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

School of Natural Sciences and School of Engineering

Environmental Science and Engineering

Integrated Master's

TR064 Handbook

2025-26

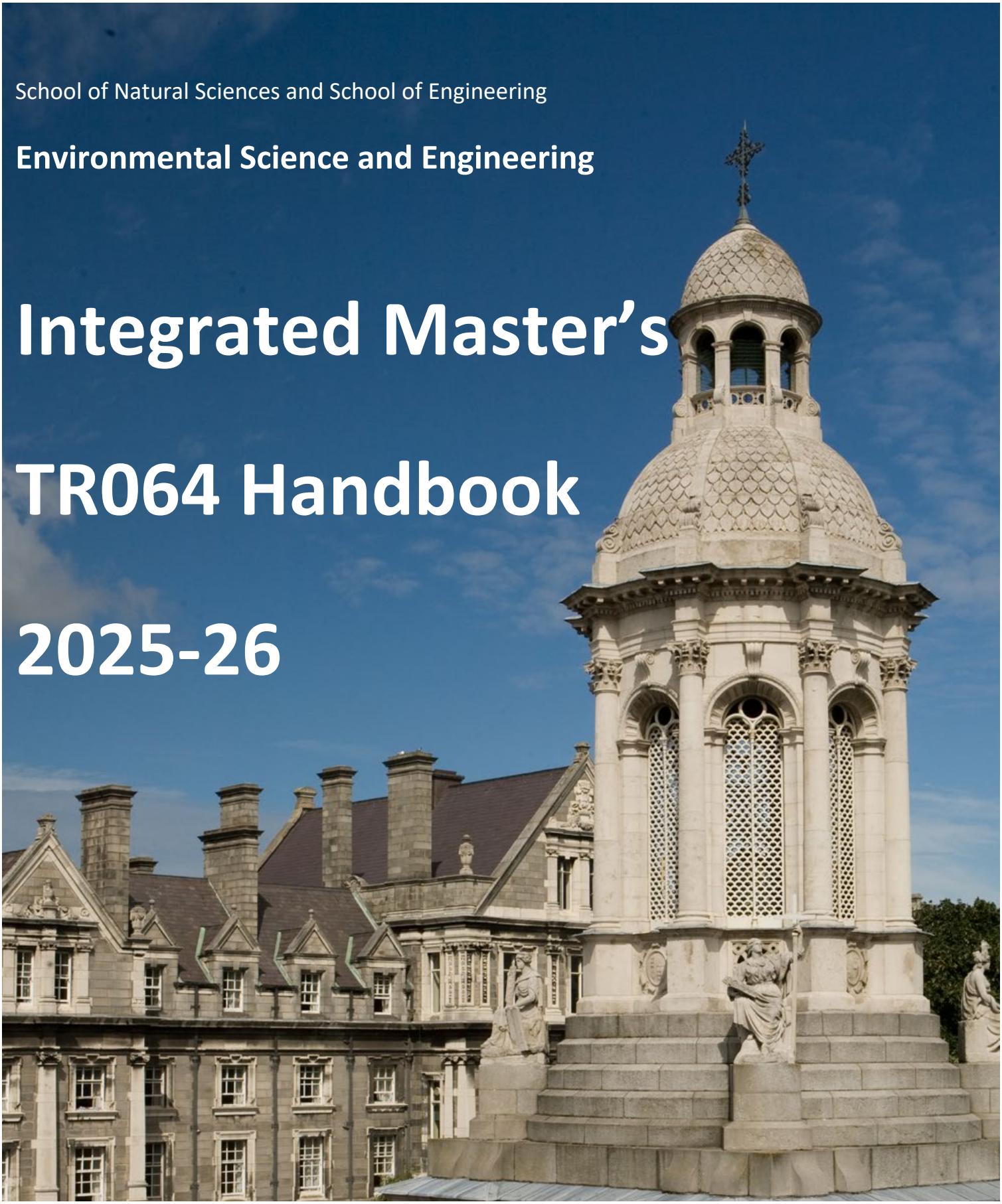


Table of Contents

Welcome

TBC

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.

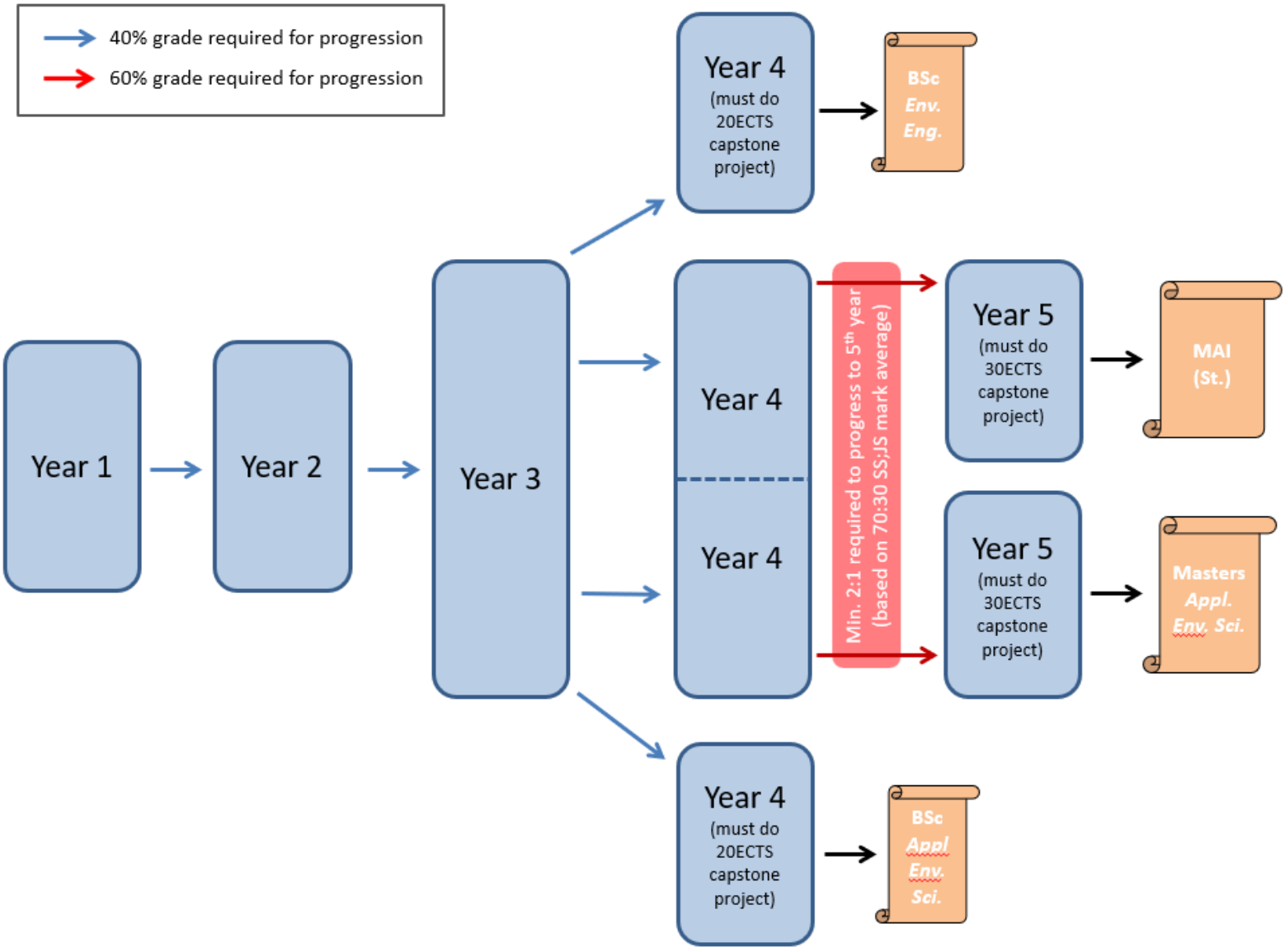
CLO4. Work effectively as an individual, in teams and in multi-disciplinary settings.

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 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:

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

The European Credit Transfer Accumulation System (ECTS)

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

The ECTS weighting for a module is a **measure of the student input or workload** required for that

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

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

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

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

Important information for TR064 students

Capstone Project

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

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

The Capstone should:

- be an integrative exercise that allows students to showcase skills and knowledge which they have developed across a range of subject areas and across the four years of study
- result in the production of a significant piece of original work by the student

- provide students with the opportunity to demonstrate their attainment of the four graduate attributes: to think independently, to communicate effectively, to develop continuously and to act responsibly.

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

Prizes, medals and other scholarships

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 – Master's (Year 5)

Core Modules

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

Optional Modules

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

Semester 1 – choose 3	Semester 2 – choose 2
CE7J02 Solar Energy Conservation & Applications (5 ECTS)	CE7E05 Water Quality and Hydrological Modelling (5 ECTS)
CE7J04 Energy Policy and Energy Storage (5 ECTS)	CE7E06 Water Resource Planning and Climate Change (5 ECTS)
CE7E07 Sustainable Water Supply and Sanitation (5 ECTS)	CE7J01 Wind Energy (5 ECTS)
ES7057 Navigating Complexity for Sustainable Future (5 ECTS)	CE7J06 Wave and Hydro Energy (5 ECTS)
CEP55E03 Air Pollution: Monitoring, Assessment, Control (5 ECTS)	ES7027 Environmental Policy (5 ECTS)
CE7E04 Waste Management and Energy Recovery (5 ECTS)	CEP55E06 Groundwater and Pollution Control (5 ECTS)
DP7023 Climate Change: Science Development and Justice (5 ECTS)	DP8017 Smart-Eco Cities of the Future (5 ECTS)
	BD7056 Human Impact with Biodiversity (5 ECTS)
	CSP7001 Intro to Machine Learning (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
ES7047	Research Project Karen Wiltshire	30 100% CW	Michaelmas and Hilary
CE7J02	Solar Energy Conservation & Applications Sarah Mc Cormack	5 50% FA 50% CW	Michaelmas
CE7J04	Energy Policy and Energy Storage Sarah Mc Cormack	5 75% FE 25% CW	Michaelmas
CE7E07	Sustainable Water Supply and Sanitation Laurence Gill	5 70% FE 30%CW	Michaelmas
ES7057	Navigating Complexity for Sustainable Future Quentin Crowley	5 100% CW	Michaelmas
CEP55E03	Air Pollution: Monitoring, Assessment, Control John Gallagher	5 100% CW	Michaelmas
CE7E04	Waste Management and Energy Recovery	5	Michaelmas

	Liwen Xiao	70% FE 30%CW	
DP7023	Climate Change: Science Development and Justice	5	Michaelmas
	Susan Murphy	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
ES7046	Team Design	5	Hilary
	Laurence Gill / Jennifer McElwain	100% CW	
CE7E05	Water Quality and Hydrological Modelling	5	Hilary
	Laurence Gill	70% FE 30% CW	
CE7E06	Water Resource Planning and Climate Change	5	Hilary
	David O'Connell	80% FE 20% CW	
CE7J01	Wind Energy	5	Hilary
	Breiffni Fitzgerald	70% FE 30% CW	
CE7J06	Wave and Hydro Energy	5	Hilary
	Biswajit Basu	80% FE 20% CW	
ES7027	Environmental Policies	5	Hilary
	Jean Wilson	100% CW	
CEP55E06	Groundwater and Pollution Control	5	Hilary
	David O'Connell	100% FE	
DP8017	Smart-Eco Cities of the Future	5	Hilary
	Federico Cugurullo	100% CW	
BD7056	Human Impact with Biodiversity	5	Hilary
	TBC	100% CW	

CSP7001	Intro to Machine Learning	5	Hilary
	Giovanni Di Liberto	100% CW	

ICA = In course Assessment – Formal Assessment in exam conditions

CW = Coursework

FE = Formal Examination in Annual Examination Period

Module descriptions:

Semester 1 and 2- Core

Module Code	ES7047
Module Name	Research Project with respect to climate resilience in Ireland
ECTS Weighting[1]	30 ECTS - Derogation
Semester taught	Semester 1 & 2
Module Coordinator/s	Karen Wiltshire
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: MLO2.1. Contribute individually to the development of scientific/technological knowledge in one or more areas of their stream of Environmental Engineering or Applied Environmental Science/ possibly also with links to Arts, Humanities, and social sciences. MLO2.2. Identify, assess and synthesize existing literature and research findings on an unfamiliar Climate Resilience-related issues.

[1] TEP Glossary

	MLO2.3. Define, elucidate and outline a climate resilience problem and develop tests and methodologies and a “recipe” for solution. MLO2.4. Apply a range of standard and specialised research tools and techniques to provide innovative and appropriate solutions to complex climate system solutions related achieving Climate resilience in Ireland. MLO2.5. Apply and develop models for climate resilience in Irish climate socio-ecosystems. MLO2.6. Develop and apply theoretical, scientific and mathematical principles to effectively solve a defined climate resilience research problem. MLO2.7. Design and conduct unsupervised modelling experiments and or surveys and to analyse and interpret data relating to climate resilience. MLO2.8. Discuss and critically evaluate the research findings and reflect on the strength and limitations of the research. MLO2.9. Assess the implications of the project outcomes for engineering, policy and/or societal practice. MLO2.10. Write a research dissertation with publication to professional and academic standards using appropriate graphics and references.
Module Content	This module allows the students to complete an individual research project on topics related to future climate resilience in the Irish context, in Engineering and Natural Sciences, interests in AHSS could be negotiated. The main objective of this module: • To plan, execute and report on a Climate Science Project towards Climate Resilience in Ireland. A list of joint project topics/titles from the Schools of Engineering and Natural Sciences and potentially from Arts Humanities and Social Sciences will be issued to students towards the end of the second semester of the Senior Sophister year. Students will be

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

Teaching and Learning Methods

Assessment Details[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
Report	Interim report		5%	TBC
Presentation	Poster presentation		5%	TBC
Presentation	Final presentation		5%	TBC
Dissertation	full dissertation publishable online in the Climate Gateway including a 2 page summary also as a publishable white paper “short note”		85%	TBC
In addition, the students are required to attend a final viva voce.				

Reassessment Requirements

[2] TEP Guidelines on Workload and Assessment

Contact Hours and Indicative Student Workload[2]	**Contact hours:** **Independent Study (preparation for course and review of materials):** **Independent Study (preparation for assessment, incl. completion of written assessment): 750 student effort hours**
Recommended Reading List	•
Module Pre-requisite	
Module Co-requisite	N/A
Module Website	Blackboard Ultra
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Natural Sciences **Admin contact:** Julie Boustie – TR064 Course Administrator
Academic Year of Date	2024/2025

Semester 1 – Optional

Module Code	CEP55E03
Module Name	Air Pollution: Monitoring, Assessment & Control
ECTS Weighting[3]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Asst Prof. John Gallagher [j.gallagher@tcd.ie]

Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Describe key concepts relating to air pollution science and its application to environmental engineering. LO2. Assess, apply and evaluate differing forms of air pollution models for the prediction of concentrations in the atmosphere. LO3. Appraise differing approaches to the control of air pollution for outdoor and indoor settings and in urban and industrial settings. LO4. Discuss the development and application of national emissions inventories and projections. LO5. Measure air pollution concentrations in practice and identify the advantages and limitations of differing monitoring approaches. L06. Critically evaluate an environmental impact assessment of new infrastructure developments or policy from an air pollution perspective. **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Attained To develop continuously - Attained To communicate effectively – Enhanced
Module Content	The module commences with an introduction to the field of air pollution science, identifying the current challenges in the field and key background knowledge in the provision of clean air for society and the environment. The module explores the adoption of, and best practice in, air pollution monitoring and modelling, to help understand concentrations and exposure in various settings and to assess the impacts of policy changes, new technology or developments. The module also explores the control of air pollution in outdoor and indoor conditions from an environmental engineering perspective with a particular focus on sustainable approaches to air pollution mitigation or management. The development of national emissions inventories is examined and inform how to approach the projection of pollution into the future using forecasting techniques. The module deals with the development of environmental impact assessment in relation to air pollution in infrastructure developments/policy, using case studies examples to demonstrate good and/or bad practice (e.g., incineration, construction projects, roads, etc).

Teaching and Learning Methods

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

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

Assessment 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
Personal Exposure monitoring, modelling & mitigation	Personal exposure monitoring and modelling study including assessment of policy and mitigation measures (30-page limit).	LO1-LO6	100%	Wk12

Reassessment Requirements

Resubmission of failed coursework.

Contact Hours and Indicative Student Workload[2]

Contact hours: 30 hours Lectures – 3 hours per week Tutorials/Practicals – 3 hours
Independent Study (preparation for course and review of materials): 15 hours Review of lecture notes suggested reading and scientific papers provided for revision during the semester.
Independent Study (preparation for assessment, incl. completion of assessment): 80 hours (coursework) Data analysis using air pollution monitoring equipment.

	Application of monitoring, modelling and control application of air pollution modelling tools. Review of scientific literature to develop a mitigation strategy.
Recommended Reading List	
Module Pre-requisite	N/A
Module Co-requisite	N/A
Module Website	
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Engineering, Civil Structural and Environmental Engineering **Admin contact:** Liam McCarthy - Executive Officer, Civil Struct & Env. Eng. Julie Boustie – TR064 Course Administrator
Academic Year of Date	2024/2025

Module Code	CE7E04
Module Name	E4: Waste Management and Energy Recovery
ECTS Weighting[5]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Lecturer(s): Assoc. Prof. Liwen Xiao (Liwen.Xiao@tcd.ie)
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should have LO1. An understanding of the nature of solid waste and the conceptual approaches to solving the problems of its management. LO2. An understanding of the theories and technologies of energy recovery from solid waste. LO3. An understanding of the best available technologies for waste treatment. LO4. An understanding of legislations and regulations relevant to waste management.

[5] TEP Glossary

	LO5. An understanding of the relationships between waste management, climate change, circular economy and sustainable development. LO6. The capacity to collect and analyse data for waste management. LO7. The capacity to develop sustainable waste treatment strategies for a region or city. **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Enhanced
Module Content	This module will introduce (1) the definition of waste and approaches to the assessment, management and control of solid waste in its various forms, and (2) the theories and technologies of energy recovery from solid waste. • Solid waste: definitions and assessment, liquid, solid and gaseous. • Landfill/landspreading hydrology: processes and modelling. • Thermal treatment: Incineration, pyrolysis, gasification. • Contaminated land: investigation and remediation of contaminated soil and groundwater. Sampling and monitoring; legal issues; risk analysis. • Energy recovery: heat, electricity and combustible gases recovery from organic waste.
Teaching and Learning Methods	Lectures, tutorials, coursework and field visit
Assessment Details[6] Please include the following:	

Assessment Component	Assessment Description	LO Addressed	% of total	Week due

[6] TEP Guidelines on Workload and Assessment

• **Assessment Component** • **Assessment description** • **Learning Outcome(s) addressed** • **% of total** • **Assessment due date**	Continuous Assessment 1	Tutorial and assignments	LO2, LO6	10%	Week 9
	Continuous Assessment 2	Report and field visits	LO1-LO7	20%	Week 17
	Examination	3 hour examination	LO1-LO7	70%	End of semester

Reassessment Requirements

Re-assessment, if needed, consists of

Contact Hours and Indicative Student Workload[2]

Contact hours: 27 hours of lectures, 3 hours of tutorials and site visits (10 hours)
Independent Study (preparation for course and review of materials): 30 hours; Researching journals; reading text books recommended in module booklist; reviewing lecture material and class notes
Independent Study (preparation for assessment, incl. completion of written assessment): 30 hours; literature review, research methods development, data collection and analysis, completion of end of semester essay;

Recommended Reading List

Text books include:

Fetter, C.W. CONTAMINANT HYDROGEOLOGY, 1999, Prentice Hall

La Grega, M.D., Buckingham, P.L., Evans, G.J., HAZARDOUS WASTE MANAGEMENT, 1994, McGraw-Hill

Nathanail, C.P. and Bardos, R.P. RECLAMATION OF CONTAMINATED LAND, 2004, Wiley

Tchobanoglous, G., Theisen, H., Vigil, S.A. INTEGARTED SOLID WASTE MANAGEMENT, 1993, McGraw-Hill

Williams, P. WASTE TREATMENT AND DISPOSAL, 1997, Wiley

Module Pre-requisite	Chemistry and environmental engineering background
Module Co-requisite	N/A
Module Website	Blackboard Ultra
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Engineering, Civil Structural and Environmental Engineering **Admin contact:** Liam McCarthy - Executive Officer, Civil Struct & Env. Eng. Julie Boustie – TR064 Course Administrator
Academic Year of Date	2024/2025

Module Code	CE7J02
Module Name	J2: Solar Energy Conversion & Applications
ECTS Weighting[7]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Assoc. Prof. Sarah McCormack (Sarah.McCormack@tcd.ie) Lecturer(s): Prof. Laurence Gill (Laurence.gill@tcd.ie)
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Describe the function and design of difference system types of (i) solar thermal including the flat plate, evacuated tube, thermosiphon and integrated collector store systems and (11) photovoltaic including monocrystalline silicon, amorphous, thin film and multijunction modules and emerging technologies. LO2. Calculate optical properties of material for solar energy systems based on spectral measurements. LO3. Explain how the performance of solar energy systems varies annually and diurnally, depending on location, sky conditions, device and application type and load/user behaviour.

[7] TEP Glossary

	LO4. Clarify which materials are best suited for use in solar panels as well as explain what surface treatments can be used to enhance thermal and electrical performance. LO5. Describe the function of the most important components necessary in a solar energy system. LO6. Describe the state of the art in thermal and photovoltaic technologies as well as show an insight into future trends and advances. **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Enhanced
Module Content	This module introduces a range of topics in the advanced physics and technology of solar energy conversion and materials, devices and applications. Participants will gain an in dept knowledge of current advances in solar energy, principles of operation of solar thermal and photovoltaic devices, technological challenges and their applications. The module also provides an introduction into next generation technologies. The aim of this module is to give the students an extended foundation of the main concepts of solar energy and to enable them to practically apply their knowledge in research and development.
Teaching and Learning Methods	A combination of lectures, tutorials and laboratories.
Assessment Details[8] Please include the following:	

Assessment Component	Assessment Description	LO Addressed	% of total	Week due

[8] TEP Guidelines on Workload and Assessment

• **Assessment Component** • **Assessment description** • **Learning Outcome(s) addressed** • **% of total** • **Assessment due date**	Continuous Assessment	Group work – designing solar PV and thermal systems	LO1,3,5	50%	Week 6
	Examination	3 hour online examination	ALL	50%	N/A

Reassessment Requirements	Re-assessment, if needed, consists of 100% written examination (3 hours), weighted at 50% to pass
Contact Hours and Indicative Student Workload[2]	**Contact hours:** 33 hours **Independent Study (preparation for course and review of materials):** 45 hours **Independent Study (preparation for assessment, incl. completion of written assessment):** 45 hours
Recommended Reading List	Photovoltaic solar energy conversion. G. H. Bauer, (2015) Springer.
Module Pre-requisite	N/A
Module Co-requisite	N/A
Module Website	Blackboard Ultra
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Engineering, Civil Structural and Environmental Engineering **Admin contact:** Liam McCarthy - Executive Officer, Civil Struct & Env. Eng. Julie Boustie – TR064 Course Administrator
Academic Year of Date	2024/2025

Module Code	CE7J04
Module Name	J4: Energy Policy and Energy Storage
ECTS Weighting[9]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Prof. Sarah McCormack Other lecturer(s): Prof. Brian Caulfield, Asst. Prof Mohammad Reza Ghaani
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 and discuss the main areas of energy policy. LO2. Understand requirements for LEED/Zero Energy and Net Passive buildings. LO3. Evaluate energy projects using economic analysis tools. LO4. Compare and evaluate various energy storage technologies in terms of their strengths, limitations, and cost-effectiveness for different energy systems and applications. LO5. Design energy storage systems to support grid stability, integrate renewable energy sources, and optimize energy dispatch and management. LO6. Evaluate the environmental sustainability of energy storage technologies, considering factors like resource utilization, emissions, and end-of-life management. **Graduate Attributes: levels of attainment** To act responsibly - Introduced To think independently - Attained To develop continuously - Enhanced To communicate effectively - Enhanced
Module Content	This module is an optional module which runs in the first semester. The module will develop knowledge in current energy policy and our energy storage options. It will include topics in energy economics, policy, energy storage options and circular economy and sustainability in storage systems will be addressed.

[9] TEP Glossary

Teaching and Learning Methods	Core content via lectures Individual assignments

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	Energy Storage Project	LO4-6	25%	Week 12
Examination	3 hour examination	ALL	75%	N/A

Reassessment Requirements	Re-assessment, if needed, consists of 100% written examination (3 hours), weighted at 50% to pass

Contact Hours and Indicative Student Workload[2]	
	Contact hours: 30 hours
	Independent Study (preparation for course and review of materials): 20 hours
	Independent Study (preparation for assessment, incl. completion of written assessment): 75 hours

Recommended Reading List	Sustainable energy systems engineering; P Gevorkian (2007) Storing Energy - with Special Reference to Renewable Energy Sources; Trevor Letcher (2022)
Module Pre-requisite	N/A

[10] TEP Guidelines on Workload and Assessment

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	CE7E07
Module Name	E7: Sustainable Water Supply and Sanitation
ECTS Weighting[11]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Prof. Laurence Gill (Laurence.gill@tcd.ie) Lecturer(s): Prof. Bruce Misstear (bmisster@tcd.ie)
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Develop conceptual models to help to solve typical problems within the field of water supply and sanitation projects in developing countries. LO2. Explain the conceptual pathways for transition of water related infectious diseases and their link to sanitation related contaminants. LO3. Formulate the full suite of sanitation technologies that can be linked into compatible combinations to design a logical sanitation system. LO4. Evaluate the need and methods for successful health and hygiene education in parallel to water supply/ sanitation infrastructure development. LO5. Assess the adequacy of existing water schemes and plan new water systems, including estimating water demands for people, animals and crops.

[11] TEP Glossary

	LO6. Evaluate different water supply options, including rainwater collection, Protected springs, hand-dug wells, drilled wells, river intakes and small dams. LO7. Design appropriate types of wells for different hydrogeological environments. LO8. Design appropriate soil-based and/or vegetated passive treatment systems for water resource protection. LO9. Elucidate the concepts of sustainable resource management within the urban water cycle. **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Attained To develop continuously - Enhanced To communicate effectively - Enhanced
Module Content	This module aims to develop the students' comprehension of water supply and sanitation, particularly focussing on rural areas in developing countries. The students should understand the conceptual pathways for transmission of water-related infectious diseases and their link to contaminant transport and attenuation in relation to appropriate water supply and sanitation technologies. This will enable students to be able to devise appropriate conceptual models to solve typical problems within the field of sustainable water supply and sanitation projects. More information here CE7E07---E7-Sustainable-Water-Supply-and-Sanitation-24.25.pdf
Teaching and Learning Methods	This module is taught by a combination of lectures and tutorials during which the two assignments are discussed. The key information from the lecture presentations will be made available on-line. The first continuous assessment assignment, on an aspect of water supply, is handed out to the students in week 4 of the module. The second continuous assessment assignment, a group project on decentralised sanitation, is handed out to the students in week 7 of the module. Both completed assignments have to be submitted by the last day of the first semester. The projects are marked and returned to the students with comments.

Assessment Details[12] **Please include the following:**

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

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Continuous Assessment 1	Assignment 1 (Rural water supply)	LO5, LO6, LO7	15%	Week 9
Continuous Assessment 2	Assignment 2 (decentralised sanitation)	LO2,LO3,LO 8	15%	Week 12
Examination	3 hour examination	LO1-LO9	70%	End of semester

Reassessment Requirements

Re-assessment, if needed, consists of 100% written examination (3 hours)

Contact Hours and Indicative Student Workload[2]

Contact hours: 27 hours
Independent Study (preparation for course and review of materials): 40.5 hours
Independent Study (preparation for assessment, incl. completion of written assessment): 32.5 hours

Recommended Reading List

Engineering in Emergencies – Davis and Lambert [ITDG]

Compendium of Sanitation Systems & Technologies – Tilley et al. [EAWAG]

Water wells and boreholes – Misstear et al. [Wiley]

The material from textbooks is supplemented by case studies and by a large number of references from international agencies and others, including the UN World Water Development reports.

[12] TEP Guidelines on Workload and Assessment

Module Pre-requisite	N/A
Module Co-requisite	N/A
Module Website	Blackboard Ultra
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Engineering, Civil Structural and Environmental Engineering **Admin contact:** Liam McCarthy - Executive Officer, Civil Struct & Env. Eng. Julie Boustie – TR064 Course Administrator
Academic Year of Date	2024/2025

Module Code	DP7023
Module Name	Climate Change: Science, Development and Justice
ECTS Weighting[13]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Dr Conor Buggy (conor.buggy@ucd.ie), Dr. Susan Murphy (susan.p.murphy@tcd.ie)
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	**Learning Objectives:** This module aims to provide students with the following: - An understanding of climate change in the context of earth system science, planetary 'tipping points', and the effects of recent anthropogenic activities on climate change; - An introduction to anticipating (i.e. modelling) the future physical effects of climate change and their societal impacts, particularly with regard to development; - An understanding of how concerns regarding the impacts of climate change in the developing world came to influence the climate change agenda, and an overview of relevant legislative and policy frameworks concerning climate change at international and national levels (including adaptation and mitigation approaches to dealing with climate change in the developing world); - A projection of potential climate change impacts to public health; - Examine and critically assess justice-based issues to which climate change can give rise.

[13] TEP Glossary

Learning Outcomes:

Having successfully completed this module a student should expect to:

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

Module Content

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

Teaching and Learning Methods	There will be guest lectures with leading-edge scientific researchers on topic related to climate modelling, measuring ecosystem services, just transitions, and the social and political dynamics of climate policy and actions. Attendance at lectures is mandatory. Participation in the debate is mandatory. A debate protocol will be provided during the course of the module.

Assessment 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
Written Examination	In class 2hour written examination		100%	
Continuous Assessment 1	Class debate & write up		20%	
Continuous Assessment 2	Debate self-reflection		10%	

Reassessment Requirements	Re-assessment, if needed, consists of
Contact Hours and Indicative Student Workload[2]	**Contact hours:** 25 to 30 hours teaching; 3 hour debate; 2 hour written examination **Independent Study (preparation for course and review of materials, preparation for assessment, incl. completion of written assessment):** 100 hours reading, specified learning activities (SLA's)
Recommended Reading List	
Module Pre-requisite	N/A
Module Co-requisite	N/A

[14] TEP Guidelines on Workload and Assessment

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 – MSc Smart and Sustainable Cities Course Administrator Elaine Elders – MDP Course Administrator
Academic Year of Date	2024/2025

Module Code	ES7057
Module Name	Navigating Complexity for Sustainable Future
ECTS Weighting[15]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Quentin Crowley
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	Upon successful completion of this module, students will be able to: • Apply Systems Thinking: Demonstrate a comprehensive understanding of Systems Thinking principles and apply them to analyse complex environmental issues, recognising the interconnections between ecological, social, and economic systems. • Translate Science into Action: Effectively translate scientific knowledge into practical, actionable solutions that address contemporary environmental and biodiversity challenges. • Collaborate: Engage in interdisciplinary collaboration, working effectively within diverse teams to develop innovative solutions to complex challenges.

[15] TEP Glossary

	• Enhance Science Communication: Communicate complex scientific concepts clearly and effectively to a variety of audiences, utilising a systems perspective to enhance understanding and engagement. • Evaluate Systemic Impacts: Critically evaluate the potential social, economic, and ecological impacts of proposed solutions, considering the broader implications for sustainability and resilience in natural systems.
Module Content	In this module, students will engage with the intricate challenges of our time through a Systems Thinking lens. The focus will be on translating scientific knowledge into actionable solutions that address pressing environmental and biodiversity issues. Using a Systems Thinking approach, the module explores the interconnectedness of ecological, social, and economic systems, gaining a holistic understanding of contemporary challenges such as climate change, habitat loss, and biodiversity decline. The module adopts an experiential learning framework which applies practical tools in real-world contexts. Innovative problem-solving will be practiced through interdisciplinary collaboration and project-based learning. Competencies in systems innovation, science communication, and stakeholder engagement will be developed to enable effective communication of complex ideas to diverse audiences. Group work will focus on developing ideas aimed at transforming systems to drive sustainable change in relation to environmental sciences and biodiversity and conservation. Students will be empowered to navigate complexity and contribute meaningfully to sustainable futures, making a positive impact on the environment and society.
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 1	Group work assessed on Miro		30%	
	Continuous Assessment 2	Group work, live presentation and slides submitted on Blackboard.		20%	
	Continuous Assessment 3	Learning log - written account of learning and self-reflection (submitted on Blackboard).		50%	

Reassessment Requirements	
Contact Hours and Indicative Student Workload[2]	**Contact hours:** **Independent Study (preparation for course and review of materials):** **Independent Study (preparation for assessment, incl. completion of written assessment):**
Recommended Reading List	
Module Pre-requisite	
Module Co-requisite	
Module Website	
Are other Schools/Departments involved in the delivery	School of Natural Sciences **Admin contact:** George Oatridge - MSc Environmental Sciences Course Administrator

[16] TEP Guidelines on Workload and Assessment

of this module? If yes, please provide details.	Julie Boustie – TR064 Course Administrator
Academic Year of Date	2024/2025

Semester 2 – Core

Module Code	ES7046
Module Name	Team Design
ECTS Weighting[17]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Prof. Laurence Gill (Laurence.gill@tcd.ie) & Prof. Jennifer McElwain (jmcelwai@tcd.ie)
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Critically appraise and design solutions for environmental challenges including climate mitigation and climate adaptation based upon field data LO2. Evaluate and integrate nature-based approaches into the design solutions for environmental challenges LO3. Apply engineering and scientific knowledge gained in other modules to formulate solutions to multidisciplinary design problems LO4. Interpret the requirements from a design brief and formulate and appraise potential solutions LO5. Work successfully in small teams, clearly demonstrating group working, including task sub-division and integration of individual contributions from the team. LO6. Clearly communicate a design/solution to experts and non-experts using design statements, drawings, calculations, models, and other methods LO7. Clearly communicate a design/solution to experts and non-experts via face-to face presentation LO8. Demonstrate organised and concise report writing skills LO9. Apply basic thinking around the human-environment interaction and the ethical and environmental issues involved in design solutions to environmental challenges.

[17] TEP Glossary

	Graduate Attributes: levels of attainment To act responsibly - Attained To think independently - Attained To develop continuously - Attained To communicate effectively - Attained
Module Content	This module will be based on developing solutions to contemporary environmental problems. The contemporary environmental challenges for which design solutions will be required will mainly address different aspects of the overarching twin emergencies of climate change and biodiversity loss but will be defined from a list of ongoing research projects provided by academics in the Schools of Engineering and Natural Sciences. Such subjects could include renewable energy, coastal protection, wetland restoration, water and wastewater treatment, rewilding, air pollution, hydrology and flood protection, environmental policy etc. Students will work in interdisciplinary teams to develop design solutions to the challenges set by the lead academics, using both field data provided, and any new data / resources gathered by the teams during the design process.
Teaching and Learning Methods	Field based and team based teaching and learning. **Associated laboratory/project/tutorial programme** • 18 hours of lectures / tutorials • 2 half day field visits related to the design challenge • 1 group project

Assessment Details[18] Please include the following:

- **Assessment Component**
- **Assessment description**

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Continuous Assessment 1	Scoping Report	LO1, 4, 5,9	10%	3
Continuous Assessment 2	Project Design Report	LO1 to LO9	65%	12
Continuous Assessment 3	Mock planning hearing to challenge the solution	LO1 to 9	10%	12

[18] TEP Guidelines on Workload and Assessment

• **Learning Outcome(s) addressed** • **% of total** • **Assessment due date**	Continuous Assessment 4	Group Presentations	LO5, 6, 7	15%	12

Reassessment Requirements	Resit module
Contact Hours and Indicative Student Workload[2]	**Contact hours:** 28 hours in class guidance and field visits **Independent Study (exercises, preparation for assessment, incl. completion of written assessment):** 70
Recommended Reading List	Wilding by Isabella Tree; Energy at the End of the Word by Laura Watts
Module Pre-requisite	n/a
Module Co-requisite	n/a
Module Website	Blackboard
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Natural Sciences School of Engineering **Admin contact:** Julie Boustie – TR064 Course Administrator
Academic Year of Date	2025/2026

Semester 2 – Optional

Module Code	BD7056

Module Name	Human Interactions with Biodiversity
ECTS Weighting[19]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	TBC
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module students will be able to: • Demonstrate knowledge of the links between biodiversity and ecosystem functioning and the flow of ecosystem services which benefit human well-being. • Articulate the pros and cons of the "Natural Capital Approach" to nature conservation. • Develop business cases for biodiversity initiatives for corporate enterprises • Appreciate human-wildlife conflict in urban temperate and tropical biodiverse areas and debate in situ nature conservation vs human livelihoods. • Carry out independent and group research, synthesise information and present in a variety of formats
Module Content	This module will address how the concepts of ecosystem services and natural capital can be used in the conservation of biodiversity. Students will explore how and why businesses might integrate biodiversity into their practices, and discuss conflicts between biodiversity conservation and human well-being.
Teaching and Learning Methods	

[19] TEP Glossary

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 1	Business and biodiversity presentation (group mark)		20%	
Continuous Assessment 2	Conflicts summary		20%	
Continuous Assessment 3	Written article		60%	

Reassessment Requirements

Contact Hours and Indicative Student Workload[2]

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

Recommended Reading List

Module Pre-requisite N/A

Module Co-requisite N/A

Module Website Blackboard Ultra

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

School of Natural Sciences

Admin contact:
Julie Boustie – TR064 Course Administrator
George Oatridge – MSc Biodiversity and Conservation Course Administrator

Academic Year of Date 2024/2025

[20] TEP Guidelines on Workload and Assessment

Module Code	CSP7001
Module Name	Introduction to Machine Learning
ECTS Weighting[21]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Giovanni Di Liberto
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: Programme learning outcomes PLO2: Analyse big data sets using technical tools to enable the better planning of cities. PLO3: Develop integrated plans to deliver smart and sustainable city interventions. PLO6: Effectively design, develop and deliver independent research focused on key elements of smart and sustainable urbanization. Module learning outcomes MLO1 Configure a programming environment suitable for exploring ML techniques MLO2 Prepare datasets for ML processing, visualise the data, and understand the consequences of decisions made in cleaning data MLO3 Assess the performance of a ML pipeline MLO4 Critically evaluate the outputs of a ML pipeline MLO5 Communicate with ML experts and non-experts: Explain goals and requirements of a project, interpret the outcomes of typical ML analyses, present results to non-experts. MLO6 Assess the cost/benefit of distinct ML methodologies and explain what makes one approach more suitable than another one for a given task MLO7. Understand challenges involving data sharing, storage, and privacy **Graduate Attributes: levels of attainment**

[21] TEP Glossary

	To act responsibly - Introduced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Attained
Module Content	Please provide a brief overview of the module of no more than 350 words written so that someone outside of your discipline will understand it. Introduction to Machine Learning is designed to offer an introduction to the basics of ML, specifically with a hands-on curriculum aimed at developing knowledge and skills in establishing ML pipelines with state of the art languages and toolkits. This module is designed for students with limited prior experience of programming. It will introduce the fundamentals of programming, with a focus on setting up an effective pipeline for processing datasets to execute common ML techniques such as Support Vector Machines and Linear Regression. Students will be assessed both on the acquired technical skills and on their ability to understand the ML pipeline and results and communicate effectively with experts and non-experts.
Teaching and Learning Methods	Lectures, tutorials, group project, guest lecture/seminar, classroom discussion

Assessment Details[22]
Please include the following:

- **Assessment Component**
- **Assessment description**

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Engagement and Communication	Group project presentation	LO2-6	10	Second last week

[22] TEP Guidelines on Workload and Assessment

• **Learning Outcome(s) addressed** • **% of total** • **Assessment due date**	Technical (coding & ML) skills	Individual laboratory assignments	LO1-4	25	Weeks 3, 6, 9
	Communication, presentation, group work	Group assignment (written report)	LO2-7	25	Final week
	Written Test	2h written test	LO2-7	40	Final week
Reassessment Requirements	100% written examination				
Contact Hours and Indicative Student Workload[2]	**Contact hours:** 28h in total: 14h lectures + 4h tutorials discussion + 3h laboratory Q&A + 3h group project discussion + 2 group project presentations + 2 written test				
	Independent Study (preparation for course and review of materials, this includes flipped classroom tutorials): 40h				
	Independent Study (preparation for assessment, incl. completion of assessment): 49h				
Recommended Reading List	- Python Crash Course: A Hands-On, Project-Based Introduction to Programming, Eric Matthes (eBook available in the TCD library) - Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, 2nd Edition, O'Reilly Media (first half of the book)				
Module Pre-requisite	None				
Module Co-requisite					
Module Website	Blackboard. Website (to be defined).				
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Computer Science				
Academic Start Year	September 2022				
Academic Year of Date	2025-26				

Module Code	DP7023
Module Name	Climate Change: Science, Development and Justic
ECTS Weighting[23]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Dr Conor Buggy (conor.buggy@ucd.ie), Dr. Susan Murphy (susan.p.murphy@tcd.ie)
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	**Learning Objectives:** This module aims to provide students with the following: - An understanding of climate change in the context of earth system science, planetary 'tipping points', and the effects of recent anthropogenic activities on climate change; - An introduction to anticipating (i.e. modelling) the future physical effects of climate change and their societal impacts, particularly with regard to development; - An understanding of how concerns regarding the impacts of climate change in the developing world came to influence the climate change agenda, and an overview of relevant legislative and policy frameworks concerning climate change at international and national levels (including adaptation and mitigation approaches to dealing with climate change in the developing world); - A projection of potential climate change impacts to public health; - Examine and critically assess justice-based issues to which climate change can give rise. **Learning Outcomes:** Having successfully completed this module a student should expect to: - Understand the concepts of earth system science and planetary boundaries, particularly within the context of recent anthropogenic activity and climate change; - Be conscious of relevant global climate processes and climate dynamics; - Be conversant with current relevant climate and development discourses and negotiations; - Be aware of the main organisations, mechanisms and legislative frameworks through which climate change is being mainstreamed within development strategies at international and national levels; - Be aware of the potential role of climate in major areas of concern for development workers, including food security, public health, water availability and security;

[23] TEP Glossary

- Understand concepts and conceptions of justice, human rights, and climate change in the light of sustainable development policy and practice;
- Demonstrate an understanding of climate justice debates;
- Understand the basics of computer-based modelling of climate change and of development-relevant climate change impacts; and
- Be able to communicate effectively the results of their research and project work to a wider audience.

Module Content

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

Teaching and Learning Methods

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

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

Assessment Details[24] Please include the following:

- **Assessment Component**
- **Assessment description**

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Written Examination	In class 2hour written examination		100%	

[24] TEP Guidelines on Workload and Assessment

• **Learning Outcome(s) addressed** • **% of total** • **Assessment due date**	Continuous Assessment 1	Class debate & write up		20%	
	Continuous Assessment 2	Debate self-reflection		10%	

Reassessment Requirements	Re-assessment, if needed, consists of
Contact Hours and Indicative Student Workload[2]	**Contact hours:** 25 to 30 hours teaching; 3 hour debate; 2 hour written examination **Independent Study (preparation for course and review of materials, preparation for assessment, incl. completion of written assessment):** 100 hours reading, specified learning activities (SLA's)
Recommended Reading List	
Module Pre-requisite	N/A
Module Co-requisite	N/A
Module Website	Blackboard Ultra
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Natural Sciences **Admin contact:** Julie Boustie – MSc Smart and Sustainable Cities Course Administrator Elaine Elders – MDP Course Administrator
Academic Year of Date	2024/2025

Module Code	ES7027
Module Name	Environmental Policies

ECTS Weighting[25]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Dr Jean Wilson
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, following lecture attendance, completion of specified learning activities and the assignments students will be able to: • Demonstrate broad knowledge of environmental law and policy and principles relevant to its application • Describe the legal framework within which environmental law in Ireland operates and identify the scheme of environmental regulation at national, European and International level • Advise management on compliance with the requirements of key environmental legislation, regulation and policy
Module Content	ES7027 Practical Environmental Assessment is designed to provide a high-level overview of environmental law and policy as an introduction to the fundamentals of law that govern how society interacts with the environment. As future scientists, consultants, and conservationists it will be impossible to successfully deliver research or projects without careful attention to the legal framework protecting the environment. The module seeks to provide you with foundations of both theoretical and empirical knowledge of environmental law and policy, as well as equipping you with an understanding of the contemporary debates and critical issues in, and perspectives on, environmental regulation.
Teaching and Learning Methods	

[25] TEP Glossary

Assessment Details[26] Please include the following:

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

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Continuous Assessment 1	Essay		45%	
Continuous Assessment 2	Group work (report and digital presentation)		40%	
Continuous Assessment 3	In-class quiz		15%	

Reassessment Requirements

Contact Hours and Indicative Student Workload[2]

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

Recommended Reading List

Module Pre-requisite N/A

Module Co-requisite N/A

Module Website Blackboard Ultra

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

School of Natural Sciences

Admin contact:
Julie Boustie – MSc Smart and Sustainable Cities Course Administrator
Elaine Elders – MDP Course Administrator

Academic Year of Date 2024/2025

[26] TEP Guidelines on Workload and Assessment

Module Code	CE7E05
Module Name	E5: Water Quality & Hydrological Modelling
ECTS Weighting[27]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Prof. Laurence Gill (Laurence.gill@tcd.ie) Asst. Prof. Liwen Xiao (liwen.xiao@tcd.ie) Asst. Prof. David O'Connell (david.oconnell@tcd.ie)
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Develop conceptual models for typical problems within the field of environmental engineering. LO2. Demonstrate an awareness of different approaches to hydro(geo)logical modelling. LO3. Calculate the dissolved oxygen sag in a water course downstream of an input of organic pollution. LO4. Develop complex water quality models for natural processes such as eutrophication and nitrification. LO5. Develop kinetic microbiological models for wastewater treatment processes. LO6. Elucidate the different conceptual flow paths through karst systems. LO7. Construct a numerical model of a lowland karst system using conceptual pipes and tanks. LO8. Interpret soil water potential curves for different soil types. LO9. Develop numerical equations for both steady water flow and transient Flow through saturated & unsaturated soils. **Graduate Attributes: levels of attainment** To act responsibly - Enhanced

[27] TEP Glossary

	To think independently - Attained To develop continuously - Attained To communicate effectively - Enhanced
Module Content	This module aims to develop the students' comprehension of the relevance and usefulness of mathematical modelling in both water quality and hydrological scenarios. This will enable students to be able to devise a conceptual model to solve typical problems within the field of environmental engineering. • Modeling approaches in hydrology Physical, mathematical and analogue modelling Aquifer testing Groundwater flow modelling Surface hydrological modeling • Water quality modelling Fundamental relationships Numerical methods Streeter-Phelps Dissolved Oxygen Model Eutrophication model Nitrification model Activated Sludge Model • Karst hydrology Karst generation / landforms Karst hydrogeology Modelling karst conduit networks

	• Modelling the vadose zone Overview & fundamentals of soil science Soil water potential & retention curves Steady water flow in saturated & unsaturated soils Unsteady water flow in saturated & unsaturated soils Solute transport Evaporation and transpiration
Teaching and Learning Methods	This module is taught by a combination of lectures and tutorials during which two assignments are discussed. Copies of the lecture presentations are given to the students just before the beginning of each lecture. The first continuous assessment, on modelling nitrogen transport through the unsaturated zone, is handed out to the students in week 4 of the module. The second continuous assessment, on modelling a constructed wetland treatment process, is handed out to the students in week 7 of the module. Both completed assignments have to be submitted by the last day of the second semester. The projects are marked and returned to the students with constructive comments.
Assessment Details[28] Please include the following: • **Assessment Component** • **Assessment description** • **Learning Outcome(s) addressed** • **% of total** • **Assessment due date**	

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Continuous Assessment 1	Modelling Assignment (unsaturated flow)	LO4, LO8, LO9	15%	Week 9
Continuous Assessment 2	Modelling Assignment (constructed wetland)	LO1, LO5	15%	Week 12
Examination	3 hour examination	LO1-LO9	70%	End of semester

[28] TEP Guidelines on Workload and Assessment

Reassessment Requirements	Re-assessment, if needed, consists of 100% Written Examination)3 hours)
Contact Hours and Indicative Student Workload[2]	**Contact hours:** 27 hrs **Independent Study (preparation for course and review of materials):** 40.5 hrs **Independent Study (preparation for assessment, incl. completion of written assessment):** 32.5 hrs
Recommended Reading List	Text books include: Water quality modelling – Steven Chapra [McGraw-Hill] Soil Physics with Hydrus – Radcliffe & Simunek [CRC Press] Introduction to Soil Physics – Hillell [Elsevier] Rainfall-runoff modelling – The Primer – Beven [Wiley]
Module Pre-requisite	N/A
Module Co-requisite	N/A
Module Website	Blackboard Ultra
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	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	CE7E06
Module Name	Water Resource Planning and Climate Change
ECTS Weighting[29]	5 ECTS

[29] TEP Glossary

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

	• Water resource planning in arid zones • Groundwater protection strategies in UK and Ireland • Climate change, energy balance, global warming, global and regional climate models • Environmental impact assessment
Teaching and Learning Methods	This module is taught by a combination of lectures and tutorials, along with one assignment, which is linked to one of the module topics. The completed assignment has to be submitted by the end of week 6 of the second semester. The projects are marked and returned to the students with constructive comments.
Assessment Details[30] Please include the following: • **Assessment Component** • **Assessment description** • **Learning Outcome(s) addressed** • **% of total** • **Assessment due date**	

Assessment Component	**Assessment Description**	**LO Addressed**	**% of total**	**Week due**
Continuous Assessment	Assignment related topics from one of LO1-6	Annually dynamic LO1-6	20%	Week 6
Examination	3 hour examination	LO1-LO6	80%	End of semester

Reassessment Requirements	
Contact Hours and Indicative Student Workload[2]	**Contact hours:** 27 hrs **Independent Study (preparation for course and review of materials):** 40.5 hrs **Independent Study (preparation for assessment, incl. completion of written assessment):** 32 hrs

[30] TEP Guidelines on Workload and Assessment

Recommended Reading List	A comprehensive reading list is provided at the beginning of the course. Texts cited include 'Hydrology in practice' by Shaw et al. (2011), 'The hydrology of the Nile' by Sutcliffe & Parks (1999), 'Hydrogeology: Principles and Practice' by Hiscock & Bense (2014), 'Water wells and boreholes' by Misstear et al. (2017), 'Water sustainability: A global perspective' by Jones (2011) and 'Introduction to Environmental Impact Assessment' by Glasson et al (2012). In addition, the module includes many case study examples, with an extensive reading list of published papers
Module Pre-requisite	No specific pre-requisite, but previous engineering hydrology module helpful.
Module Co-requisite	N/A
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	CE7J01
Module Name	J1: Wind Energy
ECTS Weighting[31]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Asst. Prof. Breiffni Fitzgerald (breiffni.fitzgerald@tcd.ie) Lecturer(s): Asst. Prof. Breiffni Fitzgerald

[31] TEP Glossary

Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Explain the impact of surface roughness and orography on wind speed profiles. LO2. Calculate wind speed at a given height using the log law and power Laws. LO3. Carry out siting assessment. LO4. Derive the Betz equation for wind power extraction using an idealized Wind turbine. LO5. Calculate power curve to analyse the impact of various control systems in a wind turbine. LO6. Explain concepts related to wind turbine design. LO7. Carry out analysis for stresses generated and fatigue design. LO8. Demonstrate ability to carry out aerodynamic analysis for a wind turbine. LO9. Describe and explain wake effects for wind farms. **Graduate Attributes: levels of attainment** To act responsibly - Attained To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Enhanced
Module Content	To develop a detailed foundation of the issues associated with the development of wind energy for electrical energy supply. The module will focus on the current state of wind energy technology domestically and internationally and will consider the future development of wind resources. Content will include: • Overview of wind energy and introduction to wind flow. • Fluid mechanics for wind energy • Wind resources and siting • Ideal wind turbines and practical constraints. Power Curves • Turbine design (tower, blades, gearbox, foundations) • Aerodynamics ad aeroelasticity • Wake effects and wind farm design • Controls in wind turbines

	• Offshore wind turbines, Joint wind and wave effects
Teaching and Learning Methods	Teaching strategies: • Lectures • Coursework • Mini projects
Assessment 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 1	Problem sheet	LO1-LO4	5%	Week 4
Continuous Assessment 2	Data analysis	LO2-LO3	25%	Week 10
Examination	3 hour examination	All	70%	End of semester

Reassessment Requirements	Reassessment Examination, 3 hours written exam, weighted 100%

Contact Hours and Indicative Student Workload[2]	**Contact hours:** 36 hrs
	Independent Study (preparation for course and review of materials): 20 hrs

[32] TEP Guidelines on Workload and Assessment

	Independent Study (preparation for assessment, incl. completion of written assessment): 70 hrs
Recommended Reading List	Wind Energy Explained: Theory, Design and Application (2009) Manwell, McGowen and Rogers, Wiley, 2nd Edition. Wind Energy Handbook (2001) Burton, Sharpe, Jenkins, Bossyani, John Wiley, New York
Module Pre-requisite	N/A
Module Co-requisite	N/A
Module Website	Blackboard Ultra
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Engineering, Civil Structural and Environmental Engineering **Admin contact:** Liam McCarthy - Executive Officer, Civil Struct & Env. Eng. Julie Boustie – TR064 Course Administrator
Academic Year of Date	2024/2025

Module Code	CE7J06
Module Name	J6: Wave Energy
ECTS Weighting[33]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Prof. Biswajit Basu (basub@tcd.ie)

[33] TEP Glossary

Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Carry out assessment of wave energy, applying wave equations and wave theory. LO2. Carry out simplified analysis using linear wave theory. LO3. Carry out nonlinear wave analysis. LO4. Analyse oscillating body systems. LO5. Analyse fixed and floating wave energy devices. LO6. Analyse mooring systems. LO7. Carry out the basic design of wave energy power systems. LO8. Calculate resource and potential outputs for wave energy systems. LO9. Articulate the social and environmental aspect of wave power systems. **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Enhanced
Module Content	To introduce the students about the theory, technology and engineering associated with wave, hydro-power, tidal and ocean energy. The topics covered are: • Introduction to wave energy resource • Hydrodynamics – Theoretical and numerical, model testing • Controls • Oscillating water column – Fixed, Floating • Oscillating body systems – single, multiple, pitching , many body • Overtopping devices • Power equipment • Moorings The aims of the module are:

1. To foster problem solving and critical thinking skills by requiring students to apply the theory learnt on wave energy to real life projects and engage in discussions with other experts.

2. To enable students to communicate well in engineering contests in relation to ocean energy, both when discussing about projects, plans and problems, and when writing, reporting and communicating about these.

3. To achieve a pro-active engagement in wave energy problems.

4. To enable students to identity, formulate, analyse and solve engineering problems by applying the theory of ocean energy both analytically and computationally.

5. To solve real world engineering problems by carrying out analysis using real data such as those available from tank tests or sea trials.

6. To solve real world engineering problems by applying the theory and employing software packages such as WecSim, Nemoh and DynaMOOC.

Teaching and Learning Methods

- Lectures
- Tutorials
- Labs

Assessment Details[34] Please include the following:

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

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Continuous Assessment	Coursework and project work during the semester (2 Theoretical assignment - 6% each, Computer assignment – 8%)	LO1-LO5, 7, 8	20%	Weeks 4, 7, 11
Examination	3 hour examination	All	80%	End of semester

[34] TEP Guidelines on Workload and Assessment

Reassessment Requirements	
Contact Hours and Indicative Student Workload[2]	**Contact hours:** 33 hrs **Independent Study (preparation for course and review of materials):** 47 hrs **Independent Study (preparation for assessment, incl. completion of written assessment):** 45 hrs
Recommended Reading List	Ocean wave energy conversion (1981) McCormick, Wiley, New York. Power from sea waves (1995) Ross, OUP, Oxford. Wave energy conversion (2003) Brooke, Elsevier, Amsterdam. Wave and Tidal Power (2011) Gerdes, Greenhaven Press, Detroit. Costal & Offshore Engineering (2011) Reid, Chadwick and Flemming.
Module Pre-requisite	Mechanics (1styear), Fluid Mechanics (2nd or 3rd year), Maths (1st and 2 nd year -Complex numbers, Linear Ordinary Differential Equations), MATLAB
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	CEP55E06
Module Name	5A2 Groundwater and Pollution ControL

ECTS Weighting[35]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Asst. Prof. David O'Connell (david.oconnell@tcd.ie)
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Solve mathematical problems concerned with groundwater flow, geophysical surveys, rock discontinuities and slope stability. LO2. Question the assumptions underlying common methods of groundwater analysis, particularly in the context of the heterogeneous nature of the bedrock aquifers found in Ireland. LO3. Develop a conceptual model of an aquifer system and plan a groundwater investigation programme, including identification of suitable drilling, geophysical and other investigation techniques. LO4. Appraise organic groundwater pollution in a variety of contexts, such as how to identify and then manage and remediate the groundwater system contaminated **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Enhanced
Module Content	This is an applied geology module aimed at civil engineers, geologists and environmental scientists. The hydrogeology component covers the analysis of groundwater flow, both regional flow and radial flow to wells, with an emphasis on teaching the student to compare and evaluate different methods of analysis, and to critically examine the underlying assumptions. Students are introduced to various techniques in groundwater investigation, borehole drilling, geophysical logging methods, well design, profile sampling. Students are also taught how to plan groundwater investigations in a systematic manner, with the aid of case studies. The

[35] TEP Glossary

groundwater pollution component deals with the analysis of organic pollutant properties and their application to groundwater contamination problems (as such, this module component is complementary to compulsory modules in the students third and fourth years which focus on water flow and quality issues).

More information here: CEU44A02.CEP55E06---Groundwater-and-Pollution-Control-24.25.pdf

This is an applied geology module aimed at civil engineers, geologists and environmental scientists. The hydrogeology component covers the analysis of groundwater flow, both regional flow and radial flow to wells, with an emphasis on teaching the student to compare and evaluate different methods of analysis, and to critically examine the underlying assumptions. Students are introduced to various techniques in groundwater investigation, borehole drilling, geophysical logging methods, well design, profile sampling. Students are also taught how to plan groundwater investigations in a systematic manner, with the aid of case studies. The groundwater pollution component deals with the analysis of organic pollutant properties and their application to groundwater contamination problems (as such, this module component is complementary to compulsory modules in the students third and fourth years which focus on water flow and quality issues).

Teaching and Learning Methods

Lectures, tutorials, demonstrations and in-class labs.

Assessment Details[36] Please include the following:

- **Assessment Component**

Assessment Component	Assessment Description	LO Addressed	% of total	Week due

[36] TEP Guidelines on Workload and Assessment

• **Assessment description** • **Learning Outcome(s) addressed** • **% of total** • **Assessment due date**	Examination	2 hour written examination	All	100%	End of semester

Reassessment Requirements	100% written examination

Contact Hours and Indicative Student Workload[2]	**Contact hours:** 32 hours lectures including lectures, tutorials, labs.
	Independent Study (preparation for course and review of materials): 40 hours; Researching journals; reading text books recommended in module booklist; reviewing lecture material and class notes; practice calculations.
	Independent Study (preparation for assessment, incl. completion of written assessment): 30 hours; literature review, review of lectures and tutorial questions.
Recommended Reading List	Groundwater and Pollution Fetter, CW (2001). Applied Hydrogeology. Fourth edition. Macmillan. Hiscock, KM & Bense, V (2014). Hydrogeology: Principles and Practice. Second edition. Wiley-Blackwell. Misstear, BDR, Banks, D & Clark, L. (2006) Water Wells and Boreholes. Wiley Reynolds, JM (2011). An introduction to Applied and Environmental Geophysics. Second edition. Wiley. C. W. Fetter, Thomas Boving, David Kreame. Contaminant Hydrogeology, Third Edition
Module Pre-requisite	N/A
Module Co-requisite	N/A

Module Website	Blackboard Ultra
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	School of Engineering, Civil Structural and Environmental Engineering **Admin contact:** Liam McCarthy - Executive Officer, Civil Struct & Env. Eng. Julie Boustie – TR064 Course Administrator
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

All students should undergo a Lab Safety training before

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

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?

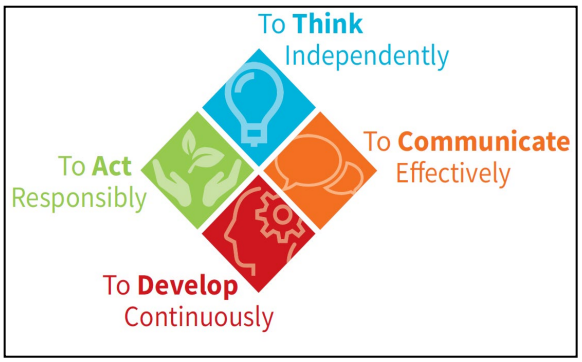
There is no right or wrong answer to this question. Writing your entire assessment using an LLM will most certainly fall under the College Academic Integrity policy. Using machine learning as a statistical method for your research project will most certainly not and might create a very exciting and state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

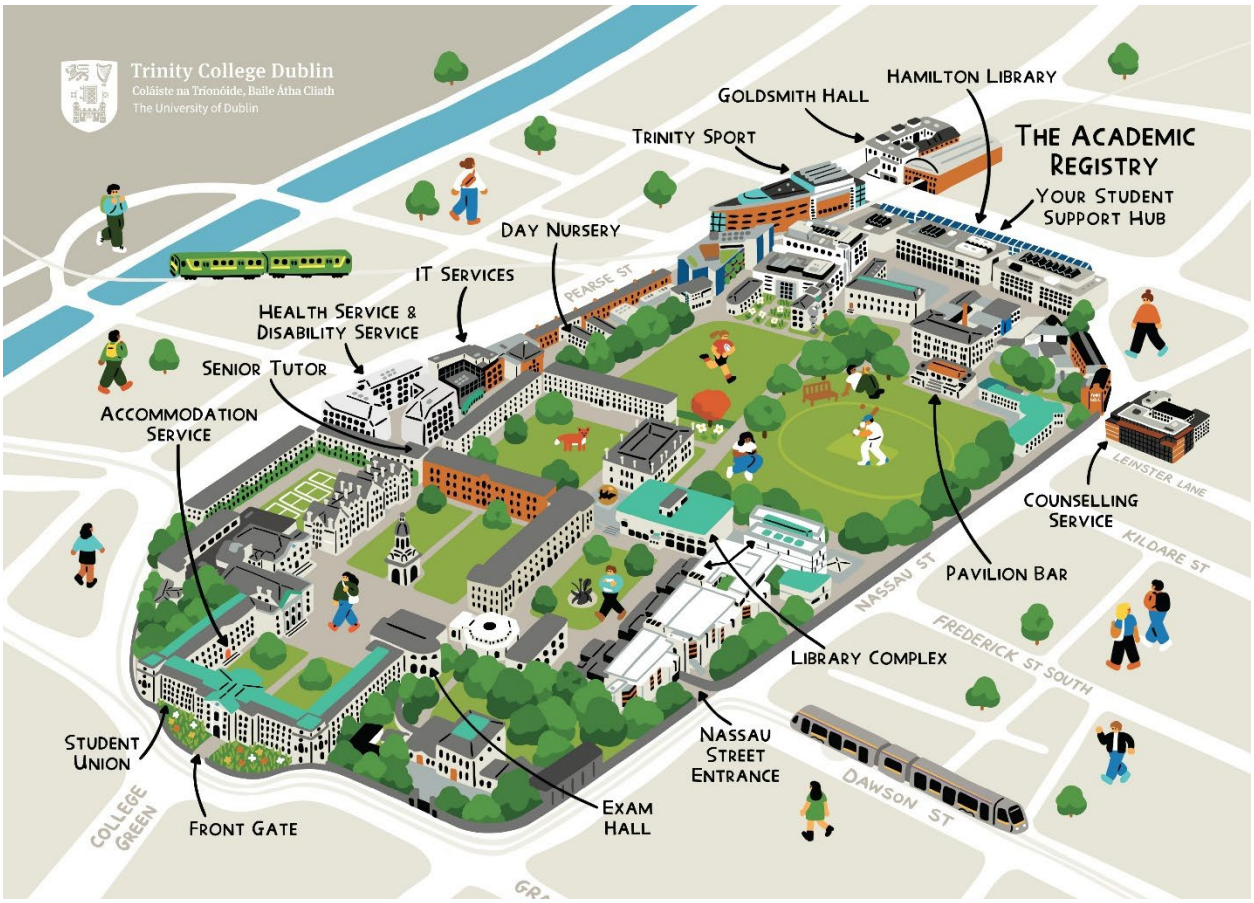
Many of the Graduate Attributes are 'slow learned', in other words, you will develop them over the four or five years of your programme of study.

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 Struct & Env. Eng.	laurence.gill@tcd.ie
ES7047 Dr. Karen Witlshire	Karen.Wiltshire@tcd.ie
ES7046 Professor Laurence Gill & Professor Jennifer McElwain	laurence.gill@tcd.ie jmcelwai@tcd.ie
CE7J02 Professor Sarah Mc Cormack, Civil Struct & Env. Eng.	sarah.mccormack@tcd.ie
CE7J04 Professor Sarah Mc Cormack, Civil Struct & Env. Eng.	sarah.mccormack@tcd.ie
CE7E07 Professor Laurence Gill, Civil Struct & Env. Eng.	laurence.gill@tcd.ie
ES7057 Professor Quentin G Crowley, Geology	crowleyq@tcd.ie
CEP55E03 Dr. John Gallagher, Civil Struct & Env. Eng.	j.gallagher@tcd.ie
CE7E04 Dr. Liwen Xiao, Civil Struct & Env. Eng.	liwen.xiao@tcd.ie

DP7023 Dr. Susan Murphy, Geography	susan.p.murphy@tcd.ie
CE7E05 Professor Laurence Gill, Civil Struct & Env. Eng.	laurence.gill@tcd.ie
CE7E06 Dr. David O'Connell, Civil Struct & Env. Eng.	DAVID.OCONNELL@tcd.ie
CE7J01 Dr. Breiffni Fitzgerald, Civil Struct & Env. Eng.	breiffni.fitzgerald@tcd.ie
CE7J06 Professor Biswajit Basu, Civil Struct & Env. Eng.	basub@tcd.ie
ES7027 Dr. Jean Wilson	wilsonj1@tcd.ie
CEP55E06 Dr. David O'Connell, Civil Struct & Env. Eng	DAVID.OCONNELL@tcd.ie
DP8017 Dr. Federico Cugurullo, Geography	cugurulf@tcd.ie
BD7056 TBC	
CSP7001 Dr. Giovanni Di Liberto, Computer Science	gdiliber@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