Guidelines on Workload and Assessment

• **Assessment due date**	
Reassessment Requirements	Re-assessment, if needed, consists of 100% Written Examination
Contact Hours and Indicative Student Workload[2]	**Contact hours:** 30 hours **Independent Study (preparation for course and review of materials):** approx. 40 hours; Researching journals; reading text books recommended in module booklist; reviewing lecture material and class notes **Independent Study (preparation for assessment, incl. completion of written assessment):** approx. 30 hours; literature review, review of lectures and tutorial questions.
Recommended Reading List	**Geology for Engineers** Understanding Earth (second edition), Press & Siever The Solid Earth (second edition), Fowler Geology Basics for Engineers, Parriaux **Engineering geology** Waltham, T (2009) Foundations of Engineering geology, Third edition, Spon Press Hoek, E & Bray, JW (1981). Rock slope engineering. E & FN Spon.
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 School of Natural Sciences, Geology **Admin contact:** Liam McCarthy - Executive Officer, Civil Struct & Env. Eng.

	Julie Boustie – TR064 Course Administrator
Academic Year of Date	2024/2025

Module Code	CEU33A11
Module Name	3A11 Fluids & Environment
ECTS Weighting[27]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Aonghus McNabola
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. Estimate flows in pipes and channels from devices such as notches, weirs and flumes. LO2. Develop the head/discharge relationship for pipes, allowing for friction in the pipes and loss of head at bends etc. LO3. Predict the depth variation in open channels LO4. Analyse & predict flows and head in pipe networks, including the effect of devices such as pumps within these systems. LO5. Design water distribution networks, appraise differing design approaches and communicate design approaches to a lay audience. LO6. Estimate the flow in gravity sewer systems and determine hydraulic loads from both wastewater and storm water under different design storm conditions, including for future climate change scenarios. LO7. To design the size and assess the efficiency of a Combined Sewer Overflow at different settings.

[27] TEP Glossary

	Graduate Attributes: levels of attainment To act responsibly - Introduced To think independently - Enhanced To develop continuously - Attained To communicate effectively - Enhanced
Module Content	Fluids & Environment is a one semester module which provides students with the concepts of hydraulic engineering of fluids in the built environment. The module reviews the relevant aspects of fluid flow developed in 2E5, such as Bernoulli's equation, and the momentum and continuity relationships and demonstrates how these are developed for use in Civil Engineering design. The methods of developing head/discharge relationships for pipe flows which includes for friction loss are formulated. The principals involved in the flow of water in open channels are explained and relationships are developed to allow the estimation of the discharge in open channels and the depth variation behind control structures. The methods used to analyse pipe networks, with and without pumps within the system, are developed. The design of water distribution systems providing an adequate supply of water to consumers is also examined. Finally, the module examines the subject of Urban Drainage, initially comparing combined systems against separate systems. The calculation of hydraulic loads for the network is then demonstrated for both wastewater quantities and also storm water predictions from the analysis of rainfall events. The hydraulic design of the pipe network to these loads is then examined before moving onto the design of Combined Sewer Overflows which are used to relieve the system hydraulically under storm conditions. The Course Curriculum includes: • Velocity & Discharge Measurement • The Momentum Equation • Energy and Flow of water in pipes • Open channel flow

	• Pipe network analysis • Pump-Pipe Systems • Pumps • Urban Drainage Systems • Design of Water Distribution Systems
Teaching and Learning Methods	3A11 will be delivered through face to face hybrid lectures. The module will include a significant group design element where students will work together in competitive groups to complete the preliminary design of a water supply system, including technical design, reporting and presentation as a consulting bid/pitch. The module includes three laboratory practical exercises and reports dealing with pipe flow, open channel flow and pump systems. Two assignments must also be completed independently by students on pipe network analysis and open channel flow systems.

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
Examination	2 hours written examination	LO1-4 & 6-7	60%	End of semester
Continuous Assessment 1	Group Project	LO5	20%	
Continuous Assessment 2	Labs & Assignments	LO1-7	20%	

Reassessment Requirements	Re-assessment, if needed, consists of 100% written examination

Contact Hours and Indicative Student Workload[2]	**Contact hours:** 33 lectures, 3 lab sessions, 2 tutorials
	Independent Study (preparation for course and review of materials): 37 hours

[28] TEP Guidelines on Workload and Assessment

	Independent Study (preparation for assessment, incl. completion of written assessment): 50 hours
Recommended Reading List	Mechanics of Fluids, Massey (Taylor & Francis). Hydraulics in civil and environmental engineering, Chadwick & Morfett (E & FN Spon). Urban Drainage, Butler & Davies (E & FN Spon).
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:** Liam McCarthy - Executive Officer, Civil Struct & Env. Eng. Julie Boustie – TR064 Course Administrator
Academic Year of Date	2024/2025

Module Code	GGU33915
Module Name	Globalisation and Geopolitics
ECTS Weighting[29]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Padraig Carmody

[29] TEP Glossary

Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module students will be able to: • Analyse the relationships between economic forces, spatial development, geopolitics and the role of the state at different scales of analysis in the developed and developing worlds; • Judge and critique different perspectives on the nature of the globalisation; • Comprehend and critique the influence of organisations such as the International Monetary Fund, World Bank and International Non-Governmental Organisations; • Apprehend the construction and interaction between ethnicity, conflict and terrorism; regionalisation and globalisation; • Discuss critically the relationship between different types of globalisation "from above" and "below"; • Critically evaluate alternatives to globalisation.
Module Content	This module examines the impacts of globalisation in both the developed and developing world and its relation to geopolitics. Particular emphasis is placed on the theories of geopolitics and globalisation and topics covered include the implications of the rise of China and its international relations in the developing world, "shadow globalisation" – human, arms and drug trafficking and resistance to these processes through social movements, amongst others.
Teaching and Learning Methods	
Assessment Details[30] Please include the following: • **Assessment Component** • **Assessment description**	

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

[30] TEP Guidelines on Workload and Assessment

• **Learning Outcome(s) addressed** • **% of total** • **Assessment due date**	Examination	Written Examination 2 hours		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):
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, Geography **Admin contact:** Julie Boustie – TR064 Course Administrator Helen O'Halloran – Executive Officer, Geography
Academic Year of Date	2024/2025

Module Code	GGU33931
Module Name	Environmental Governance I

ECTS Weighting[31]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	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 the key developments and debates within modern environmentalism over the past fifty years; • Identify and discuss the key thinkers and texts that have shaped modern environmental thinking; • Debate the nature and impact of different environmental policies and initiatives at local, national and global scales; • Use the critical analytic skills developed through the module to better examine a range of sources including documentary films, government reports, academic papers, and more.
Module Content	Despite growing awareness of the many forms of environmental degradation, the political and societal response has been far from adequate. How can we explain this? One starting point is to interrogate the contested history and development of environmental politics since the 1960s. This historically informed understanding invites us to consider how reframing current environmental problems may help us to orientate society towards a more just and sustainable future. This module will introduce students to the emergence of environmental politics as a unique field of policymaking, scientific production, and conflict since the 1960s. It will discuss key texts, writers and thinkers, whose work has been instrumental in shaping how we think about the environment, as well as how private, public and civil society actors have responded to environmental problems in recent times

[31] TEP Glossary

Teaching and Learning Methods

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
Continuous Assessment	Coursework Essay		100%	

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

[32] 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, Geography **Admin contact:** Julie Boustie – TR064 Course Administrator Helen O'Halloran – Executive Officer, Geography
Academic Year of Date	2024/2025

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 Fieldcourses

Certain modules have laboratory experiments attached to them. Students are expected to keep a log book 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 Three - Engineering | Trinity College Dublin

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 substanceor 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.

Full regulations on non-submission of coursework can be found via the following:

https://www.tcd.ie/calendar/undergraduate-studies/general-regulations-and-information.pdf

(Specific Regulations by Course in STEM Faculty - Undergrad and postgrad) faculty-of-science-tech-eng-maths.pdf

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.pdf

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.

Use of AI tools in academic work

Statement prepared by Dr Sylvia Caldararu

In recent years, we have seen the rise of AI tools, including text and image generation tools, information mining and many more. Such tools are now becoming embedded in search engines and PDF readers such as Adobe. If and how to use AI in academic and scientific work is still a matter of debate in the scientific community, and opinions evolve as the algorithms themselves evolve. At College level, the use of AI falls under the general Academic Integrity policy and associated regulations. Due to the rapidly changing nature of the field of AI, students are advised to keep up to date with this policy as it might change through the academic year.

AI tools are increasingly being incorporated into workflows in professional contexts and it is important that you familiarise yourself with what AI can do and what are its limitations and pitfalls. Keep in mind that a lot of information available on the topic on the internet is biased and produced by individuals and companies that are trying to sell AI products or by people who are, rightfully, angry that their work has been used for AI training without their consent (see 'Ethical concerns' below).

The below is meant to serve as an explainer of what AI and its various forms are and of the possible caveats of using AI tools in your academic work and beyond.

Definitions

Artificial Intelligence (AI) – In its more general and futuristic definition, artificial intelligence algorithms are those that provide human-like or beyond human-like interpretation in a way that looks like the output of human intelligence. In its present-day use, the term refers to mathematical algorithms that use advanced statistical methods to find patterns in the data provided (numbers, text, images, etc) and create the desired output.

Training data – data that is used for an AI algorithm to 'learn' the patterns in the data and create the actual AI model that creates the output and is provided to users.

Generative AI (GenAI) – AI algorithms that can create new content based on given training data, including text, images, sound and videos.

Large Language Models (LLM) – a generative AI algorithm that creates text in natural language. The best known one is ChatGPT but there are many more out there with various uses.

Machine learning (ML) – largely synonymous with AI but more frequently used in scientific papers specifically about developing or applying algorithms. You will see, for example, studies using ML to identify plant species or to scale up measurements to areas where these measurements are not available.

Accuracy concerns

LLMs are built to mimic human language, and a model is considered good if the output looks convincingly like language. There is nothing in the LLM's training to check if the information in the text is true or accurate. The model has been trained on real text, so there is a chance that the output contains actual information, but there is also a chance that it doesn't. If asked to include reference in the text, LLMs will frequently make up plausible looking but non-existent references. While there are efforts being made to integrate LLMs with real search engines, no reliable and accurate LLM exists at the time of writing this explainer.

Ethical concerns

All AI algorithms need training data. There are of course ways to obtain such data in equitable ways, but in practice AI companies have used, art, literature, journalism and academic text without obtaining permission or paying the original authors.

Environmental concerns

Training AI algorithms requires large amounts of computational power, which in turn require a lot of energy and water. Serious concerns have been raised around the climate impact of training and using AI. As scientists and especially scientists working in the natural sciences, we cannot ignore these facts.

Should I use AI in my academic work?

There is no right or wrong answer to this question. Writing your entire assessment using an LLM will most certainly fall under the College Academic Integrity policy. Using machine learning as a statistical method for your research project will most certainly not and might create a very exciting and state of the art

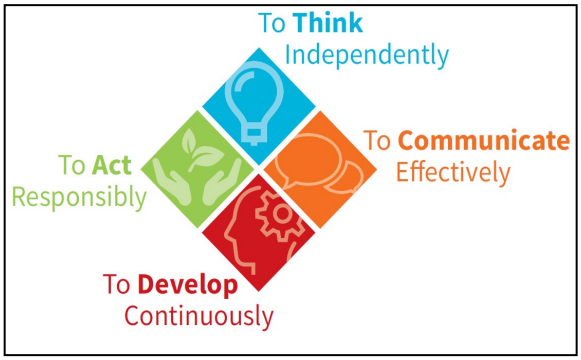
project. Beyond that, use your judgment, keeping in mind the caveats above. Some modules will have a specific AI policy, and you should follow that. If in doubt, do not hesitate to ask the module coordinator.

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?

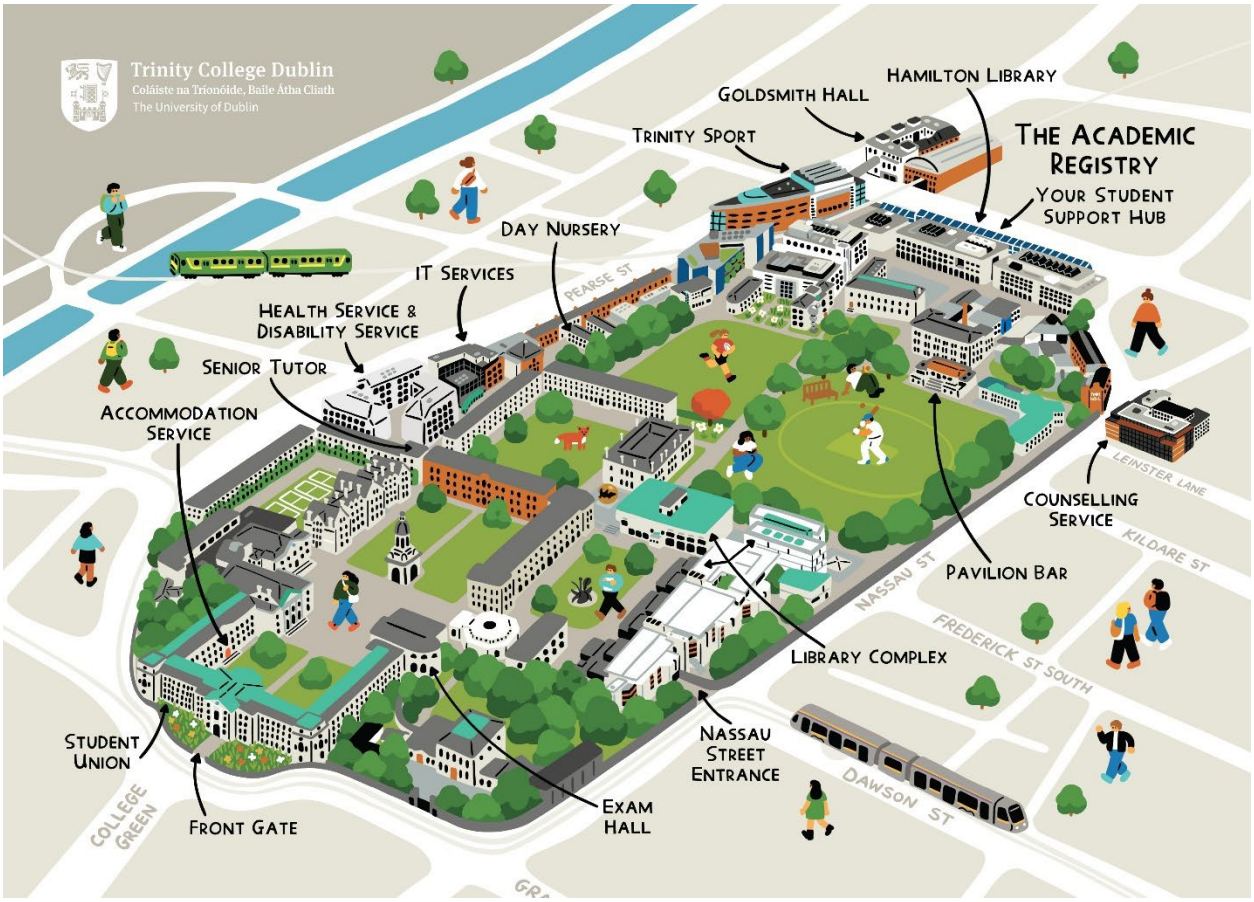
Many of the Graduate Attributes are 'slow learned', in other words, you will develop them over the four or five years of your programme of study.

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/

Contact:

Module coordinators List

Contact list per module

Staff	Email
Course Director Professor Jennifer McElwain - Botany	jmcelwai@tcd.ie
Course Director Professor Laurence Gill – Civil Engineering	laurence.gill@tcd.ie
BOU33123 Dr. Matthew Saunders – Botany	saundem@tcd.ie
ESU33040 Dr. Jeremy (Jay) Piggott – Zoology	piggotjj@tcd.ie
CEU33A13 Dr. Muhammad Ali – Civil Struct & Env. Eng.	muhammad.ali@tcd.ie
CEU33A14 Dr Mohammed Reza Ghaani– Civil Struct & Env. Eng	mohammad.ghaani@tcd.ie
ZOU33010 Professor Ian Donohue – Zoology	ian.donohue@tcd.ie
GSU33003 Dr. Robin Edwards – Geography & Geology	Robin.Edwards@tcd.ie

CEU33A05 Dr. Brendan O'Kelly – Civil Struct & Env. Eng	
GLU33002 Professor Carlos Rocha – Geology	rochac@tcd.ie
GLU33009 Dr. Alex Cabral – Geology	cabralda@tcd.ie
ZOU33070 Dr. Silvia Caldararu - Botany	caldaras@tcd.ie
CEU33A10 Dr. Julie Clarke – Civil Struct & Env. Eng	JULIE.CLARKE@tcd.ie
ESU33006 Peter Moonlight – Botany	moonligp@tcd.ie
CEU33A11 Professor Aonghus Mc Nabola – Civil Struct & Env. Eng	amcnabo@tcd.ie
GGU33931 Dr. Rory Rowan - Geography	rowanro@tcd.ie
GGU33915 Professor Padraig Carmody – Geography	carmodyp@tcd.ie
CEU33A08 Professor Sara Pavia – Civil Struct & Env. Eng	pavias@tcd.ie

Discipline Staff and Admin contact List

Administrative staff	**School**	**Email**
Julie Boustie **TR064 Course Administrator**	School of Natural Sciences	envscieng@tcd.ie boustiej@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	School of Natural Sciences	FIMOLONY@tcd.ie

Undergraduate Administrative Coordinator		
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
Lou Bodenhemier **Executive Officer Botany**	School of Natural Sciences	ZOBOES@tcd.ie
Débora Dias **Executive Officer, Geology**	School of Natural Sciences	EARTH@tcd.ie
Helen O'Halloran **Executive Officer, Geography**	School of Natural Sciences	Geography@tcd.ie
TBC **Executive Officer, Zoology**	School of Natural Sciences	ZOBOES@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