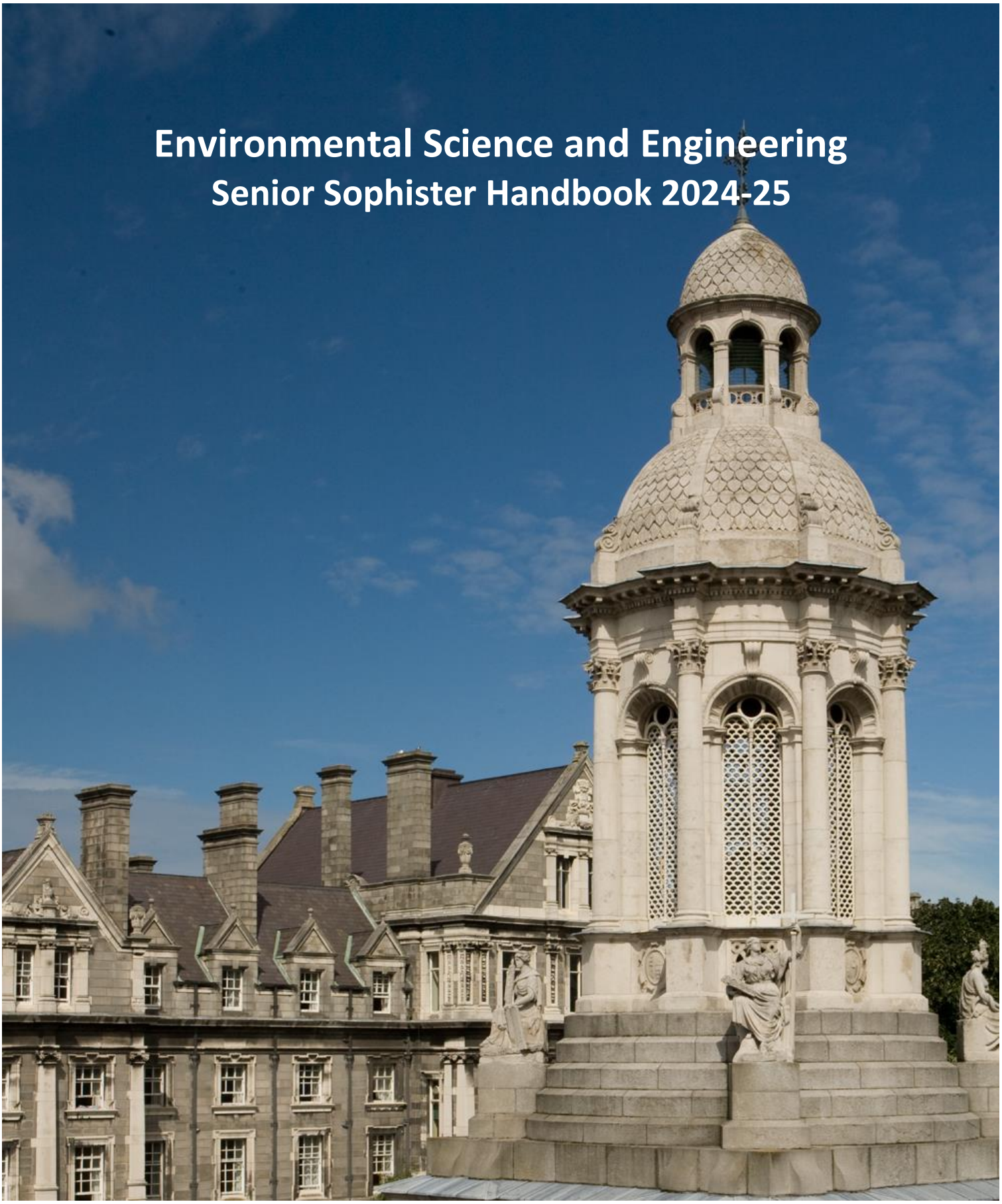
Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Environmental Science and Engineering
Senior Sophister Handbook 2024-25



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Statement on General Regulations

All students are encouraged to fully familiarise themselves with college 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 students 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 from Course Directors

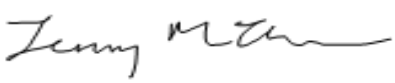
It's Year 4 – your Senior Sophister Year! We are delighted again to congratulate you on successfully progressing. This year you will gain a unique opportunity to deepen your knowledge and skills in a new environment, and for many of you a different country, through industry placements and/or international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

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

While there is a strong focus on scientific and technical content and problem solving in the syllabus, personal skills such as communication and teamwork are an integral part of your education and you will have ample opportunities to apply these this year during your industry placement or through your international exchange. As in previous years you will be given the opportunity to provide us with considered feedback via your class representative. We also encourage you to provide feedback and guidance to your peers in Fresh and Junior Sophister classes.

College offers a wide range of support services. If you are experiencing problems or need to seek advice (personal, financial, health, career or academic), there are a number of sources of help available: these are listed later in this handbook. Do not hesitate to call on these services should the need arise. Each of you has been allocated a tutor, and he/she is an excellent resource to help you with identifying relevant support services. We wish you a successful and enjoyable fourth year at University.

Professor 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 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; and

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; 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 n 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.

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

Core Modules

Semester 1	Semester 2
BOU44111 – Restoration Ecology & Rewilding (5 ECTS)	ESU44003 – Internship (30 ECTS)
ZOU44030 – Data Handling (5 ECTS)	ERASMUS – Semester 2 (30 ECTS)
CEU44A31 – 4A3(1) Environmental Engineering 1 (5 ECTS)	UNITECH (Year Long if awarded)
ESU44002 – Catchment Science (5 ECTS)	

Optional Modules

Semester 1	Semester 2
BOU44108 – Plant Environment Interactions (5 ECTS)	
CEU44A15 – Hydraulics and Hydrology – (5 ECTS)	
CEU44A16 – Transport Engineering & Modelling (5 ECTS)	
EEU33C01 – Signals & Systems (5 ECTS)	
ZOU44021 – Tropical Ecology & Conservation (5 ECTS)	
ZOU44092 – Environmental Impact Assessment (5 ECTS)	

Semester 1 – Students will have 4 core modules, and choose 2 optional module.

Semester 2 – Students will be on Internship, Erasmus or UNITECH.

*Please note that the information provided herein is correct at time of writing. However, information will be updated to reflect any changes that arise throughout the academic year.

Semester 1 - Core

BOU44111: Restoration Ecology and Rewilding

Co-Ordinator:	Dr Marcus Collier
Other Lecturer(s):	Guest Lecturers
Assessment:	50% Examination, 50% Continual Assessment
ECTS:	5 credits
Semester:	1

Description:

Restoration ecology, like conservation biology, is a 'crisis' discipline, having emerged as a science/practice response to the social and ecological impacts directly and indirectly driven by human activities. Restoration ecology has proven to be highly effective in some cases but has also given rise to some controversy as well as policy difficulties. In recent years the phrase 'rewilding' has emerged as a concept that embodies ecological restoration but with more future-oriented targets. Rewilding and novel ecosystems are new and controversial areas within restoration ecology making it difficult to know how and when to intervene. This module will introduce you to the challenges and opportunities, failings and fallacies of the complex world of restoration ecology, rewilding, and the work of restoration ecologists. It will look at how rewilding could be the most efficient of nature-based solutions and asks if this is feasible in the modern world. As the discipline struggles to navigate global climate issues, integrate with the social sciences, incorporate politics and economics, and derive policy actions, this module will draw on case studies of restoration globally to will challenge students to rethink ecology and ecosystems in the Anthropocene. It will also discuss areas of employment where students might consider after graduation, with some invited guests providing insight into the practice of restoration and rewilding.

Learning outcomes:

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

1. Understand the principals of restoration ecology as they apply in a modern context
2. Comprehend the nuanced nature of restoring ecosystems and habitats as well as re-introducing species in practice
3. Carry out restoration case study analysis
4. Understand the complex relationship between ecology, social values and policies
5. Evaluate the success of restored ecosystems and species

Indicative Reading:

Aronson, J, Milton, S.J., & Blignaut, J. Eds. (2007) *Restoring Natural Capital*. Island Press

Carver, S., Convery, I., Hawkins, S., Beyers, R., Eagle, A., Kun, Z., . . . Soule, M. (2021). Guiding principles for rewilding. *Conserv Biol, 35*(6), 1882-1893. doi:10.1111/cobi.13730

GLA (Greater London Auithority). (2023). *Rewilding London: Final Report of the London Rewilding Taskforce*.

Higgs, E., Falk, D. A., Guerrini, A., Hall, M., Harris, J., Hobbs, R. J., . . . Throop, W. (2014). The changing role of history in restoration ecology. *Frontiers in Ecology and the Environment, 12*(9), 499-506. doi:10.1890/110267

Hobbs, R. J., Higgs, E. S. & Hall, C. M. Eds. (2013) *Novel Ecosystems*. Wiley

Lorimer, J., Sandom, C., Jepson, P., Doughty, C., Barua, M., & Kirby, K. J. (2015). Rewilding: Science, Practice, and Politics. *40*(1), 39-62. doi:10.1146/annurev-environ-102014-021406

Marris, E. (2011) *Rambunctious Garden*. Bloomsbury

Monbiot, G. (2015) *Feral*. Penguin

ZOU44030: Data Handling

Co-ordinator: Dr Andrew Jackson, Prof. Yvonne Buckley

ECTS credits: 5 credits

Assessment: This module is assessed 35% by continuous assessment and 65% by questions on an annual examination paper.

Semester: 1

Description:

Being able to form research questions and challenge our hypotheses by collecting and analysing data forms the basis of scientific inquiry. An understanding of data analysis is an essential skill set for all scientists. This module will consist of 2 to 3 tutorial sessions per week spanning all of semester 1 in a flipped-classroom format with an active-learning ethos. One of the tutorials each week will be used to develop class-directed questions relevant to current scientific thinking. As a class, we will form hypotheses, collect data and develop appropriate analytical techniques to answer our research questions. Concurrently, online material including video podcasts will be used to develop hands-on skills in the use of the very powerful and flexible statistics package R for data analysis. The module will start with basic probability theory, introduce different statistical distributions and culminate in learning how General Linear Models form a common framework for conceptualizing and analyzing your data. At the end of the module you will have analysed a wide variety of data types and will have used the transferable and widely applicable statistics package R to analyse your data.

Learning Outcomes:

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

1. Summarise and communicate quantitative results graphically and textually to scientific standards.
2. Apply appropriate statistical analyses of commonly encountered data types.

3. Explain the context of the analyses within a hypothesis driven framework of scientific logic.
4. Use the R statistical computing language for data analysis.
5. Create R notebooks for documenting analyses and sharing with collaborators.

CEU44A31: 4A3(1) Environmental Engineering 1

Co-ordinator: Dr Lawrence Gill and Dr. Aonghus McNabola

ECTS credits: 5 credits

Assessment: 75% Written Exam, 10% Group Project, 7% Assignment and 8% Lab practical's

Semester: 1

Description:

This module runs throughout the first semester of the academic year and comprises three lectures per week. In addition, there is a two hour laboratory / tutorial periods every week for the module. This module aims to develop the basic concepts of Environmental Engineering encountered by the students in the Senior Freshman year by the application of such principles in terms of the analysis of the pollution of the natural aquatic environment, engineering of wastewater treatment and water treatment processes and then the study of air pollution. Analysis of environmental concepts in engineering includes the design of physical, chemical and biological treatment processes, the degradation of pollutants in the natural environment and the atmospheric dispersion of anthropogenic air pollutants.

Module content

o Water Quality

Fundamentals Physical / Chemical / Biological characteristics

o Natural Processes

Dilution / Sedimentation Mass transfer /Heat transfer Stratification / Eutrophication Gas transfer (aeration) / Dissolved Oxygen model

o Process Design

Concepts Reactor analyses / Mass balance Kinetics of biological growth Hydraulic profiles

o Wastewater Treatment

Legislation & quality parameters Wastewater network overview Wastewater characteristics Preliminary / Primary / Secondary / Tertiary treatment Sludge treatment

o Water Treatment

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

o Air Quality

Atmospheric pollutants and sources Meteorology Atmospheric stability and turbulence Atmospheric dispersion – Gaussian model

Learning Outcomes:

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

1. Categorise the difference in quality of water from different sources (such as groundwater and surface water).

2. Interpret a variety of different water quality parameters (physical, chemical and microbiological) with respect to likely waste source and pollution potential.

3. Analyse the degradation of biodegradable organic matter introduced into a watercourse with respect to time.

4. Calculate the dissolved oxygen sag in a water course downstream of an input of organic pollution.

5. Estimate the effect of increased phosphorous loading onto a water body with respect to eutrophic state.

6. Apply chemical engineering process design concepts to the design of a series of reactors for the treatment of both potable water and wastewater.

7. Calculate the size of unit processes for the treatment of potable water and wastewater on the basis of physical, chemical or biological environmental engineering concepts. In addition, be able to calculate the energy / chemical requirements and resultant by-products from such processes.

8. Demonstrate an awareness of the overall context of water and wastewater treatment with respect to national and international legislation and also human and environmental health.

9. Plan and prepare an overall design of a wastewater treatment plant from basic flow and load data.

10. Recognise a variety of atmospheric pollutants and their sources and analyse their dispersion from point sources under different meteorological conditions.

Recommended Reading:

Fundamentals of Environmental Engineering – Mihelcic (Wiley)

Wastewater Engineering – Metcalf and Eddy (McGraw-Hill)

Water Supply – Twort et al. (IWA)

Environmental Engineering – Kiely (McGraw-Hill)

ESU44002: Catchment Science

Co-ordinator: Dr. Patrick Morrissey, Dr. David O'Connell and Dr. Laurence Gill

ECTS credits: 5 credits

Assessment: 70% Examination and 30% Continuous Assessment

Semester: 1

Description:

This module aims to: (a) introduce the students to catchment science and the movement of water and associated materials across the landscape and how this drives river systems; (b) explain and provide understanding of the effect human activities have on catchment processes and river responses and; (c) provide hands on experience in quantitative and analysis techniques for catchment processes and fluxes.

- **Catchment science/processes**

Hydrological processes

Nutrient biogeochemical processes and networks

Catchment characterisation techniques

- **Geomorphological controls**

Fundamental relationships

Soil and sediment erosion and transport

Catchment structure

Drainage network development

Landscape connectivity

- **River Basin Management**

Managing extremes: Floods and droughts

Land use change and intensification

Catchment management and restoration

Aquatic pollution

Soil erosion and fine sediment transfer

Protection/Management of aquatic ecosystems/habitats

Catchment management implementation planning

Management strategy evaluation/assessment

Modelling catchment scale processes

Learning Outcomes:

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

LO1. Understand and develop conceptual models for typical problems within the field of catchment science.

LO2. Demonstrate an awareness of different processes in catchment science, which affects surface and groundwater quality.

LO3. Undertake catchment characterisation and tracing studies.

LO4. Develop soil erosion/sediment susceptibility maps models for agricultural catchments.

LO5. Develop biogeochemical models from catchment processes.

LO6. Identify and evaluate appropriate catchment management strategies.

LO7. Design and implement a catchment management programme and river basin management plan.

LO8. Develop models for catchment and river basin scale processes and management.

Recommended Reading:

From Catchment Management to Managing River Basins

Science, Technology Choices, Institutions and Policy - M. Dinesh Kumar, V. Ratna Reddy, A. J. James [Elsevier science]

Catchment and River Basin Management Integrating Science and Governance - L Smith, K Porter, KM Hiscock, MJ Porter and D Benson [Earthscan]

Water quality modelling – Steven Chapra [McGraw-Hill]

Soil Physics with Hydrus – Radcliffe & Simunek [CRC Press]

Rainfall-runoff modelling – The Primer – Beven [Wiley]

Semester 2 - Core

ESU44003: Industry Partnership Project

Coordinator: Dr. Silvia Caldararu and Dr Muhammad Ali

ECTS Credits: 30 credits

Assessment: 100% Continuous Assessment

Semester: 2

Description:

The Environmental Science & Engineering Project Internship (EPI) module is a practical internship in a professional setting. This setting can be a company, a government institution, research centre, clinic, etc as deemed appropriate. The School of Engineering and the School of Natural Sciences have selected hosts for the EPI which are already in collaboration with academics in both Schools, or are forming new relationships of mutual benefit.

Learning outcomes:

On completion of this module, the student should:

LO1. Be able to identify and use appropriate mathematical methods, numerical techniques and software tools for application to new and ill-defined environmental problems;

LO2. Be able to integrate knowledge, handle complexity and formulate judgements with incomplete or limited information;

LO3. Have the ability to redesign products, processes or systems in order to improve productivity, quality, safety and other desired needs;

LO4. Have the ability to apply design methods, processes and techniques to unfamiliar, ill-defined problems, involving other disciplines;

LO5. Be able to design according to codes of practice and industry standards; to identify limitations of codes of practice and the need for their application;

LO6. Have the ability to investigate and define a need and identify constraints including health, safety and legal issues and the impact of environmental or engineering solutions in a societal and environmental context;

LO7. Be able to make professional engineering/environmental judgements that take cognisance of the social, environmental, ethical, economic, financial, institutional and commercial considerations affecting the exercise of their specific environmental/engineering discipline;

LO8. Have the ability to consult and work with experts in various fields in the realisation of a product or system;

LO9. Have knowledge and understanding of concepts from a range of areas outside environmental science and/or engineering;

LO10. Be able, via knowledge and understanding of group dynamics, to exercise leadership;

LO11. Be able to select and apply appropriate communication tools and write technical papers and reports;

Semester 1 – Optional

BOU44108: Plant Environmental Interactions

Coordinator: Dr. Matt Saunders

ECTS: 5 ECTS

Assessment: 50% Examination, 50% Continual Assessment

Semester: 1

Description:

Plant growth is significantly influenced by the surrounding physical, chemical and biological environment. This module will address the key inter-related concepts of carbon assimilation and sequestration, plant water relations and energy balance components across the soil-plant-atmosphere continuum. Moreover, and as plants do not occur in isolation, this module will examine how fungi and fungus-like (e.g., Oomycota) interact with plants and the surrounding environment at multiple levels (soil interactions, roots, stems, leaves, and plant reproductive structures). The physiological response of plants to respond to a broad range of environmental conditions including abiotic and biotic extreme events will be explored, and the implications for natural and production-based systems will be assessed.

Learning Outcomes:

On successful completion of this module students should be able to:
1. Demonstrate an understanding of how environmental factors influence the physiological performance of plants at various stages of growth and across multiple spatial and temporal scales (leaf, whole plant, and ecosystem).
2. Investigate using suitable methodological approaches how to monitor and quantify the impacts of key environmental drivers on physiological processes.
3. Compare and contrast how plant systems respond to eternal drivers such as future climatic variability and land-use pressures.
4. Demonstrate an understanding of the various interactions and ecological strategies among fungi, fungus-like organisms, and plants.
5. Distinguish how these concepts can be implemented and utilised to address key issues in the sustainable management of land and the provision of food, fuel and fibre.

Recommended Reading List:

Hall, D.O., Scurlock, J.M.O., Bolhar-Nordenkampf, H.R., Leegood, R.C. & Long, S.P. (eds) (1993). Photosynthesis and Production in a Changing Environment - A Field and Laboratory Manual, Chapman and Hall, London.

Jones, H.G. (2014) Plants and Microclimate - A Quantitative Approach to Environmental Plant Physiology. Cambridge University Press, Cambridge.
Lambers, H., Chapin, F.S., Pons, T.L. (2006). Plant physiological ecology. Springer, New York, USA.
Nobel, P.N. (2005). Physiochemical and environmental plant physiology. Elsevier Academic Press, Burlington, MA, USA.
Southworth, D. (ed.) (2012). Biocomplexity of Plant-Fungal Interactions. John Wiley and Sons, Chichester, West Sussex, UK.
Taiz, L., Zeiger, E. (2010). Plant Physiology. Sinauer Associates Inc., Sunderland, Massachusetts USA

CEU44A15 Hydraulics and Hydrology

Coordinator: Liwen Xiao

ECTS: 5 ECTS

Assessment: 75% Written Exam and 25% Coursework

Semester: 1

Description:

This is a one semester module. It explains the use of dimensional analysis in predicting the performance of prototypes from model studies and in the analysis of significant variables in hydraulic experiments. The module reviews the important relationship of open channel flow in natural channels and uses these relationships to study the water profiles to be expected in various design situations. The module explains the concepts behind hydraulic turbines and categorises turbines in relation to the specific head and usage. The design of small-scale hydro schemes is also formulated. The module develops design methods for river protection measures by analysing the stability of sediment on the river-bed. The hydrology section of the course begins by describing how to quantify the water mass balance on a catchment by rainfall and evaporation measurement and analysis. The measurement of flow in rivers is then explained by various gauging methods before the concept of a hydrograph is detailed. The design technique of the Unit Hydrograph is then developed before finally explaining different methods which can be used to route a flood down through a river channel. The module also examines the behaviour of sea-water waves using linear wave theory, predicting their speed, power and energy among other factors. Students will be able to apply this theory to the design of coastal structures or wave energy devices. Finally, the module examines analysis of engineering problems involving unsteady flow, such as pressure transient in pipelines and quasi-steady flow problems.

Module content

o Dimensional analysis and similarity Indicial method and Buckingham's theory Prediction of the performance of prototypes from models Simplification of experimental studies.

o Open channel flow in Natural Channels Velocity Distributions in Natural Channels Flow in Compound Channels Conveyance

o Turbines and hydro schemes Engineering characteristics of turbines Analytical methods of predicting the performance of turbines

o River protection Analysis of forces on sediment in rivers Analytical methods of designing river protection systems

o Hydrology Precipitation measurement and analysis Evaporation measurement and calculation River gauging and flow measurement Hydrograph analysis Unit Hydrograph Flood routing.

o Unsteady Flow Types of unsteady flow Pressure Transients Surge Towers Quasi-steady flow

o Linear Wave Theory Wave transformation processes Wave Energy

Learning Outcomes:

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

1. Predict the performance of hydraulic prototypes from hydraulic models.

2. Demonstrate an understanding of open channel flow in relation to natural channels.

3. Categorise turbines and design the hydraulic aspects of a small-scale hydro-electric scheme.

4. Calculate the forces on sediment on the bed of a river and to design river bank slope protection measures.

5. Analyse river hydrographs and relate the river response to rainfall data.

6. Interpret the results from a network of rain gauges and synthesise the data for use in a hydrological study of a river catchment.

7. Evaluate the translation and attenuation of a flood hydrograph down a river channel using hydrologic flood routing techniques.

8. Demonstrate an understanding of and formulate design solutions for problems involving unsteady flows.

9. Predict the transformation of waves using linear wave theory

Reading Material

Hydraulics in civil and environmental engineering - Chadwick & Morfett (E & FN Spon)

Hydrology in practice – Shaw (Chapman & Hall)

Engineering Hydrology – Wilson (Scholium International)

Mechanics of Fluids – Massey (Taylor & Francis)

CEU44A16 Transport Engineering and Modelling

Coordinator: Dr. Brian Caulfield

ECTS: 5 ECTS

Assessment: 70% Written Examination and 30% Coursework

Semester: 1

Description:

This module is intended to enable students to identify, formulate, analyse, and solve transportation engineering problems, to apply the theory and employ existing transport software packages to solve real world transport problems as well as to design transport systems, to analyse transport data, to improve their communication and teamwork skills, to work in groups to solve transportation engineering problems, to explain terminology used in practice, and to communicate effectively with the transportation engineering community. The emphasis is on the societal, economic, environmental, political, ethical and business aspects of transport problems.

1. Land use

2. Sustainable Transportation

3. Transport Economics and road pricing

4. Project appraisal

5. Transportation planning and demand forecasting

Learning Outcomes:

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

1. Discuss the factors affecting transport demand in Ireland; calculate cross and direct elasticities, equilibrium, and consumer surplus, and; draw the demand, supply, performance, average cost, marginal cost, total cost, fixed, variable, and cost curves.

2. Discuss road pricing in theory and practice such as electronic road pricing in London, alternatives to road pricing, pros and cons of road pricing, societal, economic, political, and environmental considerations of road pricing; state the assumptions of road pricing, and; compute marginal toll

3. Apply various appraisal methods to the evaluate Ireland transport projects and examine these projects under societal, economic, environmental, political, and ethical considerations.

4. Develop an understanding of the fundamental concepts and standard practices in sustainable transportation and how such practices can be implemented in Dublin.

5. Describe the transportation planning process, information required for transportation planning, and travel demand forecasting techniques, and discuss environmental, economic, societal, political, business and ethical issues in transportation planning using Ireland examples.

6. Discuss the factors affecting route, mode, and destination choices; derive the coefficients of regression models; judge whether a regression model is suitable for applications; identify the limitations and assumptions of the gravity model, the discrete choice model, and the user equilibrium model, and; forecast and estimate trip distribution, modal split, and route choice using these models.

7. Work as part of a team to identify, formulate, analyse and solve transport engineering problems by using existing transport software packages, and design transport systems.

Reading Material

1. Modeling Transport. J. de D. Ortuzar and L. G. Willumsen. John Wiley & Sons. 1990

2. Traffic Engineering (2nd Edition), W.R. McShane and R.P. Roess, Prentice Hall, Inc. 1998.

3. British Railway Track, 6th Edition, Published by the Permanent Way Institution, 1993, ISBN 0 903489 03 1.

4. Transport Economics. Kenneth Button. Aldershot, Hants, England; Brookfield, Vt.: Elgar, 1993

5. Transportation Engineering: An Introduction. C. Jotin Khisty. Prentice Hall Inc. 1990

EEU33C01: Signals & Systems

Coordinator: Dr. Nicola Marchetti

ECTS: 5 ECTS

Assessment: 70% Written Exam, 15 % in Class Test and 15% Matlab Based

Semester: 1

Description:

This module is a pre-requisite for anyone wishing to take MAU22E01 Engineering Mathematics III in 5th year.

Learning Outcomes

On completion of this module the student will be able to:

1 - Represent both continuous-time and discrete-time periodic signals as a Fourier series.

2 - Use the Fourier transform and the Laplace transform to analyse continuoustime signals and systems.

3 - Use the discrete-time Fourier transform and the z-transform to analyse discrete-time signals and systems.

4 - Determine the impulse response, step response and frequency response of both continuous-time and discrete-time systems and determine the response of the LTI system to any input signal. Determine the stability of a feedback system.

Reading Material

A.V. Oppenheim, A. S. Willsky with S. H. Nawab, "Signals and

Systems," 2nd Ed., Pearson, 2013

Semester 2 – Core Modules

ZOU44021: Tropical Ecology & Conservation

Coordinator: Dr. Ian Donohue

ECTS: 5 ECTS

Assessment: This module is assessed 50% by continuous assessment and 50% by questions on an annual examination paper.

Semester: 1

Description:

The module comprises a ten-day residential field course in East Africa that will run during the reading week mid-end October. The course will focus on the ecology and biodiversity of a range of ecosystems and habitats (including tropical montaine forest, aquatic ecosystems [freshwater rivers and lakes, wetlands and saline lakes] and grasslands) and the connectivities among them. Issues and problems to do with human impacts and the conservation and management of these diverse habitats will also comprise an important element of the course.

Learning Outcomes:

To provide students with a thorough understanding of the principles underpinning the ecology, conservation and management of tropical ecosystems.

Learning Outcomes

1. On successful completion of this elective, the student will be able to:
2. Demonstrate holistic knowledge of East African geology, landscapes and ecosystems and the extent and nature of human interactions within them.
3. Understand the principles underpinning the ecology of tropical grasslands, forests, freshwaters and alkaline waters and be able to explain these to a layperson.
4. Evaluate the importance of natural background environmental fluctuations compared to those caused by human impact.
5. Synthesise and reconcile the conflicting arguments for the future of each of the ecosystems visited and be capable of integrating these arguments into sustainable management plans, which incorporate indigenous livelihoods.
6. Design a group research project on tropical ecosystem(s) of their choice.
7. Make a competent oral presentation, supported by a written synthesis, of their research proposal.

Recommended Reading List:

ZOU44092: Environmental Impact Assessment

Coordinator: Dr. John Rochford

ECTS: 5 ECTS

Assessment: This module is assessed 50% by continuous assessment and 50% by questions on an annual examination paper.

Semester: 1

Description:

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

Learning Outcomes:

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

1. Outline the development of the Environmental Impact Assessment process as a management and legislative tool from its inception in the 1960s to its present form.
2. Explain the stages in the process from initial screening to post-project monitoring and auditing.
3. Conduct a scoping exercise for a project and produce a draft Scoping Statement.
4. Critically evaluate Environmental Impact Assessment Reports prepared for a wide range of projects.
5. Compare and contrast the process of Environmental Impact Assessment with Strategic Environmental Assessment.
6. Describe Appropriate Assessment in the context of Natura 2000 sites.

Academic Year Structure

The academic year structure can be found below:

https://www.tcd.ie/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.

Examinations, Assessment and Progression

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.

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 do not 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.

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 Schools of Natural Sciences (SNS) and Engineering (SE) 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 make themselves aware of training and supports available at the following link https://www.tcd.ie/research/support/ethics-approval.php.

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.

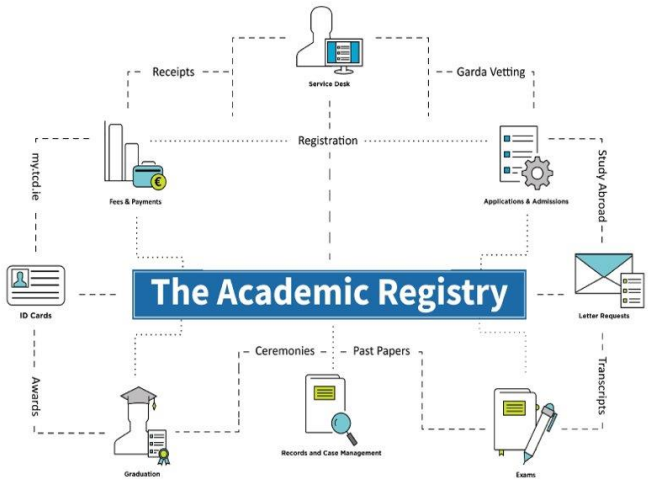
For more information see: https://www.tcdsu.org/.

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.

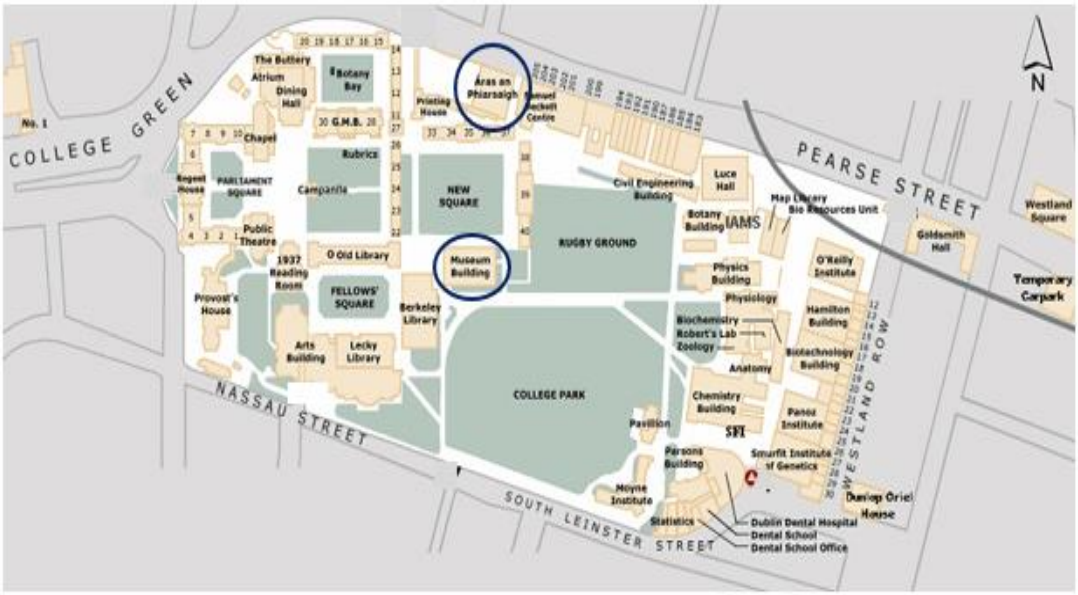
Telephone: 01 896 4500

Email: academic.registry@tcd.ie

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

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

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, Botany Building	jmcelwai@tcd.ie
Professor Laurence Gill - Course Director, Museum Building	Laurence.Gill@tcd.ie
Assoc. Prof. Marcus Collier – Restoration Ecology and Rewilding	marcus.collier@tcd.ie
Asst.Prof. Matthew Saunders – Plant Environment Interactions	saundem@tcd.ie
Asst. Prof. Patrick Morrissey – Catchment Science	morrisp5@tcd.ie
Asst. Prof. Muhammad Ali – Semester 2 Internship/Erasmus	muhammad.ali@tcd.ie
Assoc. Prof. Andrew Jackson - Data Handling	jacksoan@tcd.ie
Prof. Brian Caulfield - Transport Engineering and Modelling	brian.caulfield@tcd.ie
Assoc. Prof. Liwen Xiao - Hydraulics and Hydrology	liwen.xiao@tcd.ie
Prof. Laurence Gill - 4A3(1) Environmental Engineering 1	Laurence.Gill@tcd.ie
Emeritus Assoc.Prof. John Rochford – Environment Impact Assessment	rchfordj@tcd.ie
Prof. Ian Donohue – Tropical Ecology & Conservation	donohui@tcd.ie
Asst. Prof. Silvia Caldararu – Semester 2 Internship/Erasmus	caldaras@tcd.ie
Prof. Nicola Marchetti – Signals and Systems	nicola.marchetti@tcd.ie
School of Natural Sciences – James Higgins (School Manager)	SchoolofNaturalSciences@tcd.ie
School of Engineering	engineering@tcd.ie
T.B.C. Executive Officer – Room 4.29 Aras an Phiarsaigh	envscieng@tcd.ie