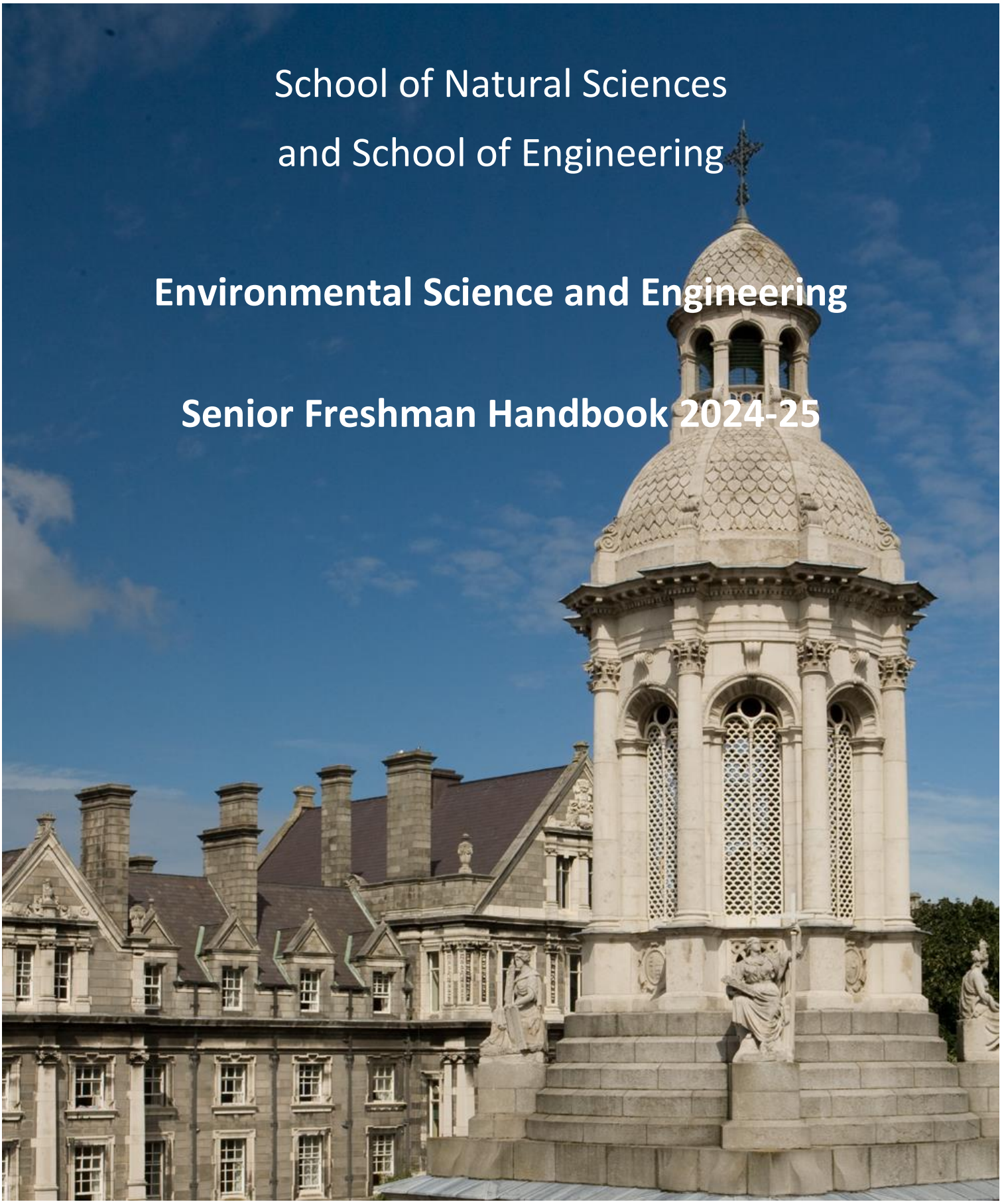
Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin



School of Natural Sciences

and School of Engineering

Environmental Science and Engineering

Senior Freshman Handbook 2024-25

Contents

Statement on General Regulations

All students are encouraged to fully familiarise themselves with colleges rules and general regulations which can be found here: https://www.tcd.ie/calendar/undergraduate-studies/general-regulations-and-information.pdf Your attention is drawn to the University Calendar Part II (the relevant parts of which are available at registration, or from your tutor) and, in particular, sections that outline general rules governing all student's progression and attendance through College. The information provided in this handbook is accurate at the time of preparation. Any necessary revisions will be notified to students via email. In the event of any conflict or inconsistency between the General Regulations published in the University Calendar and information contained in course/departmental handbooks, the provisions of the General Regulations will prevail.

Welcome

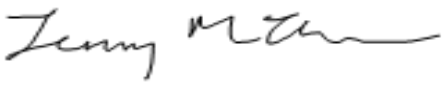
Congratulations to you all for your engagement in the Junior Freshman year of the Environmental Science and Engineering Programme and on your successful progression to Senior Freshman year. This year is going to be exciting and challenging with new modules from the biological and geological sciences, 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

Course Objectives and Learning Outcomes

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.

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 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 engineering activities with the engineering community and with society at large;

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

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; and

LO9: Display high ethical standards in the practice of engineering, including the responsibilities of the engineering profession towards people and the environment. 5

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; and

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 issues;

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

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; and

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

The European Credit Transfer System

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.

Modules and Module Descriptors

Semester 1	Semester 2
ESU22002 – Team Design – Sustainability & Nature Based Solutions (5 ECTS)	CEU22E07 – 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)
BYU22204 – Sustainable Production: Food, Drink and Drugs (5 ECTS)	ESU22001 – Climate Science & The Global Carbon Cycle (5 ECTS)
GSU22201 – From Atoms to Rocks (5 ECTS)	Trinity Elective (5 ECTS)
GSU22205 – Sedimentary Processes & Environments (5 ECTS)	

Module Code: **ESU22002**

Module Name: **Team Design – Sustainability & Nature Based Solutions**

ECTS: **5 ECTS**

Semester Taught: **Semester 1**

Module Coordinators:

Associate Prof. Marcus Collier (School of Natural Sciences) (marcus.collier@tcd.ie); Assistant Prof. Muhammad Ali (School of Engineering) (Muhammad.Ali@tcd.ie); Mary-Liz Walshe maryliz.walshe@gmail.com

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.

Learning Outcomes:

LO1. Demonstrate a full comprehension of nature and natural systems as engineering technologies

LO2. Demonstrate a rounded knowledge of the human-nature interface and the concept of co-benefits

LO3. Competently discuss the interactions between the Sustainable Development Goals and

the realities of designing, planning, building and managing urban and rural landscapes;

LO4. Demonstrate an ability to communicate effectively with peers and to a non-academic audience

LO5. Develop and apply critical analysis skills.

LO6. Develop and apply transferable skills

Recommended Reading:

Peer reviewed literature on student chosen topic

Blackboard resources

Exam Details: 100% Continuous Assessment

Module Code: **CEU22E07**

Module Name: **Engineering & the Environment**

ECTS: **5 ECTS**

Semester Taught: **Semester 1**

Module Coordinators:

Assoc Prof. Sarah McCormack (mccorms1@tcd.ie)

Prof. Laurence Gill (laurence.glll@tcd.ie)

Asst Prof. Liwen Xiao (liwen.xiao@tcd.ie)

Module Content:

Introduction

Population growth and environmental interaction; urbanisation; correlation of energy and economic growth; energy and environmental impact

Introduction to concepts of sustainability, pollution and contamination

Environmental measurements and analysis

Introduction: Concentrations, flux, units and conversions

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

Chemistry in the natural environment:

Chemical equilibria: Examples of equilibrium processes: volatilisation, air/water equilibrium, dissolution/precipitation, sorption

Chemical kinetics: rate laws

Tutorials on all sections of course with marked MCQ tests

Biological Processes

Clean water, Sanitation and Diseases

Carrying capacity: Monod kinetics; Modelling microbial growth

Energy flow in ecosystems: Sources of energy; photosynthesis and primary production. Food chains, food webs, and the energy pyramid

Nutrients and eutrophication in natural waters: trophic state and water quality.

Energy demand & Supply

- Energy and environmental impact: greenhouse gases, carbon cycle, climate change
- Energy demand – how much do we use? Sectoral usage, electricity, heating
- Energy supply - low-carbon generation: wind, wave, tidal, photovoltaic, biofuels, nuclear, solar, geothermal, storage
- How much energy use is sustainable?

Learning Outcomes:

On successful completion of this module, students should be able to:
1. Outline the fundamental causes of environmental impact including the associated methods of analysis.

2. Discuss the major measures of environmental and energy sustainability.

3. Utilise environmental analysis, scientific reasoning and communication skills.

4. Apply practical experimental skills in environmental and energy measurement.

5. Appraise claims of emerging technologies in terms of sustainability and contribution to supply.

6. Undertake problem identification using basic scientific and engineering principals.

7. Discuss global development issues and approaches to ensuring that basic rights and needs are fulfilled.

8. Listen, engage with and respect local knowledge before proposing solutions.

9. Explain the need for high ethical standards in the practice of their profession, including the responsibilities of the profession towards people and the environment.

Recommended Reading:

Environmental Engineering: Fundamentals, Sustainability, *Design,* JR Mihelcic, JB Zimmerman, 2010, Wiley [ISBN: 978-0470165058]

Heat - How to Stop the Planet From Burning, George Monbiot, South End Press, 2009 [ISBN: 978-0896087873]

Assessment Details:

Laboratory – 10 %

Individual report on energy and water usage – 10%

Class tests – 20%

EWB tutorial – 10%

Poster -10%

Presentation – 10%

EWB report – 30%

Module Code: **MAU22E01**

Module Name: **Engineering Maths III**

ECTS: **5 ECTS**

Semester Taught: **Semester 1**

Module Coordinators: **Associate Prof. Dmitri Zaitsev (zaitsevd@tcd.ie)**

Module Content:

Euclidean n-space and n-vectors

- Linear transformations and their matrices; subspaces; linear combinations of vectors; Subspaces spanned by a set of vectors; linear independence of a set of vectors
- Basis and dimension; standard basis in n-space; coordinates of vectors relative to a basis
- General and particular solutions for a linear system
- Row, column and null space of a matrix, finding bases for them using elementary row operations, rank and nullity of a matrix
- Inner products, lengths, distances and angles relative to them;
- Orthogonal and orthonormal bases relative to an inner product, orthogonal projections to subspaces, Gram-Schmidt Process;
- Best approximation by the least squares method;

- Eigenvalues and eigenvectors of square matrices

- Fourier series for periodic functions, Euler formulas for the Fourier coefficients, even and odd functions, Fourier cosine and Fourier sine series for them, Fourier integral and Fourier transform.

Learning Outcomes:

On successful completion of this module, students should be able to:
1. Pass effectively between linear systems, linear transformations and their matrices.

2. Analyse a system of vectors for linear dependence and for being a basis.

3. Calculate dimension of a subspace.

4. Calculate the rank and nullity of a matrix and understand their importance.

5. Construct a basis for row, column, and null spaces of a matrix.

6. Calculate eigenvalues and eigenvectors of matrices.

7. Apply the Gram-Schmidt process to transform a given basis into orthogonal one.

8. Apply methods of general and particular solutions to ordinary differential equations.

9. Calculate the Fourier series of a given function and analyse its behaviour.

10. Apply Fourier series to solving ordinary differential equations.

11. Calculate the Fourier transformation.

Recommended Reading:

Elementary Linear Algebra (with applications), Anton and Rorres, Chapters 4 - 7

Advanced Engineering Mathematics, Kreyszig, Chapter 10

Assessment Details:

Continuous Assessment - 10%

Examination (2 hours) – 90%

Module Code: **BYU22204**

Module Name: **Sustainable Production: Food, Drink and Drugs**

ECTS: **5 ECTS**

Semester taught: **Semester 1**

Module Coordinators: Asst. Prof. Richard Nair (richard.nair@tcd.ie)

Module Content:

The aims of this course are to familiarise the student with concepts of sustainable development, ecological farming, green pharma, sustainable diets, novel food and drink products, and how environmental impacts are assessed by Life Cycle Assessment methodologies. of the food/drink and drug industry are assessed using Life Cycle Assessment methodologies (LCA). Practicals will focus on biotechnology (tissue culture), brewing (students will produce their own SMASH beer – single malt and single hop beer) and environmental LCAs of dietary protein sources ((meta-analysis of published data).

Learning Outcomes:

On successful completion of this module, students should be able to:

LO1. Summarise the UN Sustainability Goals

LO2. Make informed decisions with respect to diet and food choice

LO3. Explain concepts and methodology associated with Life Cycle Assessment of food production pathways

LO4. Comprehend the role of tissue culture in biotechnology

LO5. Demonstrate the processes involved in beer production

LO6. Work as part of a team.

Recommended Reading:

1. UN Transforming our world: the 2030 Agenda for Sustainable Development - https://sustainabledevelopment.un.org/post2015/transformingourworld

2. Poore, J. and Nemecek, T. 2018. Reducing food's environmental impacts through producers and consumers. Science, 360 (6392), 987-992.

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.

4. Roschanger et al., 2017. A deeper shade of green: inspiring sustainable drug manufacturing. Green Chem., 2017, 19, 281-285

Assessment Details:

Examination – 50%

Continuous Assessments – 50%

Module Code: **GSU22205**

Module Name: **Sedimentary Processes & Environments**

ECTS: **5 ECTS**

Semester Taught: **Semester 1**

Module Coordinators: **Asst. Prof. Micha Ruhl (micha.ruhl@tcd.ie)**

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. 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. 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. 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.

Learning Outcomes:

On successful completion of this module students will be able to:

LO1. Classify sediments and sedimentary rocks

LO2. Provide technical descriptions of common sedimentary rock types and textures from hand samples and thin sections

LO3. Explain the basic concept of “source-to-sink”, and how this links weathering of mountains, and transport and deposition of sediments17

LO4. Describe changes in sedimentary archives from outcrop observations, stratigraphic logs and/or petrological evidence.

LO5. Describe (changes in) in sedimentary archives, and interpret these in regard to changes in physical, geochemical and biological Earth surface processes, and changing environments

LO6. Distinguish and describe temporal and spatial variability in Earth surface processes and how this links to sediment deposition locally

LO7. Illustrate how Global Change processes (physical/ geochemical/biological) (have) shape(d) Earth’s surface, in the past, present, and future

Module Code: **GSU22201**

Module Name: **From Atoms to Rocks: Introduction to Geochemistry**

ECTS: **5 ECTS**

Semester taught: **Semester 1**

Module Coordinators: Asst. Professor Michael Stock (Michael.Stock@tcd.ie)

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.

Leaning Outcomes:

LO1. Illustrate the importance of geochemistry in Earth Sciences and the relationship between geochemistry and geology, environmental chemistry, oceanography, soil sciences and biology.

LO2. Describe the electronic structure of atoms and ions, as well as the periodic table and the arrangement of atoms to form solids.

LO3. Describe the main geochemical reservoirs Earth and the processes responsible for distributing elements within the crust and mantle.

LO4. Outline the most relevant physicochemical phenomena occurring when minerals are dissolved in melts and aqueous solutions.

LO5. Illustrate the most important processes occurring during the interaction of minerals/rocks with water and their relevance to environmental quality and therefore to humans.

LO6. Define radiogenic and non-radiogenic isotope systematics and their importance in Earth Science.

LO7. Relate the relevance of the carbon cycle and carbonate minerals with life, ocean evolution, climate and availability of elements.

Recommended Reading:

Ryan, P. (2014) Environmental and Low Temperature Geochemistry. Wiley-Blackwell.
White, W. M. (2013) Geochemistry. Wiley-Blackwell.

Assessment Details:

Theory examination (70%; 2 hrs) and in-course practical assessment (30%)

Module Code: **CEU22E05**

Module Name: **Fluid Dynamics for Environmental Engineering**

ECTS: **5**

Semester taught: **Semester 2**

Module Coordinators: Asst. Professor Patrick Morrissey

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.

- **Introduction**

Definition of a fluid, fluid properties, equation of state

- **Hydrostatics**

Measurement of pressure, thrust on submerged surfaces

- **Principles of Fluid Motion**

Description of fluid flow; continuity equation; Euler and Bernoulli equations; Pitot total head and static tubes, venturi- meters, orifice plates;

- **Momentum Equation**

Momentum equation for steady flow; applications to jet flows, impinging flows in pipe bends; momentum theory of propellers;

- **Laminar and Turbulent Flow**

Reynolds demonstration of flow regimes; criterion for laminar/ turbulent flow, Reynolds number

- **Pipe Flow**

Fully developed flow; laminar pipe flow; turbulent pipe flow, friction factor, friction losses, other losses

- **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

Learning Outcomes:

On successful completion of this module, students should be able to:

1. Analyse, generate mathematical models, solve problems, and communicate the solutions of simple fluid based engineering problems including pressures and forces on submerged surfaces.

2. Explain the principles underpinning basic measurement devices such as venturi meters

and Pitot static tubes.

3. Determine forces generated in systems such as jets and propellers.

4. Distinguish between ideal and real flows and evaluate practical problems associated with

pipe flow systems.

5. Conceptualise and describe practical flow systems such as boundary layers and their

importance in engineering analysis.

6. Evaluate fluid properties and solve basic problems using property tables, property

diagrams and equations of state.

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.

8. Demonstrate basic laboratory procedures safely.

9. Perform laboratory tasks as a group.

10. Communicate information, analyse data and provide physical interpretation of measurements in technical laboratory reports.

Recommended Reading:

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

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

Assessment Details:

Continuous Assessments – 25%

Examination – 75%

Module Code: **BYU22203**

Module Name: **From Organisms to Ecosystems**

ECTS: **10**

Semester Taught: **Semester 2**

Module Coordinators: **Associate Professor Nessa O' Connor (n.occonor@tcd.ie)**

This module builds on several of the key concepts including evolution, biodiversity, animal and plant physiology and ecosystem biology. While further introducing core principles that underpin the study of genetics, botany, zoology and global change biology.

Module Introduction - Darwin

Natural Selection

Species and speciation

Coevolution

The evolution of sex and sexual selection

Kin selection

Evolution of reciprocity

Molecular genetics

Fitness and selection

Genetic drift and neutral evolution

Molecular phylogenetics

Population Genetics

Human evolution in health and disease

Diversity of life: Conquering the land

Diversity of life: fungi, lichens, algae, angiosperms

Diversity of life: animals, phylogeny and early evolution

Diversity of life: animal feeding strategies

Diversity of life: tetrapods and evolution of humans

Life in extreme environments: evolutionary adaptations

Diversity of animal life: reproductive behaviour

Diversity of plant life: plant reproductive strategies

Interactions between organisms including mutualisms

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

Global climates and biomes

Terrestrial ecosystems: forests and grassland

Terrestrial ecosystems: desert, tundra and peatland

Ecological modelling

Freshwater ecosystems: rivers and lakes

Marine ecosystems: estuaries

Marine ecosystems: coastal waters and open seas

Impacts of global climate change

Genes to ecosystems

Learning Outcomes:

On successful completion of this module, students should be able to1. Explain several of the fundamental principles of evolution, genetics, animal and plant diversity, physiology

2. Describe characteristic features of selected ecosystems and their ecology.

3. Use several basic lab-based methods and techniques (e.g. respirometry methods in plants

and animals, ecological modelling).

4. Discuss key issues relating to human interactions with natural environments

5. Describe the basic principles of evolution, natural selection, human evolution and

consequences for health and disease

6. Appreciate the diversity of life and discuss the evolutionary steps that yield diversity from

molecular to individual to whole ecosystem level.

7. Discuss the key physiological processes of animal and plant functioning (e.g. nutrition, gas exchange, metabolism

Recommended Reading:

Biology, A global Approach -Campbell et al. (11th Ed.) Pearson.

Introduction to Genetic Analysis, chapter 18 - Griffiths et al, (11th Ed.).

Introduction to Genetic Analysis - Griffiths, Wessler, Carroll, Doebley (11th Ed.). W.H. Freeman and Co.

Assessment Details:

Continuous Assessments – 50%

Examination – 50%

Module Code: **MAU22E02**

Module Name: **Engineering Maths IV**

ECTS: **5**

Semester Taught: **Semester 2**

Teaching Staff: **Professor Sergey Frolov (frolovs@tcd.ie)**

Module Content:

(1)Vector-valued functions.

Calculus,

Change of parameter,

Tangent vectors.

(2) Partial derivatives.

The Chain Rule,

Directional derivatives and gradients,

Tangent planes and normal vectors

Maxima and minima.

(3) Multiple Integrals.

Double and triple integrals,

Surface areas,

Volumes, masses and centres of gravity.

(4) Topics in vector calculus.

Vector fields,

Line integrals,

Green's Theorem,

Surface integrals,

The Divergence Theorem,

Stokes' Theorem.

(5) Laplace transforms.

Differential equations,

Unit and delta functions,

Convolutions.

Learning Outcomes:

On successful completion of this module, students should be able to:

Analyse the behaviour of functions of several variables, present the results graphically and efficiently calculate partial derivatives of functions of several variables (including functions given implicitly);

Obtain equations for tangent lines to plane curves and tangent planes to space

surfaces;

Apply derivative tests to find local and global maxima and minima of functions of

several variables;

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;

Determine whether a vector field is conservative, find a potential function for a

conservative field, and use it to calculate line integrals;

6. Use Green's, Stokes' and the Divergence Theorems to calculate double, surface and fluintegrals;

7. Solve differential equations by applying Laplace transforms.

Recommended Reading:

Calculus, Late Transcendentals -Howard Anton, Irl C. Bivens and

Stephen Davis, 9th Edition

Advanced Engineering Mathematics - Erwin Kreyszig, 8th Edition

Assessment Details:

Continuous Assessment – 10%

Examination – 90%

Module Code: **ESU22001**

Module Name: **Climate Science**

ECTS: **5**

Semester Taught: **Semester 2**

Module Coordinator: Assistant Professor Silvia Caldararu (caldaras@tcd.ie)

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:

Observational evidence for climate change

Putting things into perspective: current anthropogenic climate change versus long-term natural change

The greenhouse effect and the Earth's radiation budget

The terrestrial and oceanic carbon cycle

The IPCC reports and predictions, earth system models

Extreme events and their effects on ecosystems and human lives and infrastructure: storms, droughts, fires, insect outbreaks

Glacial melt, sea level rise, permafrost melt

Climate solutions

Learning Outcomes:

On successful completion of this module, students should be able to:
1. Understand the fundamental concepts behind the greenhouse effect and the Earth'

radiation budget

2. Understand the fundamental concepts behind the ocean and terrestrial carbon cycles

3. Conceptualise and discuss current and future impacts of climate change

4. Handle and interpret global datasets and model predictions on current and future climate

5. Critically understand and discuss climate solutions

Recommended Reading:

Bonan, Gordon. Ecological climatology: concepts and applications. Cambridge University Press, 2015.

+ more TBD

Assessment Details:

Examination – 45%

Continuous Assessments – 55%

Academic Year Calendar

Academic Year Calendar 2024/25

Academic Calendar Week	Week beginning	2024/25 Academic Year Calendar		Term / Semester
		UG continuing years / PG all years	UG new first years	
1	26-Aug-24	Reassessment * (Semesters 1 & 2 of 2023/24)		←Michaelmas Term begins/Semester 1 begins
2	02-Sep-24	Orientation (Postgraduate, Visiting & Erasmus); Marking/Results		
3	09-Sep-24	Teaching and Learning		←Michaelmas teaching term begins
4	16-Sep-24	Teaching and Learning	Orientation (JF UG)	
5	23-Sep-24	Teaching and Learning	Teaching and Learning	
6	30-Sep-24	Teaching and Learning	Teaching and Learning	
7	07-Oct-24	Teaching and Learning	Teaching and Learning	
8	14-Oct-24	Teaching and Learning	Teaching and Learning	
9	21-Oct-24	Study/Review	Study/Review	
10	28-Oct-24	Teaching and Learning (Monday, Public Holiday)	Teaching and Learning (Monday, Public Holiday)	
11	04-Nov-24	Teaching and Learning	Teaching and Learning	
12	11-Nov-24	Teaching and Learning	Teaching and Learning	
13	18-Nov-24	Teaching and Learning	Teaching and Learning	
14	25-Nov-24	Teaching and Learning	Teaching and Learning	
15	02-Dec-24	Revision *[1]	Revision *[1]	
16	09-Dec-24	Assessment *[1]	Assessment *[1] ~	←Michaelmas term ends Sunday 15 December 2024/Semester 1 ends
17	16-Dec-24			
18	23-Dec-24	Christmas Period - College closed 24 December 2024 to 1 January 2025 inclusive	Christmas Period - College closed 24 December 2024 to 1 January 2025 inclusive	
19	30-Dec-24			
20	06-Jan-25	Foundation Scholarship Examinations ^		
21	13-Jan-25	Marking/Results	Marking/Results	←Hilary Term begins/Semester 2 begins
22	20-Jan-25	Teaching and Learning	Teaching and Learning	←Hilary teaching term begins
23	27-Jan-25	Teaching and Learning	Teaching and Learning	
24	03-Feb-25	Teaching and Learning (Monday, Public Holiday)	Teaching and Learning (Monday, Public Holiday)	
25	10-Feb-25	Teaching and Learning	Teaching and Learning	
26	17-Feb-25	Teaching and Learning	Teaching and Learning	
27	24-Feb-25	Teaching and Learning	Teaching and Learning	
28	03-Mar-25	Study/Review	Study/Review	
29	10-Mar-25	Teaching and Learning	Teaching and Learning	
30	17-Mar-25	Teaching and Learning (Monday, Public Holiday)	Teaching and Learning (Monday, Public Holiday)	
31	24-Mar-25	Teaching and Learning	Teaching and Learning	
32	31-Mar-25	Teaching and Learning	Teaching and Learning	
33	07-Apr-25	Teaching and Learning	Teaching and Learning	
34	14-Apr-25	Revision (Friday, Good Friday)	Revision (Friday, Good Friday)	←Hilary Term ends Sunday 20 April 2025
35	21-Apr-25	Assessment *[2] (Monday, Easter Monday)	Assessment *[2] (Monday, Easter Monday)	←Trinity Term begins
36	28-Apr-25	Trinity Week (Monday, Trinity Monday) *[2]	Trinity Week (Monday, Trinity Monday) *[2]	
37	05-May-25	Marking/Results (Monday, Public Holiday)	Marking/Results (Monday, Public Holiday)	
38	12-May-25	Marking/Results	Marking/Results	
39	19-May-25	Marking/Results	Marking/Results	
40	26-May-25	Research	Research	←Trinity Term ends Sunday 1 June 2025/Semester 2 ends
41	02-Jun-25	Research (Monday, Public Holiday)	Research (Monday, Public Holiday)	
42	09-Jun-25	Research	Research	
43	16-Jun-25	Research	Research	
44	23-Jun-25	Research	Research	
45	30-Jun-25	Research	Research	
46	07-Jul-25	Research	Research	
47	14-Jul-25	Research	Research	
48	21-Jul-25	Research	Research	
49	28-Jul-25	Research	Research	
50	04-Aug-25	Research (Monday, Public Holiday)	Research (Monday, Public Holiday)	
51	11-Aug-25	Research	Research	
52	18-Aug-25	Research +	Research +	

* Note: additional/contingency days may be required outside of the formal assessment/reassessment weeks.
~ Note: it may be necessary to hold a small number of JF examinations/assessments outside of semester 1.
^ Note: it may be necessary to hold some examinations/assessments in the preceding week.
*[1] Note: semester 1 Assessment session: 09-Dec-24 to 14-Dec-24 inclusive (contingency dates during week beginning 02-Dec-24 TBC)
*[2] Note: semester 2 Assessment session: 22-Apr-25 to 02-May-25 inclusive (includes Council approved contingency dates: 29-Apr-25 to 02-May-25)
+ Note: the academic year structure is due to be reviewed during 2024/25 - any changes will be notified should Council approve any change.

The academic year structure can be found below:

https://www.tcd.ie/calendar/

Assessment and Examination

Examination Dates 2024/25:

• Semester 1 assessment dates commence the week beginning 9th December 2024.

• Semester 2 assessment dates commence the week beginning 21st April 2025.

* Note: additional/contingency days may be required outside of the formal assessment/reassessment weeks.

~ Note: it may be necessary to hold a small number of JF examinations/assessments outside of semester 1.

^ Note: it may be necessary to hold some examinations/assessments in the preceding week.

Assessment across both the undergraduate and postgraduate elements of the course will be carried out by a variety of different methods as exemplified below:

• Conventional end of term exams

• Laboratory practicals

• Marked tutorials

• Reflective diaries

• Group design projects

• Team based assessment

• Independent research project (year 5)

Conduct of examinations and submission of assessed work

The below is taken from the College Calendar, Part II, pages 35-37, 39 and is edited to include information specific to progression in Environmental Science and Engineering.

34 . Programmes have discretion to utilise a broad range of assessment practices that are programme focussed, equip students to apply their learning in contexts beyond the University and assess the graduate attributes appropriately throughout the programme. An assessment component is a discrete unit of assessment, e.g. an examination paper, an essay, an oral/aural examination, practical, field trip, professional placement, or performance which contributes a defined weighting to the overall assessment for a module. Programmes must make available to students details of the assessment components, together with their weightings, for each module, including details of penalties applying for late submission.

35.Students are entitled to receive feedback on submitted coursework in line with the Return of Coursework Policy. See www.tcd.ie/teaching-learning/academic-policies.

36. There are formal University assessment sessions following the end of teaching term in semester one (in Michaelmas term) and following the end of teaching term in semester two (in Trinity term). Students are assessed at the end of semester one in all modules that are taught only in semester one and at the end of semester two in all year-long modules and all modules that are taught only in semester two. There is one reassessment session which is held at the beginning of Michaelmas term. Students are assessed in all failed modules from both semesters during the reassessment session.

The University reserves the right to amend assessment methods and the timetable for assessments for any reason and at any stage during the academic year. All teaching and assessments are subject to public health advice and guidance as and when issued.

37. The dates of these formal assessment sessions are given in the Calendar PART I - ALMANACK. Examinations should be confined to these sessions. However, if and when approved by the University Council, certain courses, normally professional, are permitted to hold examinations outside of the standard academic year structure. The University Council may also approve additional contingency dates on which to hold examinations outside of the standard academic year structure.

38. Examination timetables are published four weeks in advance of the formal start date of each assessment period on the my.tcd.ie portal. The College reserves the right to alter the published time and date of an examination in exceptional circumstances. Students should ensure that they are available for examinations for the duration of the relevant formal

assessment session and approved contingency dates as stated in the Calendar PART I - ALMANACK.

39. No notice is required of intention to take an end-of-semester examination or to sit for reassessment in the course for which students have registered.1 The onus lies on each student to establish the dates, times, mode and venue of examinations by consulting the relevant timetable on the my.tcd.ie portal. No timetable or reminder will be sent to individual students by any office.

40. Except as provided for below, candidates for examination are forbidden during an examination to do or to attempt to do, any of the following: to have in their possession or consult or use any books, 23 papers, notes, memoranda, mobile phones, electronic devices, or written or electronic material of any nature, or to copy from or exchange information with other persons, or in any way to make use of any information improperly obtained.

41. Where the examination is of such a nature that materials are provided to the candidates, or where the candidates are allowed by the rules of that examination to have materials in their possession, then candidates may only make use of such materials, and the general prohibition above continues to apply in respect of any and all other materials.

42. Where candidates have the prior written permission of the examiner(s), of the Senior Lecturer, or of the Disability Officer, to have materials in their possession during an examination, then candidates may only make use of such materials, and the general prohibition above continues to apply in respect of any and all other materials.

43. Candidates may be allowed to bring personal belongings to examination venues upon condition that such belongings are stored in designated areas. Candidates must ensure that they store their belongings accordingly and must not return to them until they have finished their examinations and are leaving the venue.

44. Any breach of this regulation is regarded as a major offence for which a student may be expelled from the University (see §4 under CONDUCT AND COLLEGE REGULATIONS).

45. Students must not leave the examination before the time specified for the examination has elapsed, except by leave of the invigilator.

46. The College has approved the practice of anonymous marking for undergraduate examinations at the formal assessment and reassessment sessions.

47. All undergraduate results are published by student number. The results for assessments completed in semester one are provisional until moderated by the court of examiners in Trinity term. The end of year or degree result moderated by the court of examiners must be returned and recorded on the student record.

48. Students are required to complete the assessment components for each module as prescribed by the programme regulations. See Assessment: procedures for the non-submission of course work and absence from examinations at www.tcd.ie/teaching-learning/academicpolicies.

49. Students are not permitted to repeat successfully completed assessments or examinations in order to improve their performance.

50. The Board of the College reserves the right to exclude from the College, on the recommendation of the University Council, students whose academic progress is unsatisfactory

51. Students who are unable to complete such assessment components necessary to complete a module or modules at the end of the appropriate semester due to certified illness, disability, or other grave cause beyond their control may seek, through their tutor, permission from the Senior Lecturer to present at the reassessment session. Where certified illness, disability, or other grave cause beyond their control prevents a student from completing at the reassessment session they may seek, through their tutor, permission from the Senior Lecturer to repeat the year.

52. Students who may be prevented from sitting an examination or examinations (or any part thereof) due to illness should seek, through their tutor, permission from the Senior Lecturer in advance of the assessment session to defer the examination(s) to the reassessment session. Students who have commenced the assessment session, and are prevented from completing the session due to illness should seek, through their tutor, permission to defer the outstanding examination(s)/assessment(s) to the reassessment session. In cases where the assessment session has commenced, requests to defer the outstanding examination(s) on medical grounds, should be submitted by the tutor to the relevant school/departmental/course office. If non-medical grounds are stated, such deferral requests should be made to the Senior Lecturer, as normal.

53. Where such permission is sought, it must be appropriately evidenced: (a) For illness: medical certificates must state that the student is unfit to sit examinations/ complete assessments and specify the date(s) of the illness and the date(s) on which the student is not fit to sit examinations/complete assessments. Medical certificates must be submitted to the student's tutor within three days of the beginning of the period of absence from the assessment/examination. (b) For other grave cause: appropriate evidence must be submitted

to the student's tutor within three days of the beginning of the period of absence from the assessment/examination.

54. Where illness occurs during the writing of an examination paper, it should be reported immediately to the chief invigilator. The student will then be escorted to the College Health Centre. Every effort will be made to assist the student to complete the writing of the examination paper.

55. Where an examination/assessment has been completed, retrospective withdrawal will not be granted by the Senior Lecturer nor will medical certificates be accepted in explanation for poor performance.

56. If protracted illness prevents a student from taking the prescribed assessment components, so that they cannot rise into the next class, they may withdraw from College for a period of convalescence, provided that appropriate medical certificates are submitted to the Senior Lecturer. If the student returns to College in the succeeding academic year they must normally register for the year in full in order to fulfil the requirements of their class. See §26 on fitness to study and §28 fitness to practise, if relevant.

57. Where the effects of a disability prevent a student from taking the prescribed assessment components, so that they cannot rise into the next class, the Senior Lecturer may permit the student to withdraw from College for a period of time provided that appropriate evidence has been submitted to the Disability Service. If they return to College in the succeeding academic year they must normally register for the year in full in order to fulfil the requirements of their class.

58. The nature of nonstandard examination accommodations, and their appropriateness for individual students, will be approved by the Senior Lecturer in line with the Council-approved policy on reasonable accommodations. Any reports provided by the College's Disability Service, Health Service or Student Counselling Service will be strictly confidential.

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.

Academic Progress (Specific to Environmental Science and Engineering)

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 student's 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.

Prizes

Foundation Scholarships

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 environmental science and 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 environmental science and 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.

Environmental science and engineering Papers are set as follows:

Engineering science: general mathematics, physics and chemistry (3 hours)

Environmental science: spaceship Earth and geochemical cycles (3 hours)

Environmental science and engineering: microbiology, biodiversity, energy and environment (3 hours)

The material covered by each paper embraces all the work up to the end of the first semester of the second year of the course, together with such further reading as may be determined from time to time. All papers are general extending beyond the set curriculum. Papers are weighted equally.

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.

Attendance:

All students should enter into 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 department notice-boards 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 departments. Attendance is compulsory for Junior Freshmen in all subjects. The school, department or course office, whichever is relevant, publishes its requirements for attendance at lectures and tutorials on notice-boards, and/or in handbooks and elsewhere, as appropriate.

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 2024/25 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.

Ethics

In line with Trinity College Dublin's Policy on Good Research Practice, all research in the School of Natural Sciences (SNS) should be conducted according to the overarching ethical principles of "respect for the individual subject or population, beneficence and the absence of maleficence (research should have the maximum benefit with minimal harm) and justice (all research subjects and populations should be treated fairly and equally)."

All individuals involved in research should facilitate and ensure research is conducted ethically. Ethical conduct in research is a shared responsibility. Primary responsibility rests with the Principal Investigator(s). Ethical responsibilities and legal obligations may overlap. All staff and students conducting research are required to ensure that their research is carried out in compliance with this policy. Ethical review is required before any studies involving human subjects, other living organisms and natural or man-made habitats commence. For field work, ethical consideration needs to be given to the disturbance of species and habitats that may not be subject of your particular study, ethical considerations also need to apply to access to private land. This requirement applies to staff, postgraduate and undergraduate students and volunteers/interns. Field- and laboratory work cannot commence until review has been completed and/or approval has been gained. STUDENTS PLANNING TO UNDERTAKE RESEARCH SHOULD COMPLETE THE SNS Research Ethics Application.

For further details please follow this link: www.naturalscience.tcd.ie/research/ethics

Use of AI tools in academic work

Statement prepared by Assistant Professor 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.

Marking

	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
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
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.

Student Supports

Trinity College provides a wide range of personal and academic supports for its students.

Your Tutor:

All registered full-degree undergraduate students are allocated a Tutor when starting in College. Your Tutor is a member of the academic staff who is appointed to look after the general welfare and development of all students in their care.

You should see your tutor whenever you have a question or are worried or concerned about any aspect of College life or your personal life, in particular if it is affecting your academic work. Everything you say to your tutor is in strict confidence. Unless you give them permission to do so, they will not give ant information to anybody else, whether inside College or outside (not to your parents/family for example).

Your Tutor can help you only if they know you are facing difficulties, so if you are worried about anything go and see your Tutor before things get out of hand. Whilst your Tutor may not be able to solve the underlying problem, they can help you find the best way to limit the impact of your situation on your College work. Tutors can help with academic advice, changing course, withdrawing from College, exam regulations, financial assistance and personal advice. If you cannot find your own tutor, you can contact the Senior Tutor (tel: 01 896 2551). Senior Tutor's website: https://www.tcd.ie/seniortutor/

Student Counselling Service:

While Trinity implements its phased reopening, the SCS continues to offer services by telephone and video call. Please email student-counselling@tcd.ie to request an appointment. Emergency consults are available weekdays.

The student Counselling Service, 3rd Floor, 7 – 9 Leinster Street, College.

Tel: 01 896 1407

Email: student-counselling@tcd.ie

Please check the website for more up to date information: http://www.tcd.ie/Student_Counselling

College Health Service

The College Health Service has changed the way it operates in order to minimize risk to our students and staff during this time of national crisis
To ensure your safety we have restricted access. Do not attend College Health without an appointment, appointments can be made over the phone.
Opening hours: between 9.30-12.00 and 14.00-16.00

The Health Centre is situated on Trinity Campus in House 47, a residential block adjacent to the rugby pitch.

Tel: 01 896 1591 or 01 896 1556

Web: https://www.tcd.ie/collegehealth/

Chaplaincy

The chaplains are representatives of the main Christian Churches in Ireland who work together as a team, sharing both the college chapel and the chaplaincy in House 27 for their work and worship.

Steve Brunn (Anglican Chaplain): brunns@tcd.ie; tel: 01 896 1402

Julian Hamilton (Methodist Chaplain): julian.hamilton@tcd.ie; tel: 01 896 1901

Alan O'Sullivan (Catholic Chaplain): aeosulli@tcd.ie; tel: 01 896 1260

Peter Sexton (Catholic Chaplain): sextonpe@tcd.ie; tel: 01 896 1260

Web: https://www.tcd.ie/Chaplaincy/

Trinity Disability Service

Disability Services, Declan Treanor

Room 2054, Arts Building

Email: askds@tcd.ie

Tel: 01 896 3111

Web: https://www.tcd.ie/disability/

Niteline

A confidential student support line run by students for students which is open every night of term from 9pm to 2.30am.

Tel: 1800 793 793

Web: https://niteline.ie/

Students' Union Welfare Officer

House 6, College

Email: welfare@tcdsu.org

Web: https://www.tcdsu.org/welfare

Undergraduate Programming Centre

The Programming Centre is available to all Computer Engineering students free of charge. The centre operates as a drop-in service where you can get help with any problems you might have with programming in your courses. For further information, please visit http://www.scss.tcd.ie/ugpc/.

Student Learning Development

Student Learning Development provides learning support to help students reach their academic potential. They run workshops, have extensive online resources and provide individual consultations. To find out more, visit their website at https://student-learning.tcd.ie/.

Student 2 student (S2S)

S2S offers trained Peer Supporters for any student in the College who would like to talk confidentially with another student, or just to meet a friendly face for a chat. The service is free and available to everyone. To contact a Peer Supporter you can email student2student@tcd.ie.

Web: https://student2student.tcd.ie/peer-support/.

Trinity Careers Service

As a Trinity College Dublin student you have access to information, support and guidance from the professional team of expert Careers Consultants throughout your time at Trinity. The support offered includes 'next step' career guidance appointments, CV and LinkedIn profile clinics and practice interviews.

Web: https://www.tcd.ie/Careers/.

Co-curricular activities

Trinity College has a significant number of diverse student societies which are governed by the Central Societies Committee. They provide information on the societies including how to get involved and even how to start your own society. See http://trinitysocieties.ie/ for more details. Students are encouraged to get involved. Trinity College also has a huge range of sports clubs which are governed by the Dublin University Athletic Club (DUCAC). Dublin University Central Athletic Club - Trinity Sport - Trinity College Dublin (tcd.ie) for more details.

Trinity College Students' Union

The Trinity College Students' Union (TCDSU) is run for students by students. TCDSU represents students at college level, fight for students' rights, look after students' needs, and are here for students to have a shoulder to cry on or as a friend to chat with over a cup of tea. Students of Trinity College are automatically members of TCDSU. It has information on accommodation, jobs, campaigns, as well as information pertaining to education and welfare.

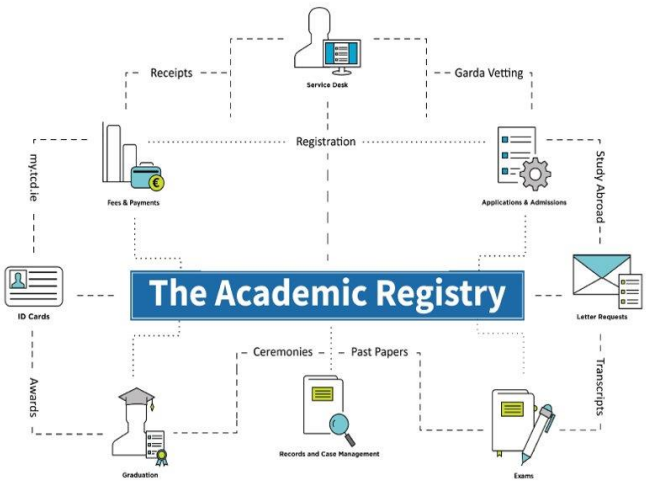
For more information see: https://www.tcdsu.org/.

Postgraduate Advisory Service

The Postgraduate Advisory Service offers free, independent, and confidential support, guidance and advocacy to registered postgraduate students. They are here to provide support on any matter that may impact upon your time as a postgraduate at Trinity.

Some of the most common issues students come to PAS to discuss include: study-related stress or worry; concerns about academic progress; supervisor-relationship concerns; extensions and going off-books; queries regarding regulations and academic appeals; bullying; plagiarism and disciplinary cases, financial assistance.

Academic Registry



The Academic Registry can help with queries on Applications & Admissions, Registration, ID Cards, Letter requests, Fees & Payments, Exams, Graduation, Fees & Payments. The Academic Registry is located in the Watts Building.

Telephone: 01 896 4500

Email: academic.registry@tcd.ie

Webchat: Academic Registry Webchat - Academic Registry - Trinity College Dublin (tcd.ie)

Website: https://www.tcd.ie/academicregistry/

Maths Support

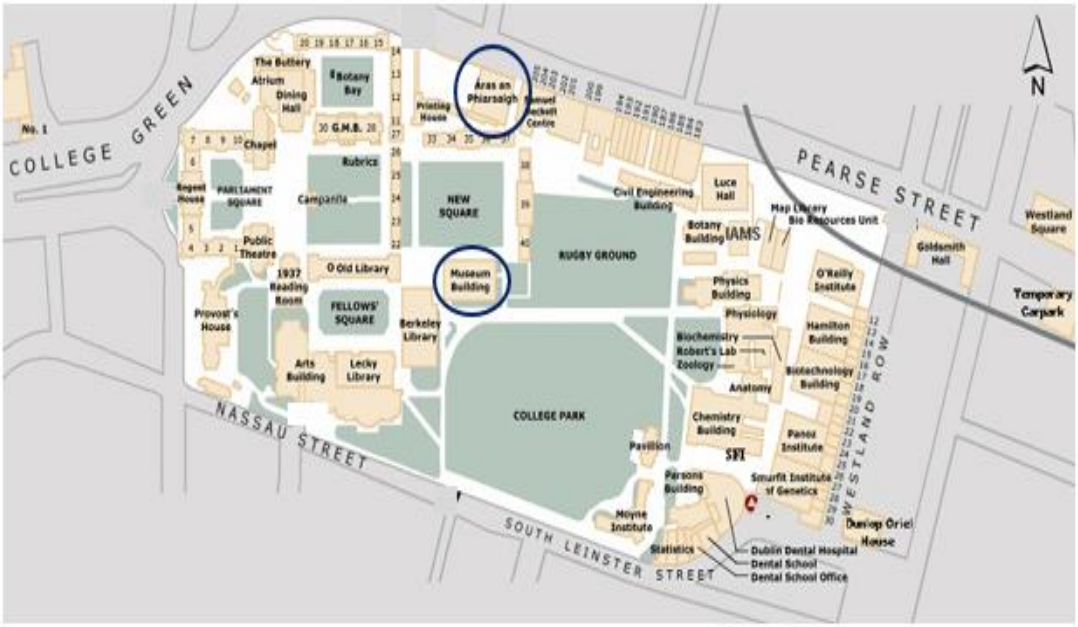
There is a Maths helproom available which runs throughout the academic year on set days/times in which students can bring any problems or questions to tutors. The link can be found below:

https://www.maths.tcd.ie/outreach/helproom/

Maths Resources on Blackboard

https://student-learning.tcd.ie/blackboard/enrolment/

Key Campus Locations:



Interactive College Map

College Maps : Trinity College Dublin (tcd.ie)

General Information

Emergency Procedure

In the event of an+ emergency, **dial Security Services on extension 1999**

Security Services provide a 24-hour service to the college community, 365 days a year. They are the liaison to the Fire, Garda and Ambulance services and all staff and students are advised to always telephone extension 1999 (+353 1 896 1999) in case of an emergency.

Should you require any emergency or rescue services on campus, you must contact Security Services. This includes chemical spills, personal injury or first aid assistance.

It is recommended that all students save at least one emergency contact in their phone under ICE (In Case of Emergency).

Data Protection

Trinity College Dublin uses personal data relating to students for a variety of purposes. We are careful to comply with our obligations under data protection laws and we have prepared this short guide to ensure you understand how we obtain, use and disclose student data in the course of performing University functions and services. The guidance note is intended to supplement the University's Data Protection Policy.

Further information can be found below:

Information Compliance : Trinity College Dublin (tcd.ie)

Staff Contacts

Staff	Email
Professor Jennifer McElwain – Course Director	jmcelwai@tcd.ie
Professor Laurence Gill - Course Director	laurence.gill@tcd.ie
Assoc. Prof. Marcus Collier –ESU22001	colliema@tcd.ie
Asst. Prof. Muhammad Ali - ESU22001	muhammad.ali@tcd.ie
Assoc. Prof. Sarah McCormack – CEU22E07	Sarah.mccormack@tcd.ie
Assoc. Prof. Liwen Xiao – CEU22E07	Liwen.xiao@tcd.ie
Assoc. Prof. Dmitri Zaitsev – MAU22E01	zaitsevd@tcd.ie
Asst. Prof. Mike Williams – BYU22204	Michael.williams@tcd.ie
Asst. Prof. Patrick Morrissey – CEU22E05	morrisp5@tcd.ie
Professor Nessa O Connor – BYU22203	oconnn18@tcd.ie
Professor Sergey Frolov – MAU22E02	frolovs@tcd.ie
Asst. Prof. Silvia Caldararu – ESU22002	caldaras@tcd.ie
Asst. Prof. Michael Stock – GSU22201	michael.stock@tcd.ie
Asst. Prof. Micha Ruhl – GSU22005	micha.ruhl@tcd.ie
Asst. Prof. Richard Nair – BYU22204	richard.nair@tcd.ie
TBC (Room 4.29: Aras an Phiarsigh)	envscieng@tcd.ie
School of Natural Sciences	schoolofnaturalsciences@tcd.ie
School of Engineering	engineering@tcd.ie