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

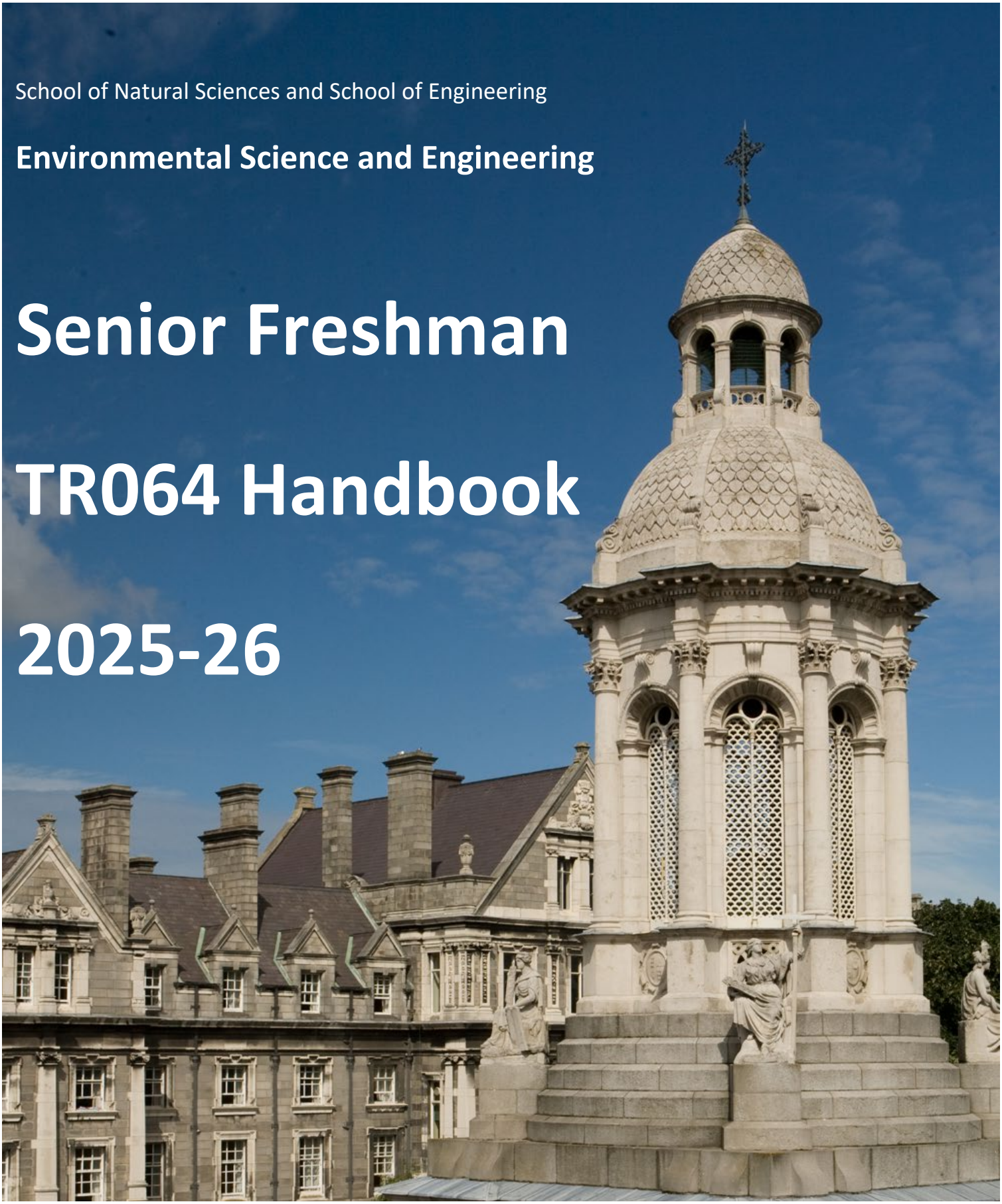
School of Natural Sciences and School of Engineering

**Environmental Science and Engineering**

# Senior Freshman

# TR064 Handbook

# 2025-26



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# Welcome

Congratulations to you all for your engagement in the Junior Freshman year of the Environmental Science and Engineering Programme and on your successful progression to Senior Freshman year. This year is going to be exciting and challenging with new modules from the biological and geological sciences, maths and engineering. You will have small cohort dedicated modules for the Environmental Science and Engineering Programme in Climate Science and the Global Carbon Cycle, Team Design; Sustainability and Nature-based Solutions and Fluid Dynamics for Environmental Engineering. These will be complemented by modules taught through the Schools of Engineering, Natural Sciences and Mathematics and Statistics that provide you with a broad and foundational knowledge base on topics such as geochemistry, sedimentary processes, water treatment, sustainable diets, UN Sustainable Development Goals, organismal biology, ecology, fluid dynamics, past, present and future climate change and nature-based and engineered solutions to address climate change. This year you will also have the opportunity to take an elective of your choice subject to timetabling constraints in Semester 2, ranging from the 'Psychology of the Climate Crisis' to the 'Art of the Megacity' to 'Black Studies'. We encourage you to think broadly in your choice of elective and to be adventurous.

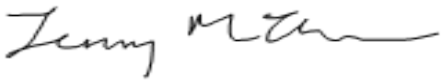
This year will be the second of two 'fresh' years of foundational learning which will be followed by two 'sophister' years of increasing specialisation in either Applied Environmental Science or Environmental Engineering. Admission to the Master's level is subject to performance in the Junior Sophister and Senior Sophister years. While there is a strong focus on scientific and technical content and problem solving in the syllabus, personal skills such as communication and teamwork are an integral part of your education. These skills are crucial in promoting an approach to lifelong learning, particularly important in today's dynamic world. The curriculum is revised on an ongoing basis and we hope that you will find it stimulating and intellectually rewarding. You will be given the opportunity to provide us with considered feedback of your experience during each year of your studies.

As you will now be aware, the College has a great deal to offer besides the formal academic programme, including the cultural, recreational and sporting activities of the many student clubs and societies. You are strongly encouraged to participate in the breadth of College life in a balanced way.

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

need arise. Each of you has been allocated a tutor, and he/she is an excellent resource to help you with identifying relevant support services. We wish you a successful and enjoyable second year at University.

Professor Jennifer McElwain



School of Natural Sciences

Professor Laurence Gill

School of Engineering

# Introduction

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

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

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

# Overall Course Objectives/ Learning Outcomes

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CLO8. Engage in lifelong professional development

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

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

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

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

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

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

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

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

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

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

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

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

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

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

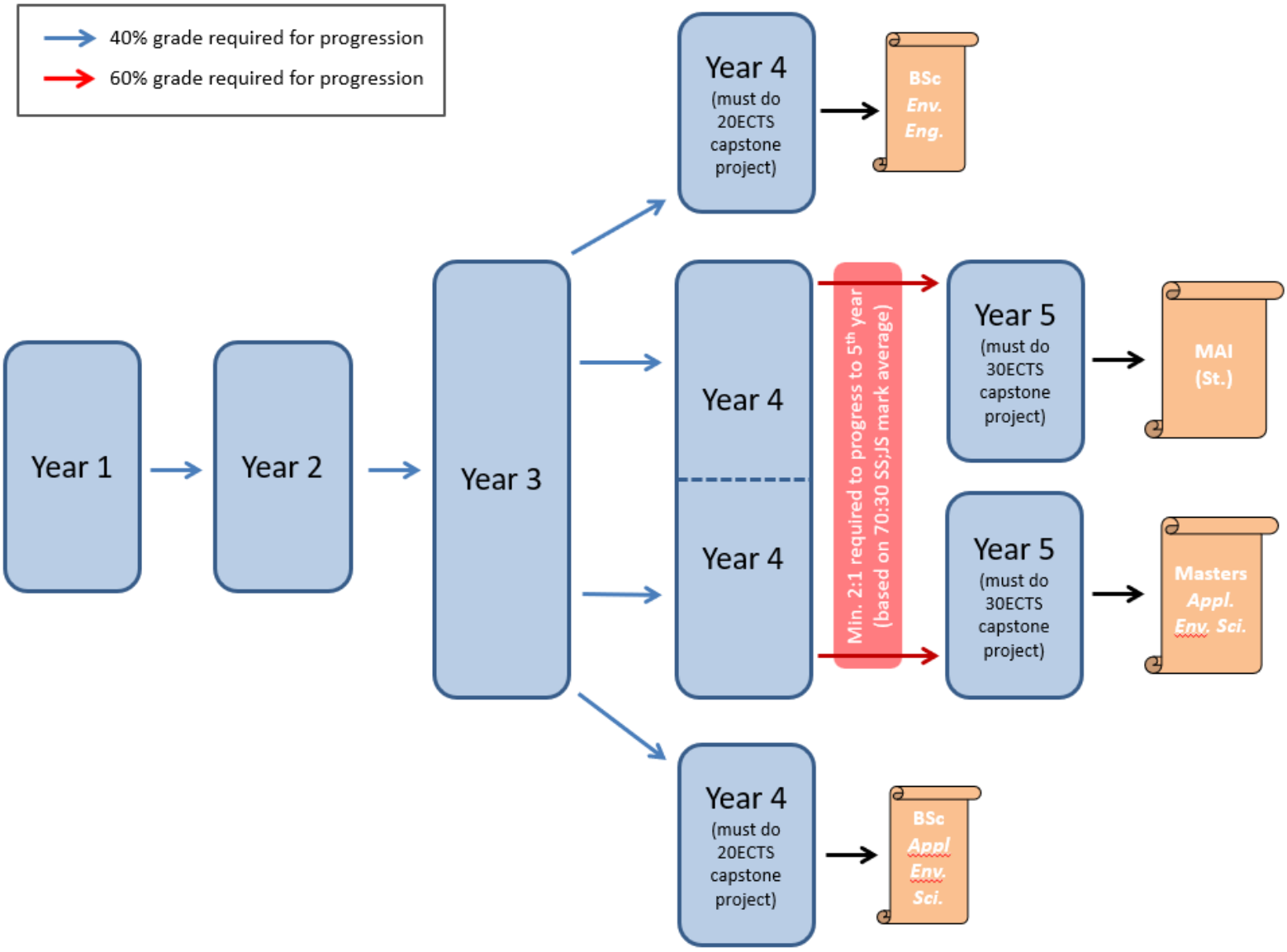
CLO4. Work effectively as an individual, in teams and in multi-disciplinary settings.

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

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

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

## Academic Progress and streaming process (Specific to Environmental Science and Engineering)



## Progression

**Year 1-4:**

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

**Year 5:**

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

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

## Streaming rules:

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

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

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

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

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

## The European Credit Transfer Accumulation System (ECTS)

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

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

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

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

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

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

# Important information for TR064 students

**Trinity Electives**

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

**Choosing your Trinity Elective**

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

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

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

## Internships and Placements

In Year 4 (Senior Sophister), Semester 2, only students who are planning to progress to Year 5 and are not participating in an Erasmus or international exchange will undertake a full-semester industry internship. This internship, worth 30 ECTS, must be in the student's chosen stream (Applied Environmental Sciences or Environmental Engineering) and offers valuable hands-on experience in a professional environment. Students who intend to exit with a BSc in Applied Environmental Science or Environmental Engineering at

the end of Year 4 will not be eligible for the internship and will instead complete a research project in Semester 2. In order to be eligible to undertake an industry internship or international exchange in Year 4, students must achieve a threshold grade of 60 per cent at the end of Year 3 (Junior Sophister). More detailed information will be provided at the start of Year 4.

## Erasmus and International Exchange

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

More information on Studying Abroad here:

Where Can I Go? - Study - Trinity College Dublin

How To Apply? - Study - Trinity College Dublin

Frequently Asked Questions - Engineering | Trinity College Dublin

## Unitech

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

More information here:

UNITECH - Engineering | Trinity College Dublin

## Capstone Project

The Capstone project is a significant level of independent research that you will carry out that will result in significant piece of original work in your final year. It will provide you with the opportunity to showcase the skills and knowledge which you have developed across a range of subject areas and across your years of study. The B.S.c capstone project is taken in 4th year by those students on the 'B.s.c Environmental Engineering' or 'B.s.c Applied Environmental Science' tracks, while the Master's project is taken in 5th year by those on the 'MAI Environmental Engineering' or 'Master's in Applied Environmental Sciences'. Please note that the internship project will NOT in any circumstances be deemed equivalent to a capstone project. College regulations require that all students must complete a capstone project to be eligible to graduate. The type of research that you will do will depend on your programme of study.

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

The Capstone should:

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

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

## Prizes, medals and other scholarships

**Foundation Scholarship**

Foundation Scholarship is a College institution with a long history and high prestige. The objective of the Foundation Scholarship examination is to identify students who, at a level of evaluation appropriate to the Senior Freshman year, can consistently demonstrate exceptional knowledge and understanding of their subjects. The questions that are asked in the engineering scholarship exams are very challenging.

They test a student's ability to think laterally, to solve unfamiliar problems and to tackle problems from first principles. Although the syllabi for the scholarship exams and the end of year exams are the same, the nature of the questions in the scholarship exams is more challenging. A good scholarship question will require a creative leap or a deep insight of the fundamental principles. The most important skill that is developed in an engineering education is problem solving. The most difficult problems to solve are those that are unfamiliar, that require a fundamental understanding of the basic principles and that require the student to make a creative or innovative leap.

**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<br>**UG new first years:**<br>- Orientation (JF UG) 15-Sept-25<br>- Classes start 22-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 – Senior Freshman (Year 2)

| Semester 1 | Semester 2 |
|---|---|
| ESU22002 – Team Design – Sustainability & Nature Based Solutions (5 ECTS) | CEU22E05 – Fluid Dynamics for Environmental Engineering (5 ECTS) |
| CEU22E07 – Engineering and the Environment (5 ECTS) | BYU22203 – From Organisms to Ecosystems (10 ECTS) |
| MAU22E01 – Engineering Maths III (5 ECTS) | MAU22E02 – Engineering Maths IV (5 ECTS) |
| BYU22210 – Sustainable Agriculture and the Bioeconomy (5 ECTS) | ESU22001 – Climate Science (5 ECTS) |
| GSU22201 – From Atoms to Rocks: Introduction to Geochemistry (5 ECTS) | Trinity Elective (5 ECTS) |
| GSU22205 – Sedimentary Processes & Environment (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<br>Module Coordinator | ECTS<br>ICA/CW/FE | Term |
|---|---|---|---|
| ESU22002 | Team Design – Sustainability & Nature Based Solutions | 5 | Michaelmas |
| | Marcus Collier | 100% CW | |
| CEU22E07 | Engineering and the Environment | 5 | Michaelmas |
| | Sarah McCormack | 100% CW | |

| | | | |
|---|---|---|---|
| MAU22E01 | Engineering Mathematics III | 5 | Michaelmas |
| | Dmitri Zaitsev | 90% FE 10% CW | |
| BYU22210 | Sustainable Agriculture and the Bioeconomy | 5 | Michaelmas |
| | Richard Nair | 70% FE 30% CW | |
| GSU22201 | From Atoms to Rocks: Introduction to Geochemistry | 5 | Michaelmas |
| | Michael Stock | 80% FE 20% CW | |
| GSU22205 | Sedimentary Processes & Environment | 5 | Michaelmas |
| | Micha Rhul | 100% CW | |
| Total | | 30 | |

ICA = In course Assessment – Formal Assessment in exam conditions

CW = Coursework

FE = Formal Examination in Annual Examination Period

## Hilary Term

| Module code | Module title<br>Module Coordinator | ECTS<br>ICA/CW/FE | Term |
|---|---|---|---|
| CEU22E05 | Fluid Dynamics for Environmental Engineering | 5 | Hilary |
| | Patrick Morrissey | 75% FE 25% CA | |
| MAU22E02 | Engineering Mathematics IV | 5 | Hilary |
| | Sergey Frolov | 90% FE 10% CW | |
| ESU22001 | Climate Science | 5 | Hilary |
| | Silvia Caldararu | 50% CW 50% FE | |
| BYU22203 | From Organisms to Ecosystems | 5 | Hilary |
| | Nessa O'Connor | 35% CW 65% FE | |
| | Trinity Elective | 5 | Hilary |
| | | 100% CW | |
| Total | | 30 | |

ICA = In course Assessment – Formal Assessment in exam conditions

CW = Coursework

FE = Formal Examination in Annual Examination Period

# Module descriptions:

## Semester 1 – Core

| | |
|---|---|
| **Module Code** | BYU22210 |
| **Module Name** | Sustainable Agriculture and the Bioeconomy |
| **ECTS Weighting**[1] | 5 ECTS |
| **Semester taught** | Semester 1 |
| **Module Coordinator/s** | Asst. Prof. Richard Nair (richard.nair@tcd.ie) |
| **Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline** | At completion of this module students should understand sustainability issues around agriculture and biological production systems (especially food, drink and drug production) in a holistic manner.<br><br>Students will:<br>1. Understand the role of agriculture in global change and the current sustainability crisis<br>2. Understand the role of diet in meeting nutritional needs in different societies<br>3. Understand, and gain practical experience in, the key techniques that are used in crop biotechnology<br>4. Be familiar with concepts and methodology of life cycle analysis of food production pathways |
| **Module Content** | Students will understand the broad concepts of sustainable development, and the role of living systems in the bioeconomy (particularly agriculture) in both the current global crises and their potential solutions.<br><br>· Sustainability as an urgent societal issue |

[1] TEP Glossary

· The role of dietary trends in sustainability

· History of agriculture and the environmental impacts of agriculture (GHGs, Nitrogen cycle, biodiversity, land use change)

· Biotechnology and innovation in the agricultural plant sciences

· Life cycle assessment as a method of assessing sustainability impacts and innovations

· Societal aspects of a sustainable transition

Practical sessions will focus on

· Genetic techniques applied in biotechnology

· Dietary analysis

· Hand-on-experience in life cycle analysis

**Teaching and Learning Methods**

2 lectures a week, 4 practicals
More information here: TR060-SF-Programme-Handbook-25-26.pdf PP 48-49

**Assessment Details[2] Please include the following:**

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

| Assessment Component | Assessment Description | LO Addressed | % of total | Week due |
|---|---|---|---|---|
| Continuous Assessment | Practical activities will be assessed by laboratory report and data analysis as appropriate. | | 30% | |
| Examination | One essay question from a choice of three (60% of examination) and compulsory short answer questions (40% of examination) – 2 hours | | 70% | End of semester |

[2] TEP Guidelines on Workload and Assessment

| | |
|---|---|
| | |
| **Reassessment Requirements** | |
| **Contact Hours and Indicative Student Workload**[2] | **Contact hours:** 16 hours lectures, 12 hours practical |
| | **Independent Study (preparation for course and review of materials):** |
| | **Independent Study (preparation for assessment, incl. completion of written assessment):** |
| **Recommended Reading List** | 1. UN Transforming our world: the 2030 Agenda for Sustainable Development - https://sustainabledevelopment.un.org/post2015/transformingourworld<br>2. Poore, J. and Nemecek, T. 2018. Reducing food's environmental impacts through producers and consumers. Science, 360 (6392), 987-992.<br>3. Willet et al., 2019. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. The Lancet Commissions, 393 (10170) 447 – 492.<br>4. Roschanger et al., 2017. A deeper shade of green: inspiring sustainable drug manufacturing. Green Chem., 2017, 19, 281-285<br>5. Muralikrishna, I.V. and Manickam, V. 2017. Life Cycle Assessement. In: Muralikrishna, I.V. and Manickam, V (eds) Environmental Management – Science and Engineering for Industry, chapter 5, pp 57-75. Butterworth Heinemann publishers.<br>6. Thorpe T. (2012) History of Plant Tissue Culture. In: Loyola-Vargas V., Ochoa-Alejo N. (eds) Plant Cell Culture Protocols. Methods in Molecular Biology (Methods and Protocols), vol 877. Humana Press, Totowa, NJ https://www.fooddrinkeurope.eu/publication/data-trends-of-the-european-food-and-drink-industry-2018/ |

| | |
|---|---|
| **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<br>Discipline of Biology<br><br>**Admin contact:**<br>Julie Boustie – TR064 Course Administrator<br>Mirela Dardac - Biology Teaching Manager<br>Daniel McCormick – Executive Officer Biology |
| **Academic Year of Date** | 2024/2025 |

| | |
|---|---|
| **Module Code** | CEU22E07 |
| **Module Name** | Engineering and the Environment |
| **ECTS Weighting**[3] | 5 ECTS |
| **Semester taught** | Semester 1 |
| **Module Coordinator/s** | Assoc Prof. Sarah McCormack (mccorms1@tcd.ie)<br>Prof. Laurence Gill (gilll@tcd.ie)<br>Asst 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 be able to:<br><br>LO1.Have a knowledge of the fundamental causes of environmental impact including a basic familiarity with the methods of analysis.<br>LO2.Have acquired knowledge of the major measures of environmental and energy sustainability.<br>LO3.Have developed skills in the areas of environmental analysis, scientific reasoning and communication. |

[3] TEP Glossary

| | |
|---|---|
| | LO4.Have developed practical experimental skills in environmental and energy measurement.<br>LO5.Appraise claims of emerging technologies in terms of sustainability and contribution to supply.<br>LO6.Gain an ability to undertake problem identification and to apply knowledge and understanding of basic science and engineering principals.<br>LO7.Gain an ability to communicate effectively, not only with engineers but more importantly with the community at large.<br>LO8.Develop a basic awareness of global development issues and approaches to ensuring that basic rights and needs are fulfilled.<br>LO9.Understand the importance of listening, engaging with and respecting local knowledge before proposing solutions.<br>LO10.Have demonstrated an understanding of the need for high ethical standards in the practice of their profession, including the responsibilities of the profession towards people and the environment.<br><br>Graduate Attributes: levels of attainment<br>To act responsibly - Introduced<br>To think independently - Introduced<br>To develop continuously - Enhanced<br>To communicate effectively - Enhanced |
| **Module Content** | **<u>Introduction:</u>**<br>• Population growth and environmental interaction; urbanisation; correlation of energy and economic growth; energy and environmental impact<br>• Introduction to concepts of sustainability, pollution and contamination<br>• Introduction to UN SDGs with focus on Energy and Water<br><br>**<u>Environmental measurements and analysis</u>**<br>• Introduction: Concentrations, flux, units and conversions<br>• Mass Balance: The control volume concept, conservation of mass in the control volume, terms in the mass balance equation |

| | |
|---|---|
| | • Mass transport processes: Advection, dispersion and dilution Environmental chemistry<br>• Chemistry in the natural environment:<br>• Chemical equilibria: Examples of equilibrium processes: volatilisation, air/water equilibrium, dissolution/precipitation, sorption<br>• Chemical kinetics: rate laws<br><br>**Biological Processes**<br>• Clean water, Sanitation and Diseases<br>• Carrying capacity: Monod kinetics; Modelling microbial growth<br>• Energy flow in ecosystems: Sources of energy; photosynthesis and primary production. Food chains, food webs, and the energy pyramid<br>• Nutrients and eutrophication in natural waters: trophic state and water quality<br><br>**Energy demand & Supply**<br>• Energy and environmental impact: greenhouse gases, carbon cycle, climate change<br>• Energy demand – how much do we use? Sectoral usage, electricity, heating<br>• Energy supply - low-carbon generation: wind, wave, tidal, photovoltaic, biofuels, nuclear, solar, geothermal, storage<br>• How much energy use is sustainable?<br><br>**Engineers without Borders (EWB)**<br>• Focus on UNSDG of Water and Energy in international development.<br>• Appraising sustainable energy and water technologies for international development projects.<br>• Groupwork to focus on Energy & Water solutions for EWB National competition |
| **Teaching and Learning Methods** | The module is taught using a combination of lectures, guest lectures laboratories, tutorials and workshops. Students work individually and in groups thereby encouraging teamwork and cooperation.<br><br>**Associated laboratory/project/tutorial programme**<br>• Individual Project: Energy & Water consumption |

• Laboratory: Measurement of dispersion in a fluid
• Tutorials on all sections of course with 2 marked class tests
• Groupwork on the EWB design solutions

Lectures will be given face to face as well as live streamed and recorded.

**Assessment Details[4] Please include the following:**

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

| **Assessment Component** | **Assessment Description** | **LO Addressed** | **% of total** | **Week due** |
|---|---|---|---|---|
| Continuous Assessment 1 | Dispersion laboratory | 4,6 | 10% | 1 week after lab session |
| Continuous Assessment 2 | Individual report on energy and water usage | 2, 3, 4, 6 | 10% | Week 4 |
| Continuous Assessment 3 | Class tests: biological and chemical concepts | 4,6 | 20% | Week 8 and week 10 |
| Continuous Assessment 4 | EWB workshops<br>Write up on progress at each tutorial | 1 to 10 | 10% | Weeks 2-11 |
| Continuous Assessment 5 | Posters and group presentation on EWB concept | 1 to 10 | 10% | Week 11 or 12 |
| Continuous Assessment 6 | Group report on EWB concept | 1 to 10 | 30% | Week 12 |

[4] TEP Guidelines on Workload and Assessment

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|---|---|
| **Reassessment Requirements** | |
| **Contact Hours and Indicative Student Workload**[2] | **Contact hours:** 47 hrs (33hrs lectures, 3 hr lab, 11hrs tutorials)<br>**Independent Study (preparation for course and review of materials):** 40 hours<br>**Independent Study (preparation for assessment, incl. completion of written assessment):** 40 hours |
| **Recommended Reading List** | Recommended reading Environmental Engineering: Fundamentals, Sustainability, Design, JR Mihelcic, JB Zimmerman, 2010, Wiley [ISBN: 978- 0470165058]<br><br>Heat - How to Stop the Planet From Burning, George Monbiot, South End Press, 2009 [ISBN: 978-0896087873] |
| **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<br><br>**Admin contact:**<br>Liam McCarthy - Executive Officer, Civil Struct & Env. Eng.<br>Julie Boustie – TR064 Course Administrator |
| **Academic Year of Date** | 2024/2025 |

| | |
|---|---|
| **Module Code** | ESU22002 |
| **Module Name** | Team Design – Sustainability & Nature Based Solutions |
| **ECTS Weighting**[5] | 5 ECTS |

[5] TEP Glossary

| | |
|---|---|
| **Semester taught** | Semester 1 |
| **Module Coordinator/s** | Associate Prof. Marcus Collier (SNS) (marcus.collier@tcd.ie)<br>Assistant Prof. Muhammad Ali (Engineering) (Muhammad.Ali@tcd.ie)<br>Mary-Liz Walshe (maryliz.walshe@gmail.com) |
| **Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline** | LO1. Demonstrate a full comprehension of nature and natural systems as engineering technologies<br>LO2. Demonstrate a rounded knowledge of the human-nature interface and the concept of co-benefits<br>LO3. Competently discuss the interactions between the Sustainable Development Goals and the realities of designing, planning, building and managing urban and rural landscapes;<br>LO4. Demonstrate an ability to communicate effectively with peers and to a non-academic audience<br>LO5. Develop and apply critical analysis skills.<br>LO6. Develop and apply transferable skills. |
| **Module Content** | Team Design in Sustainability & Nature-based Solutions is an E3 module that brings together expertise from the Schools of Engineering and Natural Sciences with Tangent – Trinity's Ideas Workspace. The module aims to deepen students understanding that Earth's resources are finite and that future development must be sustainable. Students will work in small teams co-supervised by professors in Engineering and Natural Sciences to develop technological, engineered and/or nature-based solutions to specific local environmental problems in a classroom based setting. For example, student will be challenged to quantify the impacts of passive hydrological solutions (wetlands etc.) with respect to flood attenuation or to do a life cycle analysis on different household sustainable energy retrofits. Project topics will be strongly aligned with seven of the UN Sustainable Development Goals. These include Goal 6. Clean Water and Sanitation, Goal 7. Affordable and Clean Energy, Goal 11. Sustainable Cities and Consumption, Goal 12. Responsible Consumption and Production, Goal 13. Climate Action, Goal 14. Life Below Water and Goal 15. Life on Land. |

**Teaching and Learning Methods**

The module is taught primarily through lectures, group discussions and student-led thematic challenges. Students will work individually and in teams in both supervised (tutorials) and timetabled unsupervised (workshops) formats thereby encouraging teamwork, cooperation and independence. This module will consist of some introductory lectures and in-class discussion, which includes a reflexive journal assignment. This will be followed by a field visit to the case study site that will be the subject of the team design. Students will be randomly assigned groups and will work independently on the team assignment, carrying our research and revisiting their assigned case study location to carry out in-field research. The design process will consist of weekly in-class workshops with tutors present for consultation. This also includes lectures on report writing and poster presentation. The module will culminate in a poster session, where each student will present a poster on a specific topic withing their groups' assigned case study location, and its relationship to one or more of the SDGs. This poster session will be accompanied by a flash talk and short Q&A session. The poster session will be attended by the wider faculty, postgraduates, and invited non-academic guests, all of whom will assess and grade the presentations.

**Assessment Details[6] Please include the following:**

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

| Assessment Component | Assessment Description | LO Addressed | % of total | Week due |
|---|---|---|---|---|
| Continuous Assessment 1 | Attendance & Contribution / involvement in Tutorial | LO1 to LO6 | 10% | All |
| Continuous Assessment 2 | Reflexive Journal | LO1 | 10% | Week 6 |
| Continuous Assessment 3 | Group Presentation | LO1 to LO6 | 20% | Week 11 |
| Continuous Assessment 4 | Group Report | LO1 to LO6 | 20% | Week 11 |

[6] TEP Guidelines on Workload and Assessment

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|---|---|---|---|---|---|
| | Continuous Assessment 5 | Poster Presentation | LO1 to LO6 | 40% | Week 12 |

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|---|---|
| **Reassessment Requirements** | Re-assessment, if needed, consists of resitting the module |
| **Contact Hours and Indicative Student Workload**[2] | **Contact hours:** 25 hours<br>**Independent Study (preparation for course and review of materials):** 45 hours<br>**Independent Study (preparation for assessment, incl. completion of written assessment):** 45 hours |
| **Recommended Reading List** | Peer reviewed literature on student chosen topic<br><br>Blackboard resources |
| **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<br><br>**Admin contact:**<br>Julie Boustie – TR064 Course Administrator |
| **Academic Year of Date** | 2025/2026 |

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|---|---|
| **Module Code** | GSU22201 |
| **Module Name** | From Atoms to Rocks: Introduction to Geochemistry |

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|---|---|
| **ECTS Weighting**[7] | 5 ECTS |
| **Semester taught** | Semester 1 |
| **Module Coordinator/s** | Dr. Michael Stock and Dr Juan Diego Rodriguez-Blanco |
| **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:<br>• Illustrate the importance of geochemistry in Earth Sciences and the relationship between geochemistry and geology, environmental chemistry, oceanography, soil sciences and biology.<br>• Describe the electronic structure of atoms and ions, as well as the periodic table and the arrangement of atoms to form solids.<br>• Describe the main geochemical reservoirs Earth and the processes responsible for distributing elements within the crust and mantle.<br>• Outline the most relevant physicochemical phenomena occurring when minerals are dissolved in melts and aqueous solutions.<br>• Illustrate the most important processes occurring during the interaction of minerals/rocks with water and their relevance to environmental quality and therefore to humans.<br>• Define radiogenic and non-radiogenic isotope systematics and their importance in Earth Science.<br>• Relate the relevance of the carbon cycle and carbonate minerals with life, ocean evolution, climate and availability of elements. |
| **Module Content** | Geochemistry is a branch of Earth Sciences that uses chemical principles to study how the geosphere, hydrosphere, atmosphere and biosphere interact to process and distribute elements. This module will introduce fundamental chemical concepts, using geological examples to demonstrate their importance in Earth Science. The module provides an overview of high- and low-temperature geochemistry, outlining both how elements are processed in the Earth's crust/mantle, and providing an overview of the interaction between dissolved elements in natural waters and the rocks which they come in contact. |

[7] TEP Glossary

**Teaching and Learning Methods**

**Assessment Details**[8] **Please include the following:**

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

| Assessment Component | Assessment Description | LO Addressed | % of total | Week due |
|---|---|---|---|---|
| Continuous Assessment | Practical assessment 2x problem-based activities | | 20% | |
| Examination | Written examination, 1.5 hours | | 80% | End of semester |

**Reassessment Requirements**

**Contact Hours and Indicative Student Workload**[2]

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

**Recommended Reading List**

Ryan, P. (2014) Environmental and Low Temperature Geochemistry. Wiley-Blackwell.

White, W. M. (2013) Geochemistry. Wiley-Blackwell.

**Module Pre-requisite**

N/A

[8] TEP Guidelines on Workload and Assessment

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|---|---|
| **Module Co-requisite** | N/A |
| **Module Website** | Blackboard Ultra |
| **Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.** | School of Natural Sciences, Geology Department<br><br>**Admin contact:**<br>Débora Dias – Executive Officer, Geology<br>Julie Boustie – TR064 Course Administrator |
| **Academic Year of Date** | 2024/2025 |

| | |
|---|---|
| **Module Code** | GSU22205 |
| **Module Name** | Sedimentary Processes & Environments |
| **ECTS Weighting**[9] | 5 ECTS |
| **Semester taught** | Semester 1 |
| **Module Coordinator/s** | Dr Micha Ruhl<br>Prof Jerry Dickens, Dr Robin Edwards |
| **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:<br>• Classify sediments and sedimentary rocks<br>• Provide technical descriptions of common sedimentary rock types and textures from hand samples and thin sections<br>• Explain the basic concept of "source-to-sink", and how this links weathering of mountains, and transport and deposition of sediments<br>• Describe changes in sedimentary archives from outcrop observations, stratigraphic logs and/or petrological evidence |

[9] TEP Glossary

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|---|---|
| | • Describe (changes in) in sedimentary archives, and interpret these in regard to changes in physical, geochemical and biological Earth surface processes, and changing environments<br>• Distinguish and describe temporal and spatial variability in Earth surface processes and how this links to sediment deposition locally<br>• Illustrate how Global Change processes (physical/ geochemical/biological) (have) shape(d) Earth's surface, in the past, present, and future |
| **Module Content** | Earth's climate and environments have changed on multiple temporal and spatial scales throughout its history, which significantly impacted on physical, chemical and biological processes across Earth's surface. Information on past climates and environments, stored in sedimentary archives, informs our understanding on present-day conditions at Earth's surface and provides constraints on future changes. Sedimentary materials storing such information can be found across most of the Earth's crust, both on land and in the oceans, and much of our understanding of Earth history comes from their examination.<br><br>This Module will introduce key physical, chemical, biological and sedimentary processes, deposits and examples of contemporary sedimentary depositional environments. It will analyse and explain the generation, transport and preservation of sediments, as diagnostic tools to link surface processes with the geological records of Earth history, as well as modern environmental change.<br>To achieve the module learning aims, the module will introduce examples of environmental change, and their impact on the sedimentary depositional environment at that time, such as Snowball Earth, Oceanic Anoxic Events, Hyperthermals, the Messinian Salinity Crisis, and Quaternary GlacialInterglacial Cycles.<br>The above described module will prepare the student for related modules in Stratigraphy, Climate Change, Oceanography, as well as fieldwork, in Junior and Senior Sophister. |

**Teaching and Learning Methods**

**Module Aims**

Sediments and sedimentary rocks hold a rich history of how physical, chemical, and biological processes have changed over space and time. This module is designed to give basic information, so that the evolution of Earth's surface can be understood. We will share how one can take sediments and sedimentary rocks and reconstruct the past and appreciate the processes that led to what we can
see today. This module will provide the fundamentals of sediments and sedimentary rocks, and how to think about Earth evolution.

The module will develop understanding of:

• Geological time

• Basic sedimentary rock-analyses: from observation, to interpretation

• How sediments are generated transported, deposited & preserved

• Different sedimentary depositional environments across the Earth system (past & present; continental & marine)

• How sedimentary archives provide records of (changes in) the past Earth system and past environmental & climate change processes

**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 1 | Laboratory practical's | | 50% | |
| Continuous Assessment 2 | In-course problem solving exercises and tests | | 50% | |

[10] TEP Guidelines on Workload and Assessment

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

| | |
|---|---|
| **Module Code** | MAU22E01 |
| **Module Name** | Engineering mathematics III |
| **ECTS Weighting**[11] | 5 ECTS |
| **Semester taught** | Semester 1 |
| **Module Coordinator/s** | Prof. Dmitri Zaitsev |

[11] TEP Glossary

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|---|---|
| **Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline** | On successful completion of this module, students will be able to<br>• Relate linear systems, linear transformations and their matrices.<br>• Check whether a system of vectors is linearly independent and/or a basis.<br>• Calculate the dimension of a subspace.<br>• Calculate the rank and the nullity of a matrix.<br>• Construct a basis for the row, column and null spaces of a matrix.<br>• Calculate the eigenvalues and the eigenvectors of a square matrix.<br>• Apply the Gram-Schmidt process to transform a given basis into an orthogonal basis.<br>• Solve ordinary differential equations using general and particular solutions.<br>• Calculate the Fourier series of a given function and analyse its behaviour.<br>• Apply Fourier series to solve ordinary differential equations.<br>• Calculate the Fourier transformation of a given function. |
| **Module Content** | • Euclidean n-space and n-vectors.<br>• Linear transformations and their matrices, subspaces, linear combinations of vectors, subspaces spanned by a set of vectors, linear independence of a set of vectors.<br>• Basis and dimension, standard basis in n-space, coordinates of vectors relative to a basis.<br>• General and particular solutions for a linear system.<br>• Row, column and null space of a matrix, finding bases for them using elementary row operations, rank and nullity of a matrix.<br>• Inner products, lengths, distances and angles.<br>• Orthogonal and orthonormal bases relative to an inner product, orthogonal projections to subspaces, Gram-Schmidt process.<br>• Eigenvalues and eigenvectors of square matrices.<br>• Fourier series for periodic functions, Euler formulas for the Fourier coefficients, even and odd functions, Fourier cosine and Fourier sine series, Fourier integral and Fourier transform. |
| **Teaching and Learning Methods** | |
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**Assessment Details**[12] **Please include the following:**

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

| **Assessment Component** | **Assessment Description** | **LO Addressed** | **% of total** | **Week due** |
|---|---|---|---|---|
| Continuous Assessment | Coursework | | 10% | |
| Examination | Written examination 2 hours | | 90% | |

**Reassessment Requirements**

Re-assessment, if needed, consists of 100% exam

**Contact Hours and Indicative Student Workload**[2]

| |
|---|
| **Contact hours:** 11 weeks of teaching with 3 lectures and 1 tutorial per week |
| **Independent Study (preparation for course and review of materials):** |
| **Independent Study (preparation for assessment, incl. completion of written assessment):** |

**Recommended Reading List**

Advanced engineering mathematics by Erwin Kreyszig.

Elementary linear algebra with applications by Anton and Rorres.

**Module Pre-requisite**

N/A

**Module Co-requisite**

N/A

**Module Website**

Blackboard Ultra

**Are other Schools/Departments involved in the delivery**

School of Mathematics
School of Engineering

**Admin contact:**

[12] TEP Guidelines on Workload and Assessment

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|---|---|
| **of this module? If yes, please provide details.** | Julie Boustie – TR064 Course Administrator<br>Emma Clancy - Administrative Officer School of Mathematics |
| **Academic Year of Date** | 2024/2025 |

## Semester 2 – Core

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|---|---|
| **Module Code** | BYU22203 |
| **Module Name** | From Organism to Ecosystems II |
| **ECTS Weighting**[13] | 10 ECTS |
| **Semester taught** | Semester 2 |
| **Module Coordinator/s** | Professor Nessa O'Connor |
| **Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline** | On completion of this module students should understand some fundamental principles of evolution, genetics, animal and plant diversity, physiology and be able to describe characteristic features of selected ecosystems and their ecology. |
| **Module Content** | **Lectures:**<br>• Diversity of life: Conquering the land<br>• Diversity of life: fungi, lichens, algae, angiosperms<br>• Diversity of life: animals, phylogeny and early evolution<br>• Diversity of life: tetrapods and evolution of humans<br>• Diversity of life: animal feeding strategies<br>• Diversity of life: animal reproductive behaviour<br>• Diversity of life: plant reproductive strategies |

[13] TEP Glossary

- Darwin
- Natural selection
- Species and speciation
- Coevolution
- The evolution of sex and sexual selection
- Kin selection
- Evolution of reciprocity
- The molecular basis of Mendelian genetics.
- The principles of population genetics
- Fitness and selection
- Genetic drift and neutral evolution
- Molecular phylogenetics
- Applied evolutionary genetics
- Animal metabolism
- Thermoregulation and water stress in plants
- Animal nutrition and digestion
- Plant nutrition and digestion
- Circulation and gas exchange in animals
- Circulation and Gas exchange in plants
- Life in extreme environments: evolutionary adaptations
- Interactions between organisms including mutualisms
- Global climates and biomes
- Terrestrial ecosystems: forests and grassland
- Ecological modelling
- Terrestrial ecosystems: desert, tundra and peatland
- Freshwater ecosystems: rivers and lakes
- Marine ecosystems: estuaries
- Marine ecosystems: coastal waters and open seas
- Impacts of global climate change
- Genes to ecosystems

**Practical's:**

1. Practical 1 – Molecular Phlyogenetics.
2. Practical 2 - Altruism.
3. Practical 3 - Animal Physiology.
4. Practical 4 - Plant Physiology.
5. Practical 5 - Computer based ecological modelling.

More information here TR060-SF-Programme-Handbook-25-26.pdf pp 20-27

**Teaching and Learning Methods**

**Assessment Details[14] Please include the following:**

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

| Assessment Component | Assessment Description | LO Addressed | % of total | Week due |
|---|---|---|---|---|
| Continuous Assessment | 5 Practical's assessments | | 35% | |
| Examination | Written examination, 50 short answer/ multiple choice questions 2.5 hours | | 65% | End of semester |

**Reassessment Requirements**

Re-assessment, if needed, consists of

**Contact Hours and Indicative Student Workload[2]**

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| **Contact hours:** 38 hours lectures and 15 hours practical's |
| **Independent Study (preparation for course and review of materials):** |

[14] TEP Guidelines on Workload and Assessment

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|---|---|
| | **Independent Study (preparation for assessment, incl. completion of written assessment):** |
| **Recommended Reading List** | Recommended Reading List: The topics and concepts presented in this module can be found in selected chapters of the following textbooks:<br>• Biology, A global Approach. Campbell et al. 12TH Edition. Pearson. Introduction to Genetic Analysis, chapter 18 (Griffiths et al., 12th edition).<br>• Introduction to Genetic Analysis. Griffiths, Wessler, Carroll, Doebley (11th edition). W.H. Freeman and Co.<br>• The Evolution of Plants. 2 nd Edition. K.J. Willis & J.C. McElwain. Oxford University Press.<br>• Marine Ecology: processes, systems and impacts. 3 rd Edition. Kaiser et al., Oxford University Press |
| **Module Pre-requisite** | N/A |
| **Module Co-requisite** | N/A |
| **Module Website** | Blackboard Ultra |
| **Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.** | School of Natural Sciences, Biology<br>**Admin contact:**<br>Julie Boustie – TR064 Course Administrator<br>Mirela Dardac- Biology Teaching Manager<br>Daniel McCormick – Executive Officer, Biology |
| **Academic Year of Date** | 2024/2025 |

| | |
|---|---|
| **Module Code** | CEU22E05 |
| **Module Name** | Fluid Dynamics for Environmental Engineering |

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|---|---|
| **ECTS Weighting**[15] | 5 ECTS |
| **Semester taught** | Semester 2 |
| **Module Coordinator/s** | Asst. Professor Patrick Morrissey |
| **Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline** | On successful completion of this module, students should be able to:<br><br>1. Analyse, generate mathematical models, solve problems, and communicate the solutions of simple fluid based engineering problems including pressures and forces on submerged surfaces.<br><br>2. Explain the principles underpinning basic measurement devices such as venturi meters and Pitot static tubes.<br><br>3. Determine forces generated in systems such as jets and propellers.<br><br>4. Distinguish between ideal and real flows and evaluate practical problems associated with pipe flow systems.<br><br>5. Conceptualise and describe practical flow systems such as boundary layers and their importance in engineering analysis.<br><br>6. Evaluate fluid properties and solve basic problems using property tables, property diagrams and equations of state.<br><br>7. Analyse, generate mathematical models, solve problems, and communicate the solutions to practical closed systems and steady- flow devices by applying the conservation of energy principle.<br><br>8. Demonstrate basic laboratory procedures safely.<br><br>9. Perform laboratory tasks as a group.<br><br>10. Communicate information, analyse data and provide physical interpretation of measurements in technical laboratory reports. |

[15] TEP Glossary

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|---|---|
| **Module Content** | This module aims to develop the students' comprehension and relevance of fluid dynamics in both engineered treatment systems and natural water- based environmental systems. The course covers both hydrostatics as well as the principles of conservation of mass and momentum, laminar and turbulent flows, pipe flows and boundary layers for case of fluids in motion. This will enable students to develop numerical solutions to solve typical problems within the field of environmental engineering / science.<br>• **Introduction:** Definition of a fluid, fluid properties, equation of state<br>• **Hydrostatics:** Measurement of pressure, thrust on submerged surfaces<br>• **Principles of Fluid Motion:** Description of fluid flow; continuity equation; Euler and Bernoulli equations; Pitot total head and static tubes, venturi- meters, orifice plates;<br>• **Momentum Equation:** Momentum equation for steady flow; applications to jet flows, impinging flows in pipe bends; momentum theory of propellers;<br>• **Laminar and Turbulent Flow:** Reynolds demonstration of flow regimes; criterion for laminar/ turbulent flow, Reynolds number<br>• **Pipe Flow:** Fully developed flow; laminar pipe flow; turbulent pipe flow, friction factor, friction losses, other losses<br>• **Boundary Layers and Wake:** Description of the boundary layer; laminar and turbulent boundary layers; physical, displacement & momentum thickness; effect of pressure gradient –separation and wake formation; drag forces |
| **Teaching and Learning Methods** | |

**Assessment Details**[16] **Please include the following:**

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

| Assessment Component | Assessment Description | LO Addressed | % of total | Week due |
|---|---|---|---|---|
| Continuous Assessment | Coursework | | 25% | |
| Examination | 2-hour written examination | | 75% | End of semester |

**Reassessment Requirements**

**Contact Hours and Indicative Student Workload**[2]

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

**Recommended Reading List**

Fundamentals of Fluid Mechanics - Munson et al., [Wiley]

Hydraulics in Civil & Environmental Engineering – Chadwick et al. [Spon]

**Module Pre-requisite**

N/A

**Module Co-requisite**

N/A

**Module Website**

Blackboard Ultra

**Are other Schools/Departments involved in the delivery**

School of Natural Sciences
School of Engineering

**Admin contact:**

[16] TEP Guidelines on Workload and Assessment

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|---|---|
| **of this module? If yes, please provide details.** | Liam McCarthy - Executive Officer, Civil Struct & Env. Eng.<br>Julie Boustie – TR064 Course Administrator |
| **Academic Year of Date** | 2024/2025 |

| | |
|---|---|
| **Module Code** | ESU22001 |
| **Module Name** | Climate Science and the Global Carbon Cycle |
| **ECTS Weighting**[17] | 5 ECTS |
| **Semester taught** | Semester 2 |
| **Module Coordinator/s** | Assistant Professor Silvia Caldararu (caldaras@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:<br><br>1. Understand the fundamental concepts behind the greenhouse effect and the Earth' radiation budget<br><br>2. Understand the fundamental concepts behind the ocean and terrestrial carbon cycles<br><br>3. Conceptualise and discuss current and future impacts of climate change<br><br>4. Handle and interpret global datasets and model predictions on current and future climate<br><br>5. Critically understand and discuss climate solutions |

[17] TEP Glossary

| | |
|---|---|
| **Module Content** | Global climate change is one of the most important, if not the most important problems facing humanity today. To be able to predict future changes in climate and their impacts and to design realistic climate solutions, we need to understand the physical and biological components of the Earth system and their interactions. Topics covered in this course include:<br>- Observational evidence for climate change<br>- Putting things into perspective: current anthropogenic climate change versus long-term natural change<br>- The greenhouse effect and the Earth's radiation budget<br>- The terrestrial and oceanic carbon cycle<br>- The IPCC reports and predictions, earth system models<br>- Extreme events and their effects on ecosystems and human lives and infrastructure: storms, droughts, fires, insect outbreaks<br>- Glacial melt, sea level rise, permafrost melt<br>- Climate solutions |
| **Teaching and Learning Methods** | Practicals and lectures |

**Assessment Details[18] Please include the following:**

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

| Assessment Component | Assessment Description | LO Addressed | % of total | Week due |
|---|---|---|---|---|
| Continuous Assessment | Coursework | | 50% | TBC |
| Examination | Written examination 1.5 hours | | 50% | End of semester |

[18] TEP Guidelines on Workload and Assessment

| | |
|---|---|
| **Reassessment Requirements** | Re-assessment, if needed, consists of 100% Written Examination |
| **Contact Hours and Indicative Student Workload**[2] | **Contact hours:** 3h lectures/week and 18h practicals throughout the semester<br>**Independent Study (preparation for course and review of materials):**<br>**Independent Study (preparation for assessment, incl. completion of written assessment):** |
| **Recommended Reading List** | *Bonan, Gordon. Ecological climatology: concepts and applications. Cambridge University Press, 2015.* |
| **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<br>**Admin contact:**<br>Julie Boustie – Course Administrator |
| **Academic Year of Date** | 2025/2026 |

| | |
|---|---|
| **Module Code** | MAU22E02 |
| **Module Name** | Engineering mathematics IV |
| **ECTS Weighting**[19] | 5 ECTS |
| **Semester taught** | Semester 2 |

[19] TEP Glossary

| | |
|---|---|
| **Module Coordinator/s** | Adam Keilthy |
| **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<br>• Analyse the behaviour of functions of several variables, present the results graphically and calculate partial derivatives of functions of several variables (including those which are defined implicitly).<br>• Obtain equations for tangent lines to plane curves and for tangent planes to space surfaces.<br>• Apply derivative tests to find local and global minima and maxima of functions of several variables.<br>• Calculate multiple integrals in Cartesian, polar, cylindrical and spherical coordinates, and in particular, find areas, volumes, masses and centres of gravity of two- and three-dimensional objects.<br>• Determine whether a vector field is conservative, find a potential function for a conservative field, and use it to calculate line integrals.<br>• Use Green's, Stokes' and the divergence theorems to calculate double, surface and flux integrals.<br>• Solve differential equations using the Laplace transform. |
| **Module Content** | • **Vector-valued functions:** Introduction to vector-valued functions, calculus of vector-valued functions, change of parameter, arc length, unit tangent vector, normal and binormal vectors.<br>• **Partial derivatives:** Functions of two or more variables, limits and continuity, differentiability, differentials, local linearity, chain rule, directional derivatives and gradients, tangent planes and normal vectors, maxima and minima of functions of two variables.<br>• **Multiple integrals:** Double integrals over non-rectangular regions, double integrals in polar coordinates, surface area, parametric surfaces, triple integrals in cylindrical and spherical coordinates, centre of gravity, change of variables in multiple integrals, Jacobians.<br>• **Topics in vector calculus:** vector fields, line integrals, independence of path, conservative vector fields, Green's theorem, applications of surface integrals, flux, divergence theorem, Stokes' theorem.<br>• **Laplace transforms:** linearity, first shifting theorem, transforms of derivatives, ordinary differential equations, Heaviside function, second shifting theorem, short impulses, Dirac's delta function, convolutions. |

| | |
|---|---|
| **Teaching and Learning Methods** | |
| **Assessment Details[20] Please include the following:**<br>• **Assessment Component**<br>• **Assessment description**<br>• **Learning Outcome(s) addressed**<br>• **% of total**<br>• **Assessment due date** | |

| **Assessment Component** | **Assessment Description** | **LO Addressed** | **% of total** | **Week due** |
|---|---|---|---|---|
| Continuous Assessment | Coursework | | 10% | |
| Examination | Written examination 2 hours | | 90% | End of semester |

| | |
|---|---|
| **Reassessment Requirements** | Re-assessment, if needed, consists of 100% exam |
| **Contact Hours and Indicative Student Workload[2]** | **Contact hours:** 11 weeks of teaching with 3 lectures and 1 tutorial per week.<br>**Independent Study (preparation for course and review of materials):**<br>**Independent Study (preparation for assessment, incl. completion of written assessment):** |
| **Recommended Reading List** | |
| **Module Pre-requisite** | N/A |
| **Module Co-requisite** | N/A |

[20] 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 Mathematics<br>School of Engineering<br><br>**Admin contact:**<br>Julie Boustie – TR064 Course Administrator<br>Emma Clancy - Administrative Officer School of Mathematics |
| **Academic Year of Date** | 2024/2025 |

# School Policies and Procedures

## Health and Safety

### Health

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

### Accidents

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

### Fire Safety

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

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

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

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

Bomb Alerts

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

### Risk Assessment

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

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

## Labs and Fieldcourses

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

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

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

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

**My TCD**

**Year One - Engineering | Trinity College Dublin**

**Year Two - Engineering | Trinity College Dublin**

Year Three - Engineering | Trinity College Dublin

Year Four - Engineering | Trinity College Dublin

## Attendance

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

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

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

## Marking

**Guidelines on Grades for Essays and Examination Answers**

| | Criteria |
|---|---|
| 90-100 | Exceptional Answer; This answer will show original thought and a sophisticated insight into the subject, and mastery of the available information on the subject. It should make compelling arguments for any case it is putting forward, and show a rounded view of all sides of the argument. In exam questions, important examples will be important examples will be supported by attribution to relevant authors, and while not necessarily giving the exact date, should show an awareness of the approximate period. In essays, the referencing will be comprehensive and accurate, supported by attribution to relevant authors, and while not necessarily giving the exact date, should show an awareness of the approximate period. In essays, the referencing will be comprehensive and accurate. |

| | |
|---|---|
| 80-89 | OUTSTANDING ANSWER; This answer will show frequent originality of thought and make new connections between pieces of evidence beyond those presented in lectures. There will be evidence of awareness of the background behind the subject area discussed, with evidence of deep understanding of more than one view on any debatable points. It will be written clearly in a style which is easy to follow. In exams, authors of important examples may be provided. In essays all important examples will be referenced accurately. |
| 70-79 | INSIGHTFUL ANSWER; showing a grasp of the full relevance of all module material discussed, and will include one or two examples from wider reading to extend the arguments presented. It should show some original connections of concepts. There will be only minor errors in examples given. All arguments will be entirely logical, and well written. Referencing in exams will be sporadic but referencing should be present and accurate in essays |
| 65-69 | VERY COMPREHENSIVE ANSWER; good understanding of concepts supported by broad knowledge of subject. Notable for synthesis of information rather than originality. Evidence of relevant reading outside lecture notes and module work. Mostly accurate and logical with appropriate examples. Occasionally a lapse in detail. |
| 60-64 | LESS COMPREHENSIVE ANSWER; mostly confined to good recall of module work. Some synthesis of information or ideas. Accurate and logical within a limited scope. Some lapses in detail tolerated. Evidence of reading assigned module literature |
| 55-59 | SOUND BUT INCOMPLETE ANSWER; based on module work alone but suffers from a significant omission, error or misunderstanding. Usually lacks synthesis of information or ideas. Mainly logical and accurate within its limited scope and with lapses in detail.. |
| 50-54 | INCOMPLETE ANSWER; suffers from significant omissions, errors and misunderstandings, but still with understanding of main concepts and showing sound knowledge. Several lapses in detail. |
| 45-49 | WEAK ANSWER; limited understanding and knowledge of subject. Serious omissions, errors and misunderstandings, so that answer is no more than adequate. |
| 40-44 | VERY WEAK ANSWER; a poor answer, lacking substance but giving some relevant information. Information given may not be in context or well explained, but will contain passages and words, which indicate a marginally adequate understanding. |
| 30-39 | MARGINAL FAIL; inadequate answer, with no substanceor understanding, but with a vague knowledge relevant to the question. |
| 0-29 | UTTER FAILURE; with little hint of knowledge. Errors serious and absurd. Could also be a trivial response to the misinterpretation of a question. |

**Guidelines on Marking Projects/Dissertation Assessment**

| Mark Range | Criteria |
|---|---|
| **90 - 100%** | Exceptional project report showing broad understanding of the project area and exceptional knowledge of the relevant literature. Exemplary presentation and analysis of results, logical organisation and ability to critically evaluate and discuss results coupled with insight and novelty/originality. Overall an exemplary project report of publishable quality (e.g. peer reviewed scientific journal/patent application). |
| **80 - 89%** | An excellent project report clearly showing evidence of wide reading far above that of an average student, with excellent presentation and in-depth analysis of results. Clearly demonstrates an ability to critically evaluate and discuss research findings in the context of relevant literature. Obvious demonstration of insight and novelty/originality. An excellently executed report overall of publishable quality (e.g. short peer reviewed conference paper such as IEEE) with very minor shortcomings in some aspects. |
| **70 - 79%** | A very good project report showing evidence of wide reading, with clear presentation and thorough analysis of results and an ability to critically evaluate and discuss research findings in the context of relevant literature. Clear indication of some insight and novelty/originality. A very competent and well-presented report overall but falling short of excellence in some aspects. Sufficient quality and breadth of work similar to the requirements for an abstract at an international scientific conference. |
| **60 - 69%** | A good project report which shows a reasonably good understanding of the problem and some knowledge of the relevant literature. Mostly sound presentation and analysis of results but with occasional lapses. Some relevant interpretation and critical evaluation of results, though somewhat limited in scope. General standard of presentation and organization. |
| **50 - 59%** | A moderately good project report which shows some understanding of the problem but limited knowledge and appreciation of the relevant literature. Presentation, analysis and interpretation of the results at a basic level and showing little or no novelty/originality or critical evaluation. |
| **40 - 49%** | A weak project report showing only limited understanding of the problem and superficial knowledge of the relevant literature. Results presented in a confused or inappropriate manner and incomplete or erroneous analysis. Discussion and interpretation of result severely limited, including some basic misapprehensions, and lacking any novelty/originality or critical evaluation. General standard of presentation poor. |

| | |
|---|---|
| **20 - 39%** | An unsatisfactory project containing substantial errors and omissions. Very limited understanding, or in some cases misunderstanding of the problem and very restricted and superficial appreciation of the relevant literature. Very poor, confused and, in some cases, incomplete presentation of the results and limited analysis of the results including some serious errors. Severely limited discussion and interpretation of the results revealing little or no ability to relate experimental results to the existing literature. Very poor overall standard of presentation. |
| **0 - 19%** | A very poor project report containing every conceivable error and fault. Showing virtually no understanding or appreciation of the problem and of the literature pertaining to it. Chaotic presentation of results, and in some cases incompletely presented and virtually non-existent or inappropriate or plainly wrong analysis. Discussion and interpretation seriously confused or wholly erroneous revealing basic misapprehensions. |

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

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

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

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

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

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

*8.3.1 Submission guidelines*

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

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

*8.3.2 Policy on late submission*

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

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

*8.3.3 Policy on participation in continuous assessment-based modules*

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

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

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

Further details on the conduct of examinations and submission of assessed work in the College Calendar, Part II, pages 35-37, 39 general-regulations-and-information.pdf

## Access to Scripts and other assessed work

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

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

## Re-check/re-mark of examination scripts and other assessed work

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

(a) that the grade is incorrect because of an error in calculation of results;

(b) that the examination paper or other assessment specific to the student's course contained questions on subjects which were not part of the course prescribed for the examination or other assessment; or

(c) that bias was shown by an examiner in marking.

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

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

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

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

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

## Plagiarism

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

We ask you to take the following steps:

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

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

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

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

## Use of AI tools in academic work

*Statement prepared by Dr Sylvia Caldararu*

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

AI tools are increasingly being incorporated into workflows in professional contexts and it is important that you familiarise yourself with what AI can do and what are its limitations and pitfalls. Keep in mind that a lot of information available on the topic on the internet is biased and produced by individuals and

companies that are trying to sell AI products or by people who are, rightfully, angry that their work has been used for AI training without their consent (see 'Ethical concerns' below).

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

**Definitions**

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

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

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

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

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

**Accuracy concerns**

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

**Ethical concerns**

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

**Environmental concerns**

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

**Should I use AI in my academic work?**

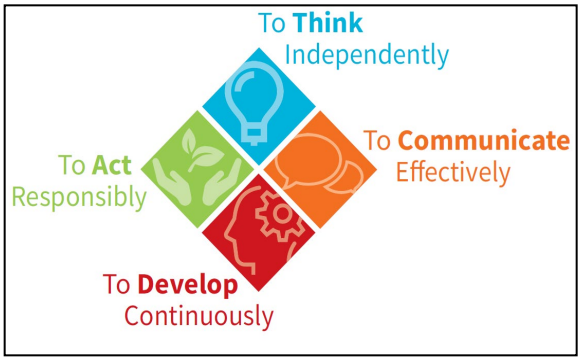
There is no right or wrong answer to this question. Writing your entire assessment using an LLM will most certainly fall under the College Academic Integrity policy. Using machine learning as a statistical method for your research project will most certainly not and might create a very exciting and state of the art project. Beyond that, use your judgment, keeping in mind the caveats above. Some modules will have a specific AI policy, and you should follow that. If in doubt, do not hesitate to ask the module coordinator.

# Graduate Attributes

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

The four Trinity Graduate Attributes are:

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




**Why are the Graduate Attributes important?**

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

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

**How will I develop these Graduate Attributes?**

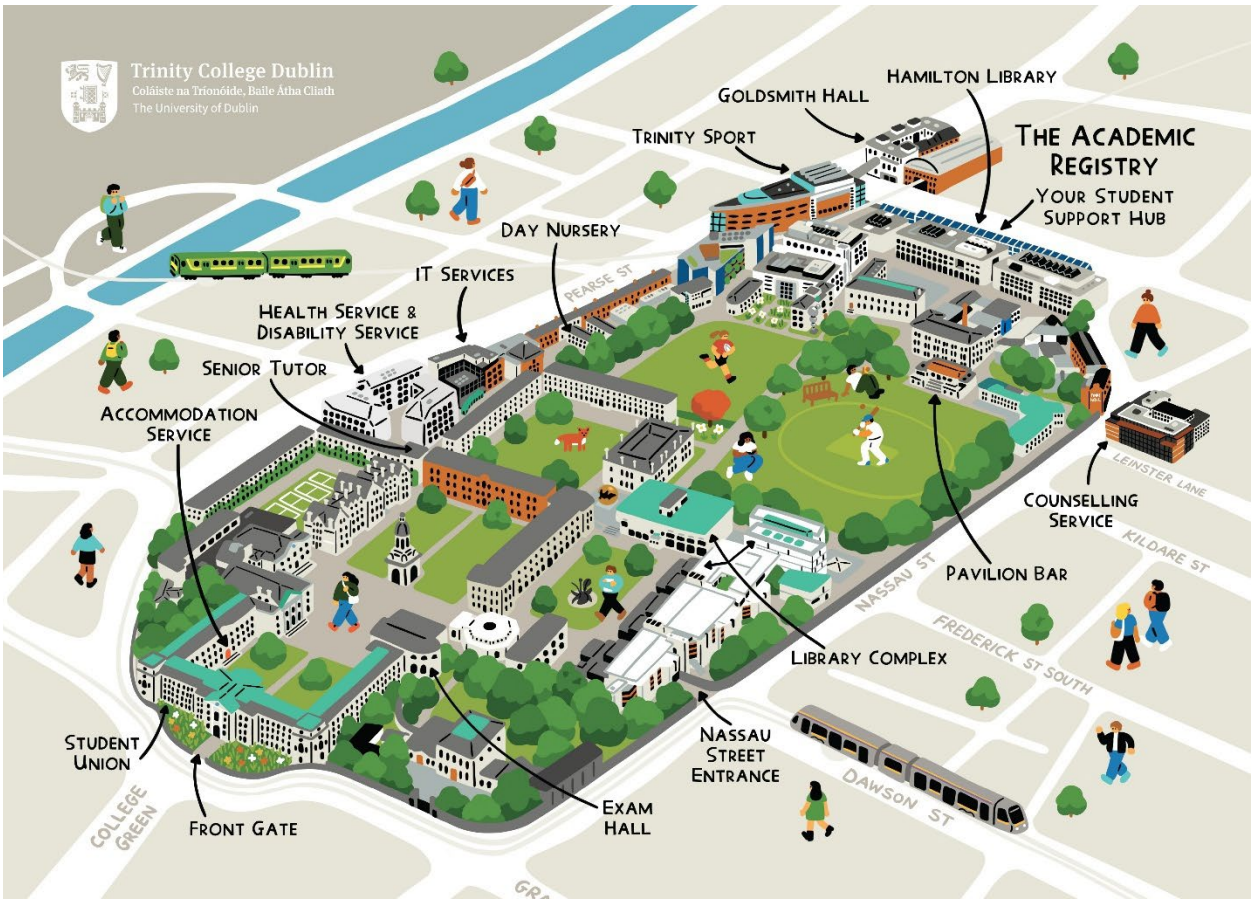
Many of the Graduate Attributes are 'slow learned', in other words, you will develop them over the four or five years of your programme of study.

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

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

# Important Information

## Student Services




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

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

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

## Trinity Tutorial Service (Undergraduate Students)

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

### Opening Hours and Appointments

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

### What is a Tutor?

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

### When should I go to see my Tutor?

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

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

## Disability Services

The Disability Service aims to provide appropriate advice, support and information to help students and staff with disabilities. The Disability Service has in place a range of supports to ensure that students with disabilities have full access to the same facilities for study and recreation as their peers. Most students registering with the Disability Service request access to a range of supports that help the student reach

their full potential while studying. Most students' needs are accommodated through these supports. The student decides what level of support they require.

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

## Student Learning Development

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

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

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

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

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

# Student Health and Wellbeing

## College Health Service

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

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

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

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

## Student Counselling

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

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

Phone: (01) 896 1407

Email: student-counselling@tcd.ie

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

## Student Life

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

## Academic Registry

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

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

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

## Student Accommodation

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

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

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

# Contact:

## Module coordinators List

Contact list per module

| Staff | Email |
|---|---|
| **Course Director**<br>Professor Jennifer McElwain – Botany | jmcelwai@tcd.ie |
| **Course Director**<br>Professor Laurence Gill – Civil Struct & Env. Eng | laurence.gill@tcd.ie |
| **ESU22002**<br>Dr. Marcus Collier – Botany<br>Dr. Muhammad Ali – Civil Struct & Env. Eng | <br>colliema@tcd.ie<br>muhammad.ali@tcd.ie |
| **CEU22E07**<br>Professor Sarah Mc Cormack – Civil Struct & Env. Eng | sarah.mccormack@tcd.ie |
| **MAU22E01**<br>Professor Dmitri Zaitsev – Pure & Applied Mathematics | zaitsev@maths.tcd.ie |
| **BYU22210**<br>Dr. Richard Nair – Botany | RICHARD.NAIR@tcd.ie |
| **GSU22201**<br>Dr. Michael Stock – Geology | michael.stock@tcd.ie |
| **GSU22205**<br>Dr. Micha Ruhl – Geology | micha.ruhl@tcd.ie |
| **CEU22E05**<br>Dr. Patrick Morrissey – Civil Struct & Env. Eng | morrisp5@tcd.ie |
| **BYU22203** | oconnn18@tcd.ie |

| | |
|---|---|
| Professor Nessa O'Connor – Zoology | |
| **MAU22E02**<br>Professor Sergey Frolov – Pure & Applied Mathematics | frolovs@tcd.ie |
| **ESU22001**<br>Dr. Silvia Caldararu - Botany | caldaras@tcd.ie |

## Discipline Staff and Admin contact List

| **Administrative staff** | **School** | **Email** |
|---|---|---|
| Julie Boustie<br>**TR064 Course Administrator** | School of Natural Sciences | envscieng@tcd.ie<br>boustiej@tcd.ie |
| James Higgins<br>**School Manager** | School of Natural Sciences | schoolofnaturalsciences@tcd.ie |
| Patricia Hughes<br>**School Manager** | School of Engineering | engineering@tcd.ie |
| Fiona Moloney<br>**Undergraduate Administrative Coordinator** | School of Natural Sciences | FIMOLONY@tcd.ie |
| Zara Cassidy-Coss<br>**Administrative Officer, School Office** | School of Engineering | ZCASSIDY@tcd.ie |
| Liam McCarthy<br>**Executive Officer, Civil Structural and Environmental Engineering** | School of Engineering | lmccart4@tcd.ie |
| Lou Bodenhemier<br>**Executive Officer Botany** | School of Natural Sciences | ZOBOES@tcd.ie |
| Débora Dias<br>**Executive Officer, Geology** | School of Natural Sciences | EARTH@tcd.ie |
| Helen O'Halloran<br>**Executive Officer, Geography** | School of Natural Sciences | Geography@tcd.ie |
| TBC<br>**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<br><br>Calendar, Part III, GeneralRegulations, Section I |
| Student Supports<br>Co-curricular activities<br>TCDSU, GSU &<br>student representationstructures | Student Supports |
| Emergency Procedures | **Standard Text:** In the event of anemergency, **dial Security Serviceson extension 1999**<br><br>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.<br><br>Should you require any emergency or rescue services on campus, you must contact Security Services.<br>This includes chemical spills,personal injury or first aid assistance.<br><br>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<br>Calendar, Part III, General Regulations & Information,Section I 'Plagiarism'<br>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<br><br>Calendar, Part III, Section III,'Examinations, Assessment and Progression'<br><br>Academic Policies |
| Reference to Relevant University Regulations | Academic Policies<br><br>Student ComplaintsProcedure<br>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/<br>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<br><br>Calendar, Part II, Part C<br><br>Calendar, Part III, Section III 'Examinations, Assessment and Progression' and 'Assessment and ProgressionRegulations' |
| Awards | National Framework forQualifications<br>Trinity PathwaysTrinity Courses |
| Professional and Statutory Body Accreditation | Provided by School/Discipline Handbooks where applicable |
| Careers<br>Information &events | https://www.tcd.ie/Science/careers/ |
| External Examiner | Procedure for the transfer ofstudents assessed work to external examiners |
| Capstone<br>(UG Programmes) | Capstone website<br>Policy on Good ResearchPractice |
| Attendance Requirements | Calendar, Part B, General Regulations and Information<br>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<br>Student Partnership Policy<br>Procedure for the conduct ofFocus Groups |