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

Department of Mechanical, Manufacturing and Biomedical Engineering

MSc Biomedical Engineering Handbook 2023–2024

Contents

2. Welcome Message from Course Director

Congratulations on joining the MSc in Biomedical Engineering at Trinity College Dublin. You are now part of a dynamic community with a shared passion for biomedical engineering that will enable you to become the future leaders in this field. As you embark on this educational journey, you will discover a branch of learning where the biological, physical and digital worlds intersect and where you will have the opportunity to have a profound impact on society.

This handbook contains important information regarding modules, course regulations, thesis guidelines, faculty members and contact details. Throughout the year you will be notified of seminars, news and other developments.

As MSc students in Biomedical Engineering at Trinity, you are now members of the Trinity Centre for Biomedical Engineering, a dynamic hub that draws expertise from over 30 academics from the Schools of Engineering, Medicine and Natural Sciences and includes over 100 Postdoctoral, PhD and MSc researchers. These researchers are involved in exciting new developments in biomedical engineering ranging from developing cutting-edge materials for cardiac care, analyzing minute electrical signals in the brain for neurological diagnosis to artificially growing new tissue for transplantation. The Trinity Centre for Biomedical Engineering has extensive clinical research partnerships with five teaching hospitals around Dublin. I encourage you to use the opportunity to learn from activities in the Trinity Centre for Biomedical Engineering, so that you can relate your course material to the real clinical challenges that are being researched and the solutions being generated.

On behalf of all the professors and staff, I would like to wish you every success for the coming year. We look forward to you becoming part of the Trinity Biomedical Engineering family as you embark on making your mark on society at large. If you have any questions or comments, please do not hesitate to contact us.

Professor Mark Ahearne

MSc Biomedical Engineering Director

Professor Tríona Lally

Director-Trinity Centre for Biomedical Engineering

3. Biomedical Engineering – Mission Statement

The Trinity Centre for Biomedical Engineering (TCBE) in the School of Engineering at Trinity College Dublin performs world class research in four research themes: (1) Tissue Engineering & Regenerative Medicine, (2) Medical Devices & Advanced Drug Delivery (3) Biomechanics & Mechanobiology and (4) Neural Engineering. These themes are based on the intersection of biomedical science and engineering and form the foundation for advances in external and implantable devices, surgical and medical device design, as well as informing clinical studies and interventions in ageing, neurodegeneration and rehabilitation. The Centre provides a structure to bring biomedical engineers, basic scientists and clinicians together to focus on important clinical needs.

TCBE also has a long and distinguished tradition in postgraduate education, combining fundamental research with translation to clinical practice.

4. Lecture / Tutorial Timetable and COVID-19

Attendance at lectures, laboratories and tutorials is compulsory

The timetable for lectures is provided online. The tutorial schedules will be announced at the start of each semester. Please note that you must attend the particular tutorial sessions to which you have been assigned. Students cannot swap sessions because of the complexity of the timetable, the large numbers in the year and the limited accommodation available.

The most up to date timetable is <u>always</u> online at:

https://www.tcd.ie/biomedicalengineering/msc/overview/

You are advised to check the online timetable regularly particularly in the first couple of weeks of term when minor changes can be made.

<u>**COVID-19 2023/24**</u>

Further to the guidelines as set out by the Vice Provost we note that due to the ongoing presence of COVID-19, it is important to follow familiar guidelines relating to hand hygiene, wearing of face masks. This is part of your individual responsibility for managing symptoms or illness of any kind. Mask wearing is not mandatory but we strongly recommend students wearing masks in lecture settings, libraries and other venues where people may be in close quarters. We know this mitigation is effective in limiting transmission.

We also encourage staying away from class for 7 days if you test positive. We will support you during this period by offering online resources as usual where practical. We will make best efforts to enable online streaming of lectures where facilitated in College lecture theatres. This may not always be possible because of the nature of the lecture/tutorial or laboratory material. Specific resources that can be made available to students in such situations will likely differ across modules and learning situations and your module coordinators will make this clear as we go through the semester.

Important information regarding COVID-19 and College procedure can be found here

Registered students are expected to be available to attend in-person teaching activities. Any request not to attend in person for exceptional reasons (such as travel restrictions or underlying health conditions) will be considered on a case-by-case basis by the relevant Head of School in consultation with College Health and there is no guarantee that these requests can be facilitated. It will depend on whether the programme learning outcomes and modes of assessment can be met through remote attendance.

We would ask all students to adhere to the safety protocols when on campus for in-person teaching activities or student club and society events, i.e. hand washing and cough etiquette.

In the event of a further serious pandemic, all programmes have been developed so that they may be delivered online if it is necessary. The health and safety of students and staff will be paramount.

The School of Engineering expects you to physically attend whatever face-to-face teaching is provided.

Please trust in us to always maintain your best interests at heart and to maintain the integrity of your education and your degrees. If any issues arise at any point in the year, please feel free to email me about this and we can arrange to talk. (ahearnm@tcd.ie)

5. Staff contact procedures

From time to time, you may find it both useful and, in some cases necessary to contact members of the teaching staff on the degree programme. When contact is made by email, messages should be polite and succinct, clearly indicating the nature of the query within both the subject title and body of the text.

Always consider the following when you have a query:

1. Is speaking with the member of staff the best way of resolving the issue?
2. Have you investigated any other methods of addressing the problem using your own initiative?
3. Is it a matter that might best be first addressed to someone other than this particular member of staff, e.g. class representative, college tutor, course coordinator/director, course administrator?

Please use the following general guidelines for staff contact:

- Module Coordinator (email addresses listed in module summaries):
  Contact the module coordinator directly for queries relating to a specific module. e.g. any issues with content and assessment of Module, blackboard/lecture material, attendance at practical's/tutorials, etc.

- MSc Programme Director (Prof. Mark Ahearne, email only at ahearnm@tcd.ie) issues relating to the course in general, any queries that could not be resolved by contact with module coordinators. Programme Director can be consulted in person by appointment only. Please make an appointment via email several days in advance. Please respect the time allocated for consultations.

- Discipline Administrator (bioengmsc@tcd.ie) - all general queries

5.1 Course Director

Staff name	Email	Location
Prof. **Mark Ahearne**	AHEARNM@tcd.ie	Parsons Building

5.2 Administrative Contact

Staff name	Email	Location
Ms. Lisa O'Neill	bioengmsc@tcd.ie	Parsons Building

5.3 Academic Contacts

Staff Name	Email	Location
Prof. Mark Ahearne	ahearnm@tcd.ie	Parsons Building
Prof. Arun Bokde	Arun.Bokde@tcd.ie	
Prof. David Hoey	dahoey@tcd.ie	Parsons Building
Dr. E. Jimenez-Mateos	jimeneze@tcd.ie	Physiology
Prof. Danny Kelly	kellyd9@tcd.ie	TCBE
Prof. Tríona Lally	lallyca@tcd.ie	Parsons Building
Prof. Michael Monaghan	monaghmi@tcd.ie	Parsons Building
Prof. Bruce Murphy	murphb17@tcd.ie	Parsons Building
Prof. Richard Reilly	REILLYRI@tcd.ie	
Prof. Alejandro Lopez Valdes	ALOPEZVA@tcd.ie	Lloyd Building

6. Personal References

Members of staff are usually willing to act as referees. It is a standard courtesy that each individual is asked before giving their name as a referee. If they have not given permission, they could properly refuse to provide a reference. Please allow adequate time (1-2 weeks) for references to be prepared. Please provide a CV and personal statement and details of the reference required in your initial email to avoid unnecessary correspondence.

7. Course Overview

The MSc in Biomedical Engineering consists of taught modules and an individual project focusing on biomaterials, biomechanics, medical devices or tissue engineering and carries 90 ECTS to be completed in one academic year.

The programme consists of four streams as illustrated in the Module Dashboard:

1. MSc Biomedical Engineering General Stream
2. MSc Biomedical Engineering with specialisation in Medical Device Design
3. MSc Biomedical Engineering with specialisation in Neural Engineering
4. MSc Biomedical Engineering with specialisation in Tissue Engineering

Students must follow one stream as agreed with the course director. See link below for module descriptors:

https://www.tcd.ie/biomedicalengineering/msc/currentstudents/index.php

Programme Architecture

The M.Sc. carries 90 ECTS. Candidates take 50 ECTS taught modules and must complete a research dissertation which carries 40 ECTS. A postgraduate diploma may be awarded where a student has completed 60 ECTS of modules. Therefore, in order to obtain the award of a postgraduate diploma, a student will be required to undertake a further 10 ECTS module (in addition to passing 50 ECTS of taught modules). An optional Biomedical Engineering Project module may be taken to enable this. This option will only be available from the start of the second semester for students intending to proceed to the Postgraduate Diploma award and should be agreed at the start of the program or beginning of semester two where students recognize that they cannot meet the demands of the MSc program. Those students who achieve an overall average mark of 70% or above for the taught modules will be awarded a Postgraduate Diploma with Distinction.

The School reserves the right to amend the list of available modules and, in particular to withdraw and add modules. Timetabling may restrict the availability of modules to individual students.

Explanation of ECTS Weighting

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

http://ec.europa.eu/education/resources/european-credit-transfer-accumulation-system_en

8. Module Dashboard

MSc Biomedical Engineering Module Dashboard – 2023/2024

General Stream Modules	ECTS	Code	Semester
Biomaterials	5	ME5M20	1
Biomechanics	5	ME5M19	1
Case Study/Design/Innovation	10	ME7B18	2
Experimental & Research Methods in Biomedical Engineering	5	ME7B24	1
Research Project	40	ME7B08	1 & 2
Total Mandatory	**65**		
Select modules amounting to 25 ECTS from the following 5/10 ECTS modules:			
Active Implanted Devices and Systems****	10	MEP55BM8	2
Advanced Medical Imaging	5	ME5BIO7	2
Basic Medical Sciences*	5	ME7B04	1
Finite Element Analysis**	5	MEP55B10	1
Form and Function of Nervous System*** & ****	5	PG7901	1
Medical Device Design Fundamentals***	5	MEP56BM9	1
Medical Device Design Innovation Project	10	MEP56BM1	1 & 2
Tissue Engineering	5	ME5BIO3	2
Total ECTS	**90**		
Medical Device Stream Modules	**ECTS**	**Code**	**Semester**
Biomaterials	5	ME5M20	1
Biomechanics	5	ME5M19	1
Case Study/Design/Innovation	10	ME7B18	2
Experimental & Research Methods in Biomedical Engineering	5	ME7B24	1
Medical Device Design Fundamentals	5	MEP56BM9	1
Medical Device Design Innovation Project	10	MEP56BM1	1 & 2
Research Project	40	ME7B08	1 & 2
Total Mandatory	**80**		
Select modules amounting to 10 ECTS from the following 5/10 ECTS modules:			
Active Implanted Devices and Systems****	10	MEP55BM8	2
Advanced Medical Imaging	5	ME5BIO7	2
Basic Medical Sciences*	5	ME7B04	1
Finite Element Analysis**	5	MEP55B10	1
Form and Function of Nervous System****	5	PG7901	1
Tissue Engineering	5	ME5BIO3	2
Total ECTS	**90**		
Neural Engineering Stream Modules	**ECTS**	**Code**	**Semester**
Active Implanted Devices and Systems	10	MEP55BM8	2
Case Study/Design/Innovation	10	ME7B18	2
Experimental & Research Methods in Biomedical Engineering	5	ME7B24	1
Form and Function of Nervous System (FNF)	5	PG7901	1
Neural Engineering	5	PG7914	1
Neural Signal Analysis	10	MEP55B21	1
Research Project	40	ME7B08	1 & 2
Total Mandatory	**85**		
Select 1 of the following 5 credit modules:			
Data science in Neuroimaging	5	PR7917	2

Introduction to Autonomous Mobile Robotics	5	MEP55B12	2
Total ECTS	**90**		
Tissue Engineering Stream Modules	**ECTS**	**Code**	**Semester**
Biomaterials	5	ME5M20	1
Case Study/Design/Innovation	10	ME7B18	2
Current Topics in Cell and Tissue Engineering	10	ME7B09	1 & 2
Experimental & Research Methods in Biomedical Engineering	5	ME7B24	1
Laboratory Techniques in Cell & Tissue Engineering	5	ME7B16	1
Research Project	40	ME7B08	1 & 2
Tissue Engineering	5	ME5BIO3	2
Total Mandatory	**80**		
Select 2 of the following 5 ECTS modules:			
Advanced Medical Imaging	5	ME5BIO7	2
Basic Medical Sciences*	5	ME7B04	1
Biomechanics	5	ME5M19	1
Finite Element Analysis**	5	MEP55B10	1
Medical Device Design Fundamentals	5	MEP56BM9	1
Total ECTS	**90**		

*Mandatory for students with no prior Biology/Biomedical Background			
**Must have approval from module co-ordinator to take module (can be discussed week one of term)			
***General Stream – must choose between MEP56BM9 & PG7901 – cannot be taken together due to timetable clashes			
****Subject to meeting pre-requisite criteria as set out in the module descriptor & recommended to take together (MEP55BM8 & PG7901)			

9. Academic Year Structure 2023/24 and Key Dates

The University academic year structure is available [here](https://www.tcd.ie/calendar/academic-year-structure/)

https://www.tcd.ie/calendar/academic-year-structure/

[academic-year-structure.pdf (tcd.ie)](https://www.tcd.ie/calendar/academic-year-structure/)

Trinity College Dublin   Academic Year Calendar 2023/2024   The University of Dublin

Academic Calendar Week	Week beginning	2023/24 Academic Year Calendar		Term / Semester
		UG continuing years / PG all years	**UG new first years**	
1	28-Aug-23	Reassessment * (Semesters 1 & 2 of 2022/23)		←Michaelmas Term begins/Semester 1 begins
2	04-Sep-23			
3	11-Sep-23	Teaching and Learning		←Michaelmas teaching term begins
4	18-Sep-23	Teaching and Learning	Orientation (JF UG)	**11-Sep-23 – MSc Class in-person meeting with Prof. Ahearne**
5	25-Sep-23	Teaching and Learning	Teaching and Learning	**11-Sep-23 – MSc Project Titles disseminated** **20-Sep-23 – MSc Project Titles allocated**
6	02-Oct-23	Teaching and Learning	Teaching and Learning	
7	09-Oct-23	Teaching and Learning	Teaching and Learning	
8	16-Oct-23	Teaching and Learning	Teaching and Learning	
9	23-Oct-23	Study/Review	Study/Review	
10	30-Oct-23	Teaching and Learning (Monday, Public Holiday)	Teaching and Learning (Monday, Public Holiday)	
11	06-Nov-23	Teaching and Learning	Teaching and Learning	
12	13-Nov-23	Teaching and Learning	Teaching and Learning	
13	20-Nov-23	Teaching and Learning	Teaching and Learning	
14	27-Nov-23	Teaching and Learning	Teaching and Learning	
15	04-Dec-23	Revision	Revision	
16	11-Dec-23	Assessment *	Assessment * ~	←Michaelmas term ends Sunday 17 December 2023/Semester 1 ends
17	18-Dec-23	Christmas Period - College closed 22 December 2023 to 1 January 2024 inclusive	Christmas Period - College closed 22 December 2023 to 1 January 2024 inclusive	
18	25-Dec-23			
19	01-Jan-24			
20	08-Jan-24	Foundation Scholarship Examinations ^	Foundation Scholarship Examinations ^	**Laboratories and Library Open**
21	15-Jan-24	Marking/Results	Marking/Results	**←Hilary Term begins/Semester 2 begins, Laboratories and Library Open**
22	22-Jan-24	Teaching and Learning	Teaching and Learning	←Hilary teaching term begins
23	29-Jan-24	Teaching and Learning	Teaching and Learning	
24	05-Feb-24	Teaching and Learning (Monday, Public Holiday)	Teaching and Learning (Monday, Public Holiday)	**09-Feb-24 – MSc Project Research Proposal Due**
25	12-Feb-24	Teaching and Learning	Teaching and Learning	
26	19-Feb-24	Teaching and Learning	Teaching and Learning	
27	26-Feb-24	Teaching and Learning	Teaching and Learning	
28	04-Mar-24	Study/Review	Study/Review	**04-Mar-24 – 08-Mar-.24 – MSc Design Innovation NCAD**
29	11-Mar-24	Teaching and Learning	Teaching and Learning	
30	18-Mar-24	Teaching and Learning (Monday, Public Holiday)	Teaching and Learning (Monday, Public Holiday)	
31	25-Mar-24	Teaching and Learning (Friday, Good Friday)	Teaching and Learning (Friday, Good Friday)	
32	01-Apr-24	Teaching and Learning (Monday, Easter Monday)	Teaching and Learning (Monday, Easter Monday)	
33	08-Apr-24	Teaching and Learning	Teaching and Learning	**10-Apr-24 -MSc Interim Presentations**
34	15-Apr-24	Revision	Revision	←Hilary Term ends Sunday 21 April 2024
35	22-Apr-24	Trinity Week (Monday, Trinity Monday)	Trinity Week (Monday, Trinity Monday)	←Trinity Term begins
36	29-Apr-24	Assessment *	Assessment *	
37	06-May-24	Marking/Results (Monday, Public Holiday)	Marking/Results (Monday, Public Holiday)	
38	13-May-24	Marking/Results	Marking/Results	
39	20-May-24	Marking/Results	Marking/Results	
40	27-May-24	Research	Research	←Trinity Term ends Sunday 2 June 2024/Semester 2 ends
41	03-Jun-24	Research (Monday, Public Holiday)	Research (Monday, Public Holiday)	
42	10-Jun-24	Research	Research	
43	17-Jun-24	Research	Research	
44	24-Jun-24	Research	Research	
45	01-Jul-24	Research	Research	
46	08-Jul-24	Research	Research	
47	15-Jul-24	Research	Research	
48	22-Jul-24	Research	Research	
49	29-Jul-24	Research	Research	
50	05-Aug-24	Research (Monday, Public Holiday)	Research (Monday, Public Holiday)	**06-Aug-24 MSc Thesis Submission**
51	12-Aug-24	Research	Research	
52	19-Aug-24	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.

10. MSc Biomedical Engineering Streams (General, Medical Devices, Neural and Tissue)

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General Stream: This programme aims to provide a sound and broad basis in biomedical engineering. In particular, we aim to provide engineers and scientists with the education needed to practice biomedical engineering in the medical devices industry.

Specifically, the learning outcomes are:

- To give students a broad understanding of the key subjects of biomedical engineering including biomechanics, biomaterials, medical device design, tissue engineering and neural engineering

- By way of case studies and assignments, to provide students a familiarity with biomedical engineering applied in the main surgical disciplines; e.g. orthopaedics, cardiology, gastroenterology, ENT Surgery, neurology, etc.

- To give students a sound understanding of how to apply the scientific method to research in an industrial or clinical context.

- To give students the ability to exploit information technology for monitoring the performance of medical devices or the health of patients through medical devices.

- To give students a knowledge of how the medical device industry is regulated and of how to obtain acceptance of new products onto the market.

General Stream Modules	ECTS	Code	Semester
Biomaterials	5	ME5M20	1
Biomechanics	5	ME5M19	1
Case Study/Design/Innovation	10	ME7B18	2
Experimental & Research Methods in Biomedical Engineering	5	ME7B24	1
Research Project	40	ME7B08	1 & 2
Total Mandatory	**65**		
Select modules amounting to 25 ECTS from the following 5/10 ECTS modules:			
Active Implanted Devices and Systems****	10	MEP55BM8	2
Advanced Medical Imaging	5	ME5BIO7	2
Basic Medical Sciences*	5	ME7B04	1
Finite Element Analysis**	5	MEP55B10	1
Form and Function of Nervous System*** & ****	5	PG7901	1
Medical Device Design Fundamentals***	5	MEP56BM9	1
Medical Device Design Innovation Project	10	MEP56BM1	1 & 2
Tissue Engineering	5	ME5BIO3	2
Total ECTS	**90**		

*Mandatory for students with no prior Biology/Biomedical Background
**Must have approval from module co-ordinator to take module (can be discussed week one of term)
***General Stream – must choose between MEP56BM9 & PG7901 – cannot be taken together due to timetable clashes
****Subject to meeting pre-requisite criteria as set out in the module descriptor & recommended to take together (MEP55BM8 & PG7901)

MSc Biomedical Engineering

Medical Device Specialisation: This programme has been developed to educate and train the next generation of biomedical device design engineers. This is an exciting multidisciplinary field of research which holds significant potential in the treatment of many diseases and disorders.

Specifically, the learning outcomes are:

- To give students a broad understanding of the key topics in medical device design
- To provide students with an understanding of design processes
- To provide "hands-on" training in state-of-the-art medical device design techniques
- To develop student's ability to identify, formulate and adapt engineering solutions to unmet clinical needs
- Develop student's ability to critically analyse the scientific literature in the field of biomedical engineering through interactive discussion (including student presentations) and through grounding in the fundamentals of experimental techniques and data analysis
- To give students a sound understanding of how to apply the scientific method to research

To give students a knowledge of how the biomedical industry is regulated and the route to market of for medical device design

Medical Device Stream Modules	ECTS	Code	Semester
Biomaterials	5	ME5M20	1
Biomechanics	5	ME5M19	1
Case Study/Design/Innovation	10	ME7B18	2
Experimental & Research Methods in Biomedical Engineering	5	ME7B24	1
Medical Device Design Fundamentals	5	MEP56BM9	1
Medical Device Design Innovation Project	10	MEP56BM1	1 & 2
Research Project	40	ME7B08	1 & 2
Total Mandatory	**80**		
Select modules amounting to 10 ECTS from the following 5/10 ECTS modules:			
Active Implanted Devices and Systems****	10	MEP55BM8	2
Advanced Medical Imaging	5	ME5BIO7	2
Basic Medical Sciences*	5	ME7B04	1
Finite Element Analysis**	5	MEP55B10	1
Form and Function of Nervous System****	5	PG7901	1
Tissue Engineering	5	ME5BIO3	2
Total ECTS	**90**		

*Mandatory for students with no prior Biology/Biomedical Background
**Must have approval from module co-ordinator to take module (can be discussed week one of term)
***General Stream – must choose between MEP56BM9 & PG7901 – cannot be taken together due to timetable clashes
****Subject to meeting pre-requisite criteria as set out in the module descriptor & recommended to take together (MEP55BM8 & PG7901)

MSc Biomedical Engineering

Neural Stream Specialisation: This MSc programme is focused on clinical neural engineering. This is based on signal processing of neuroimaging and electrophysiological data to solve specific clinical problems. MSc research projects employ neuroimaging methods (EEG and MRI) to develop quantitative methods to understand neurological function but also to develop new analytical, neurophysiological and neuroimaging methods that allow outcomes of interventions to be more accurately predicted. MSc research projects will be collaboration with clinical colleagues including those in neurology, neurophysiology, psychiatry, otolaryngology, gerontology and respiratory medicine. Many of the projects require data acquisition from clinical cohorts. This programme aims to give a sound and broad basis in neural engineering. In particular, we aim to provide engineers and scientists with the education needed to practice neural engineering in the international medical devices industry.

Specifically the learning outcomes are:

• To give students a broad understanding of the key subjects of neural engineering including neural signal analysis, neuroimaging technology, implantable neural systems and current research topics and techniques in neural engineering.
• To develop student's ability to critically analyse the scientific literature in the field of biomedical engineering through interactive discussion (including student presentations) and through grounding in the fundamentals of data analysis and modern neurotechnology
• By way of case studies and assignments, to give students a familiarity with biomedical engineering applied in the main neurological disciplines
• To give students a sound understanding of how to apply the scientific method to research in an industrial context.
• To give students the ability to exploit information technology for monitoring the performance of neural systems and related devices.
• To give students a knowledge of how the neural engineering and neurotechnology industry is regulated and of how to obtain acceptance of new products onto the market.

Neural Engineering Stream Modules	ECTS	Code	Semester
Active Implanted Devices and Systems	10	MEP55BM8	2
Case Study/Design/Innovation	10	ME7B18	2
Experimental & Research Methods in Biomedical Engineering	5	ME7B24	1
Form and Function of Nervous System (FNF)	5	PG7901	1
Neural Engineering	5	PG7914	1
Neural Signal Analysis	10	MEP55B21	1
Research Project	40	ME7B08	1 & 2
Total Mandatory	**85**		
Select 1 of the following 5 credit modules:			
Data science in Neuroimaging	5	PR7917	2
Introduction to Autonomous Mobile Robotics	5	MEP55B12	2
Total ECTS	**90**		

*Mandatory for students with no prior Biology/Biomedical Background
**Must have approval from module co-ordinator to take module (can be discussed week one of term)
***General Stream – must choose between MEP56BM9 & PG7901 – cannot be taken together due to timetable clashes
****Subject to meeting pre-requisite criteria as set out in the module descriptor & recommended to take together (MEP55BM8 & PG7901)

MSc Biomedical Engineering

Tissue Engineering Specialisation: This programme has been developed to educate and train the next generation of biomedical tissue engineers. This is an exciting multidisciplinary field of research which holds significant potential in the treatment of many diseases and disorders. This programme aims to give a sound and broad basis in tissue engineering. In particular, we aim to provide engineers and scientists with the education needed to practice tissue engineering in the international medical devices industry.

Specifically, the learning outcomes are:
- To give students a broad understanding of key topics in tissue engineering
- To provide students with an understanding of stem cells, animal/human cell culture processes, and strategies to regenerate or repair damaged tissues
- To provide "hands-on" training in state-of-the-art tissue engineering techniques
- To develop student's ability to identify, formulate and adapt engineering solutions to unmet biological needs
- Develop student's ability to critically analyse the scientific literature in the field of biomedical engineering through interactive discussion (including student presentations) and through grounding in the fundamentals of experimental techniques and data analysis
- To give students a knowledge of how the biomedical industry is regulated and the route to market for tissue engineered products
- To develop students understanding of how to apply the scientific method to research and the knowledge and capability to perform independent research.

Tissue Engineering Stream Modules	ECTS	Code	Semester
Biomaterials	5	ME5M20	1
Case Study/Design/Innovation	10	ME7B18	2
Current Topics in Cell and Tissue Engineering	10	ME7B09	1 & 2
Experimental & Research Methods in Biomedical Engineering	5	ME7B24	1
Laboratory Techniques in Cell & Tissue Engineering	5	ME7B16	1
Research Project	40	ME7B08	1 & 2
Tissue Engineering	5	ME5BIO3	2
Total Mandatory	**80**		
Select 2 of the following 5 ECTS modules:			
Advanced Medical Imaging	5	ME5BIO7	2
Basic Medical Sciences*	5	ME7B04	1
Biomechanics	5	ME5M19	1
Finite Element Analysis**	5	MEP55B10	1
Medical Device Design Fundamentals	5	MEP56BM9	1
Total ECTS	**90**		

*Mandatory for students with no prior Biology/Biomedical Background			
**Must have approval from module co-ordinator to take module (can be discussed week one of term)			
***General Stream – must choose between MEP56BM9 & PG7901 – cannot be taken together due to timetable clashes			
****Subject to meeting pre-requisite criteria as set out in the module descriptor & recommended to take together (MEP55BM8 & PG7901)			

11. Thesis Guidelines

Objectives

The project forms the final part of the course. Members of staff propose projects pertinent to their own research interests. Candidates may propose their own projects, particularly in cases where the candidate has an industrial link, but these projects must be linked to the expertise of the proposed supervisor. Each project is supervised by an academic in the School of Engineering or in some cases, academics from other schools who have a strong interest in biomedical engineering research. Furthermore, additional guidance may come from medical or healthcare professionals. In these cases, the project usually sets out to solve a problem experienced by these healthcare professionals in the use of a particular medical device.

All deadlines will be set and communicated centrally by the School Office.

Project Titles:

Below are some recent project titles undertaken by TCD MSc students:

- Machine Learning to Analysis Movement and Posture in the Diagnosis and Monitoring of Neurodegenerative Conditions
- Pre-motor syndromes of cervical dystonia: EEG-neuroimaging in Neurology
- Rationale and predictive design of mesh geometries printed using melt electrospinning writing (MEW) to yield smart-design biomaterial patches
- Developing new tools for paediatric brain surgery
- MSc2 Using imaging (MRI , microCT and histology) to understand the role of different vascular constituents in aneurysm formation and progression and developing an in vitro aneurysm model
- High Resolution Magnetic Resonance Imaging of Arterial Tissue
- A Non-Invasive System using Machine Learning for Triage of Large Vessel Acute Ischemic Stroke
- Non-invasive Characterisation of the Intervertebral Disc Microenvironment through Magnetic Resonance Imaging and Finite Element Analysis
- The Development of a Novel Device for Treating Cerebral Aneurysms using Benchtop Testing and Finite Element Modelling
- Transportation of Chondrocytes at Ambient Temperature for Cell Therapies

- Development of Extracellular Vesicle-Functionalized Materials for Bone Regeneration
- Mechanical Testing of 3D Printed Cartilage Scaffolds
- Improved Spring-Assisted Craniectomy for the Treatment of Craniosynostosis
- A comparative study between nasal and articular chondrocytes using a rapid digestion protocol for the treatment of degenerative disc disease
- Design of a perforation catheter system used in the treatment of primary paediatric pulmonary hypertension
- Development of a Novel Biomaterial for Nerve Tissue Engineering
- Maximising Cellular Augmentation of Meniscal Scaffolds for single-stage surgical applications
- Development of a new minimally-invasive device to treat intracranial aneurysms
- Development of a Gene-activated Scaffold for Skin Repair
- A Novel System For The Efficacious Treatment Of Chronic Total Occlusions Via Percutaneous Coronary Intervention

Guidelines for Thesis Report and Presentations

This section emphasizes the school's important regard for the acquisition of communication skills. These notes will help you to develop those skills and that you will take pride and pleasure in that development. You will find that you will not absorb all this information in a single reading. You should refer to these notes whenever you are carrying out a significant piece of writing and especially when you are writing your thesis.

These instructions have been prepared to indicate to both thesis supervisors and students the expected standard of report writing. It is likely that up to 20% of marks are lost by poor presentation of work. These notes are designed to help students to avoid common faults and improve presentation of work. The advice can be applied to major theses but also relevant to short reports and essays which may form part of in-course assessments.

Preparing a Synopsis

It is essential to prepare a detailed synopsis of any piece of written work which is likely to be more than one page long. A synopsis helps the writer to see clearly what the main points are and to arrange the material so as to bring out the important points. For the MSc thesis, the synopsis would show the order in which the material is to be presented,

some idea of the length of each section, what is to be included in each section and an indication of the location of Figures and Tables.

There are two main objectives in preparing a synopsis:-

a) to produce a written document which can be discussed with the supervisor before a great deal of writing is performed.

b) to help the writer to plan the work to the maximum effect

This is essential for large reports and is strongly recommended as a general practice

A carefully produced synopsis can save hours of writing time and will allow alterations and additions. Work which is not well-planned is likely to ramble and the main points will be lost.

Report Outline

Reports should be divided into the following standard sections:

1.	Title Page
2.	Abstract (Summary)
3.	Acknowledgements
4.	Table of Contents Page
5.	List of Tables
6.	List of Figures
7.	Introduction
8.	Literature Review
9.	Methods
10.	Results
11.	Discussion
12.	References
13.	Appendix

Occasionally the nature of the material may require a different format. Students should consult supervisors before deviating from the standard arrangement.

Scheduling

Literature Review should be written early in the project when you have read in detail journal articles in the project area. The Literature Review will need to be brought up to date with new, more relevant papers as you continue to research the project.

The Methods section should also be written very early in the project, after the Literature Review and "polished" later.

Results should be in the process of being written up during the experimental part of the project. Results must be professionally graphed and analysed.

The Introduction is normally written last and is used to build the argument why the area of study is of interest and importance in biomedical engineering.

Now follows a short discussion of the headings listed above.

Title Page

This page should include:

- Concise title (not more than 15 words). Should be informative. Abbreviations should be avoided
- Author's name
- Supervisors name
- Affiliation
- Date
- Degree for which thesis is being submitted

Abstract

The abstract (maximum one A4 sheet- no exceptions) should be clearly written and readily comprehensible to a broad readership. The abstract should provide a concise summary of the objectives, methodology, key results, and major conclusions of the study. It should be written in complete sentences, without explicit subheadings.

Table of Contents

- This should include chapter headings and details of sections within chapters, with page numbers.

List of Tables

- This should include details of all tables with page numbers.

List of Figures

- This should include details of all figures with page numbers.

Acknowledgements

- Acknowledge all those who provided support to you and your project (e.g., organisation, funding body, supervisor, technicians).

- The Acknowledgements should be placed at the end of the text (before the references) except in the MSc Thesis, when they should immediately follow the Title and Summary.

- As a matter of courtesy all staff mentioned should be given a title (Prof., Dr, Mr, Ms) and both forename and surname. Only intimates should be referred to by first name only.

- Work contributed by others to your project must be acknowledged. Such a situation would arise if, for example, stored samples generated by another researcher were used in the project or if the nature of specific experiments to be included in the project dictated that they must be carried out by an experienced researcher. The titles and names of such contributors and the precise nature of their contribution must be included in this section in a clear statement of acknowledgement. An omission of such an acknowledgement, where required, is plagiarism. Plagiarism, as outlined elsewhere in this Handbook, is regarded by College as a serious offence and the student concerned will be penalised.

- All the foregoing are 'preliminaries' and should not be numbered with the main body of the text. Instead, give preliminaries Roman numerals (i, ii etc.). The pages of the main text should be numbered using Arabic numerals (1, 2, etc).

Introduction

- This should emphasize the importance of the research study and provide an overview of the key concepts and questions posed. Therefore, the Introduction should include a statement of the problem, research question or hypothesis, the objectives of the study, operational definitions of term used and the background to the study.

Literature Review

- A summary of the background literature is necessary. You should aim to produce a detailed overview of the current knowledge of the problem under study and outline a theoretical framework or rationale as a basis for your study. It is important to critically analyse existing literature on your research project.

- A clear statement of the problem and the immediate background as well as the aims of the project and its relevance should be given.

Methods

- A clear account of all the experimental, materials, methods (including statistical analyses) and experimental designs used must be given so that others can repeat the experiments in a logical manner. (The anonymity of human subjects must be preserved, by using code numbers or letters.) In particular, it should always be clear to the reader exactly what is being measured, and how many measurements (or animals or subjects) there are in each value. Failure to do this will result in loss of marks. It may be useful to clarify here the contribution of others to the practical work (see Acknowledgements).

- This section will provide a comprehensive explanation of the procedures used including details of the following:

    - Overall design and justification of methods used.

    - A clear indication of the sample sizes used.

    - A detailed description of all experimental procedures; this should be sufficiently detailed to allow replication.

    - A description of the instruments used.

    - An indication, if appropriate, of how published methods or available equipment was modified for the current study.

    - An account of how data was analysed.

    - A sample of any questionnaire used, if appropriate.

    - A description of ethical issues for example, the process by which approval was obtained, ethical issues in sample selection, data collection, publication of results etc.

    - A description of the statistical tools and tests used to interrogate your data.

Results

- This section, or sections should be a description and explanation of results using narrative, tables and figures as appropriate. It should deal with facts and findings only, without interpretation (which will be included in the Discussion).

- This is usually the most poorly-presented section of a thesis and yet it is one of the most important. The reader must be led carefully through the results step by step. You should carefully consider the order of the figures to be presented. The order of figures presented may or may not follow the order the experiments were originally performed. You should consider which figures need to be presented. The objective is not to include all your figures to simply show how much work you have done, but to include those figures which are pertinent to the work. The main observations must be brought out; it is NOT sufficient to present figures or tables and then leave the reader to work out the conclusions (see later sections: *Figures* and *Tables*).

- *Second-order variables.* If you are using some transformation of the raw data, you should explain why you are doing so and, if possible, what, if any, difference the transform makes. When results are presented as % control, the absolute value of the control should be given in the Figure/Table legend.

- *Presentation of Statistics.* This requires particular attention and is a skill which must be acquired. Always state clearly what measure (mean, etc.) and what measure of variation (SD, etc.) is being used. The number of observations (n) must be clearly stated and specifically given if SDs are used. Do not give excessive numbers of decimal places; measures of variation should have one more significant figure than the mean. It is important to clearly state the direction and magnitude of the change observed. Do this first, and then give the result of any statistical tests used to determine significance.

- Over-interpretation of results is a serious error. You must demonstrate that you understand the significance of statistical testing. If a difference (or other statistical result, e.g. correlation) is not statistically significant, you should not treat it as if it is. If you want to discuss a non-significant 'trend' in your results, make it clear that you know the difference.

Discussion

- This section should deal with discussion and interpretation of the data obtained and should include a critical assessment of the data in light of previous findings in the literature, speculation on the meaning of the results obtained, analysis of the original hypothesis in the context of the findings, a discussion of whether or not the findings support the hypothesis proposed and an assessment of the limitations of the study. This should be concluded with a summary and conclusions and suggestions for further research.

- This section often presents the most problems. In particular, it is often difficult to decide what should go in the Discussion and what should go in the Results (see *Preparation of a Synopsis*, below). A good guideline is 'When in doubt, put it in the Discussion', and leave the presentation of results as uncluttered as possible.

- This section is the most common area that students lose marks in after writing an excellent literature review, and extensive research in the laboratory and often defines the difference between a 2.1 and 1.1 marks classification.

- The Discussion should include the following:
  - Interpretation of the significance of your results.
  - A comparison of results (not forgetting control values) with those in the literature.
  - A discussion of your results in context of the relevant literature.
  - A critical discussion of possible sources of error in the results. *Critical* means not only listing the sources of error but also saying how important they are likely to be.

This list is by no means exhaustive and the categories will often overlap, but it should be helpful at the planning stage.

References

- All cited references and only cited references should be included. The format used is that which is agreed with your supervisor.

- Note that all references cited in text must appear in the list of references. General reading such as textbooks should not be cited, unless you are using a figure or referring to a very specific point. Play particular attention to appropriate paraphrasing of others work, and providing your own description of that work.

Style of References

- An assistive bibliography software is recommended for referencing in the thesis document and other reports submitted in models of the MSc in Biomedical Engineering (e.g. Endnote, Medeley). However, these software programmes are not foolproof and the resultant bibliography should be double-checked.

- Most journals use an abbreviated format for Journal titles. When abbreviating Journal titles make sure to use the correct abbreviation. You can find the correct abbreviation of any journal on PUBMED (http://www.ncbi.nlm.nih.gov/pubmed/). Some examples are as follows:

- A = "Ann Biomed Eng" (single word journals are not abbreviated)

- Annals of Biomedical Engineering = "Ann Biomed Eng"

- Journal of Biomechanics = "J Biomech"

- Journal of Neural Engineering = "J Neural Eng"

- Below is the reference style used by the IEEE Transactions on Biomedical Engineering. There are different styles for journal articles, books, and book chapters as illustrated below.

Journal article

Cited in text as: (McMahon et al., 2008)

Cited in reference list as: McMahon LA, Reid AJ, Campbell VA, Prendergast PJ., Regulatory effects of mechanical strain on the chondrogenic differentiation of MSCs in a collagen-GAG scaffold: experimental and computational analysis, *Ann Biomed Eng* , 36, (2), p185 – 194, 2008.

Book

Cited in text as: (Simms and Wood, 2009).

Cited in reference list as: Simms CK and Wood DP (2009) *Pedestrian and cyclist Impact - a Biomechanical Perspective*, Springer.

Chapter in a book

Cited in text as: (Lalor, 2009) *Cited in reference list as:* Lalor, E.C., Pearlmutter, B.A., & Foxe, J.J. (2009). Reverse correlation and the VESPA method. In: Handy, T. C. (Ed.), Brain Signal Analysis: Advances in Neuroelectric and Neuromagnetic Methods, MIT press.

The most important thing to remember when citing references is to be consistent. Alternative styles of referencing are permissible upon agreement with the thesis supervisor.

Appendices

- This should include details of equipment and instruments used, details of software developed and, in some cases tables of raw data. When appropriate, it should also include a copy of any questionnaire used.

- This should contain essential data and details of any other methods. Note that all entries in the Appendix must be properly described in suitable legends. It is not inappropriate to repeat relevant statistical summaries in the Appendix. All Tables in the Appendix must have fully descriptive titles so that they can be understood without reference to the main text.

Figures and Tables

- These are a great deal of trouble to prepare and it is a pity to waste them for the sake of a little attention to detail. All Figures and Tables must be numbered in a logical sequence and have a descriptive legend, so that each can be understood without reference to the text. <u>Legends precede Tables and follow Figures</u>. It may be desirable to include the important observation or conclusion in the legend. All units of measurement and statistical parameters must be identified. Axes on graphs and columns in tables must be labelled so that it is clear what each point or value represents. Figures should also be referred to in the main text.

- Try to keep graphs uncluttered. Use conventional symbols of open and filled squares, triangles or circles. Shading aids clarity in histograms. Tables should be as simple as possible. Try not to put all your results in one huge Table because it is daunting for the reader.

- The most common fault is failure to integrate Figures and Tables with the text. The reader must be guided and the main points clearly brought out — even at the cost of some repetition of material between legend and text. If Figures or Tables are large it may not be possible to include the legend on the same page. In such cases, put the legend on the facing page. If Figures, Tables or collages (mounted groups of photographs) are brought together, rather than being interspersed with the text, say

so and tell the reader where they are. If it is necessary to put a figure or table sideways in the text, it should be arranged so that is viewed from the right.

- *You should avoid directly copy-pasting figures/mechanistic diagrams from elsewhere; you will not be awarded any marks for using previously published figures/mechanistic diagrams. You are expected to take time to draw the major parts of such figures/mechanistic diagrams that are most relevant to your research. If you do decide to copy a figure from somewhere else, or modify it only a little, the original figure must be acknowledged (with reference in the legend and in the list)* (*see* Plagiarism*).*

Grades of Heading

Careful attention should be given to this point at the planning stage. Examples of the usual grades of heading are given below with a short description of each in brackets). Use bold or italic type as shown.

HEADING: RESULTS [capitals in bold print, centered, no underline or stop]

Subheading: Electroencephalographic Analysis [Upper and lower case in bold print, centered, no stop]

Further subheading: *EEG Feature Extraction* [Upper and lower case in bold italic print, centered, no stop]

Word Processing

- *There are some conventions which should be followed. Paragraphs should be created by leaving a blank line and not by indenting. Do not put spaces before a punctuation mark because it might be carried over to the beginning of a new line.*
- All punctuation marks should have only a *single* space *after* them, never before.

  Spelling, English and Grammar

- Poorly written reports stem from poorly crafted sentences. Sentences that are long or poorly written can be frustrating to read and will lose you a great deal of marks. You are expected to spend time on writing each and every sentence in your thesis with care. Make sure you do not forget the basic rules of English. Use nouns, verbs, adverbs, adjectives accordingly in each sentence. A common mistake is to make sentences too long. Keep sentences short and simple as far as possible.

- Do not expect that the reader will remember what has been said in previous sentences. Make sure you clearly spell out what is meant in each sentence, even if it means repeating yourself. Be specific and clear and avoid being vague. Ideally each sentence should be self-explanatory.

- Your supervisor will focus on the scientific content and is not expected to check spelling, to correct your English or any mistakes in grammar. A spell check should be performed before handing documents to your supervisor and before final submissions. Ask a colleague to read your report before handing any material to your supervisor and before final submission. If your colleague does not understand what you have written, you should make corrections before handing to your supervisor.

- Ensure the spell checker is set to 'English (UK)' and not 'English (US)' by using the 'Language' option on the Tools menu. Remember that you will still need to proof-read the final draft; the spelling checker will not find all errors. Pay special attention to names and technical terms

- Here is a list of the correct forms of words that are commonly mis-spelled.

accommodate	dependent (adj.)
occurred	separate
loose (i.e. not tight)	lose (i.e. mislay)
principal (i.e. main)	principle (i.e.underlying tenet)

- 'UK English' rather than 'US English' forms should be used: *e.g.* fibre *not* fiber.

- Student's *t* test should have a capital and apostrophe); the *t* should be italicised.

- "It's" should never be written in formal prose; always use 'it is'. The possessive is "its".

- Numbers less than eleven should be spelt in full unless they refer to specific units, e.g. '6 days', but 'six subjects.'

- Note that 'sec', 'h', 'min' [no stop] and 'd' are the abbreviations for seconds, hours, minutes and days, respectively. The multiplier 'k' as in km (kilometre) is always lower case. The abbreviations for units never take an 's-plural'.

Headers and Footers

Header can be used to insert space and/or a running title at top of each page; a Footer does the same at the bottom of the pages.

Make sure that there are page numbers throughout the document.

Pagination

Should be checked as the last stage in preparing a manuscript. It is usual to adjust the text so that odd lines or parts of lines do not appear at the beginning or end of a page. The adjustment may be done by inserting blank lines in appropriate places or by using the Insert Page Break command. *Word* has a 'Control widows and orphans' option (see Format menu, Paragraph, Line & Page breaks tab). Remember to set the page style (Page Setup) and printer type (*via* Chooser) before doing this and work from the beginning of the text.

Font Style

-   Choose your font with care. Some fonts take up a lot of space and others may not be suitable for laser-printing. Avoid fonts named after cities. *Arial* has been found to be a satisfactory, clear and reasonably compact font.
-   Fonts are designed for different purposes and a font that is easy to read on a screen (e.g. *Geneva*) is not necessarily suitable for body-text. *Times* is designed for narrow columns and does not look well in A4 pages and should not be used. *Times New Roman* shares many of the characteristics of *Times* (compact, with a lot of white space) but looks better.

Type, Spacing and Margins

The type must be fully formed as in the output of a laser or ink jet printer. The output of dot matrix printers is not acceptable. The type must be black and not less than 10 point. Line-spacing must be at one and a half or double spacing between lines. The gutter margin of both text and diagrams must not be less than 35 mm and that on the other three sides not less than 20 mm. Check with your supervisor if in doubt.

Special Sorts

There are many special characters which will be useful to you, such as the degree symbol (° — alt+k) and acute accents or *fada* (alt+e, followed by the letter you wish to accent) and grave accents (alt+~, followed by the letter). For Greek characters it is better to use the 'insert font' function rather than using the font *Symbol*. This allows you to change the font in the document and keep the Greek characters. If you use font *Symbol* and decide to change the font in the document you will have to go back and individually change all the Greek characters back to *Symbol* font.

Preparing Material for PowerPoint

Students are required to make oral presentations - another important skill. PowerPoint presentation will be used.

Legibility. Anything less than 18 pt body text will be difficult to read. Headings should be about 24 pt. Use *Arial* font to improve legibility. In general avoid fonts that have a serif *Times* is not suitable for projection. Bolding the text is helpful too. Diagrams will usually need to be enlarged. It is useless to merely copy pages from papers or books — the print size will be neither big enough nor dense enough.

Density. Five lines is the useful maximum per slide; and bullet points are better than continuous prose. If you are tempted to put more on, think again.

Practice, Practice, Practice your talk: Avoid reading from your notes and from your slides. Are you trying to write your speaking notes onto the slide? It is not good technique to simply read out what is on the screen. If you practice your talk beforehand, you will not need to read from your notes.

Plagiarism

In the academic world, the principal currency is *ideas*. As a consequence, you can see that *plagiarism* – i.e. passing off other people's ideas as your own– *is tantamount to theft*. It is important to be aware the plagiarism can occur knowingly or unknowingly, and the offence is in the action not the intent.

Plagiarism is a serious offence within College and the College's policy on plagiarism is set out in a central online repository hosted by the Library which is located at

 http://tcd-ie.libguides.com/plagiarism. This repository contains information on what plagiarism is and how to avoid it, the College Calendar entry on plagiarism and a matrix explaining the different levels of plagiarism outlined in the Calendar entry and the sanctions applied.

Undergraduate and postgraduate new entrants and existing students, are required to complete the online tutorial *'Ready, Steady, Write'*. Linked to this requirement, all cover sheets which students must complete when submitting assessed work, must contain the following declaration:

I have read and I understand the plagiarism provisions in the General Regulations of the University Calendar for the current year, found at: http://www.tcd.ie/calendar

I have also completed the Online Tutorial on avoiding plagiarism 'Ready, Steady, Write', located at http://tcd-ie.libguides.com/plagiarism/ready-steady-write

Plagiarism detection software such as Blackboard's "SafeAssign" and 'Turnitin' will be used to assist in automatic plagiarism detection. Students are encouraged to assess their own work for plagiarism prior to submission using this or other software.

Cyberbullying

Cyberbullying refers to bullying which is carried out using the internet, mobile phone or other technological devices and platforms. In general, cyberbullying is psychological rather than physical but is often part of a wider pattern of 'traditional' bullying (Reference- Union of students in Ireland cyberbullying-policy: https://usi.ie/policy/usi-cyberbullying-policy/)

Due to COVID-19 and as we move to greater online interaction and remote activities, students should be aware that all forms of bullying are a college offence and we strongly discourage any such activity. All such incidents will be dealt with as per college guidelines and regulations. We ask students to familiarise themselves with the college Dignity and Respect policy which supports a respectful work and study environment free from bullying and harassment.

Blackboard

Students must submit their thesis via Blackboard. Please see link below for all student information relating to Blackboard:

https://www.tcd.ie/CAPSL/resources/eLearning-students/

Exit Form

An Exit form must be included at the back of your thesis submission. The information on this form is to document a record of what data you recorded and how it can be accessed. It is imperative that you return this form when submitting your thesis. The exit form template is available in the following pages.
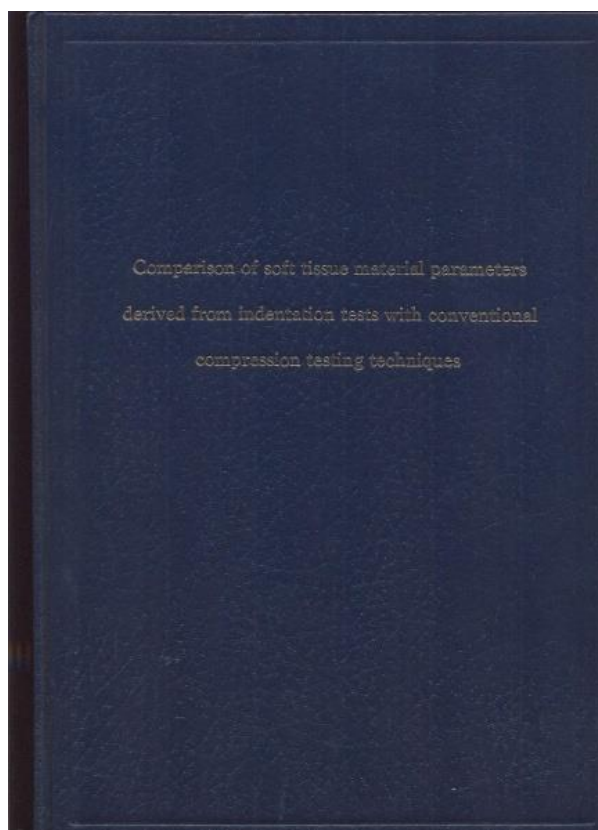
12. Thesis Submission

It is the duty of the postgraduate student to familiarise themselves with College regulations in relation to submission of theses. Please see [thesis submission guidelines](#) these regulations are on the Graduate Studies website. The thesis must contain immediately after the title page the declaration page (see sample page 2 below) signed by the author.

Note: Late submission could potentially result in a continuance fee being levied by the Graduate Studies Office. Dissertations should be written according to the style outlined below. Dissertations are assessed by academics who may not be expert in the precise field of study. The style of the dissertation should be designed for that readership.

Sample Thesis Cover – only applies if hardcopy is being submitted. Not necessary for the MSc Thesis

Comparison of soft tissue material parameters

derived from indentation tests with conventional

compression testing techniques

by

Seán Wall

A thesis submitted to the University of Dublin in partial fulfilment of the

requirements for the degree of

Masters in Bioengineering

Trinity College Dublin

September 2008

Supervisor

Dr. Ciaran Simms

Declaration

I declare that I am the sole author of this dissertation and that the work presented in it, unless otherwise referenced, is entirely my own. I also declare that the work has not been submitted, in whole or in part, to any other University as an exercise for a degree or any other qualification.

I have read and I understand the plagiarism provisions in the General Regulations of the University Calendar for the current year, found at: http://www.tcd.ie/calendar

I have also completed the Online Tutorial on avoiding plagiarism 'Ready, Steady, Write', located at http://tcd-ie.libguides.com/plagiarism/ready-steady-write

I agree that the library of Trinity College Dublin may lend or copy this dissertation upon request.

John Murphy

John Murphy

13. MSc Biomedical Engineering 2023/2024 -EXIT FORM

The information on this form is so there is a record of what data you recorded and how it can be accessed. It is mandatory that you complete this form with your thesis supervisor and return when submitting your thesis.

Student Name & ID Number	
Your contact details (mobile & email address)	
Title of research project	
Supervisor	
Where is your data stored?	
In what format is it stored?	
What are the login details and passwords to retrieve the data?	
Have you returned all documentation (publications, textbooks, articles, etc.) to your Supervisor?	
Have you returned all equipment to the Lab or Workshops(s)?	
Does this equipment function correctly or are their issues of maintenance to be addressed to have it function correctly for the next project?	
Any Other relevant information	

Student Signature and date: _____

Supervisor Signature and date: _____

14. The Supervisor and the Student

An outline of the role of the supervisor has been provided by the TCD Graduate Studies Office: The relationship between the supervisor and research student is a critical factor in determining the quality of the postgraduate experience. Best practice leads to a relationship that may be described as mentoring on the part of the supervisor and learning on the part of the student. For a successful collaboration between student and supervisor, both parties have to recognize their own separate responsibilities. Due to the diverse demands of different disciplines, it is not possible to legislate in detail across the whole academic range of college for the practices that supervisors and students should follow. However certain general principles should be clearly understood by all involved in postgraduate education. These are set out below.

Responsibilities of the supervisor

A postgraduate student is admitted by the Dean of Graduate Studies on the recommendation of the Director of Postgraduate Teaching and Learning and course coordinator all of whom sign to this effect. The course coordinator will assign each student to a supervisor for the duration of their project.

The supervisor has a reactive and proactive role. He or she must be reasonably accessible to the student for academic help and advice during progress of the research and particularly during preparation of the research thesis; he or she has a duty to be in touch with progress of the research student's work and inform the student of what is expected of him or her. In addition, the supervisor should help student in the latter's dealings with College officialdom and should be aware of College regulations as they affect postgraduates. Many of the cases of poor relationships between research students and their supervisors stem from a differing interpretation of what constitutes reasonable access. Supervisors need to recognize that the lack of adequate analysis of work submitted to them, undue delay in its return, and refusal to make, or inability to keep, appointments, damage the relationship with their students. Such inadequacies of supervision cannot be excused on the grounds of pressure of other work.

Responsibilities of the student

A research student must keep in contact with his/her supervisor and advise the latter on progress of research. He/she should submit written work or perform other academic exercises (for example contribute to seminars) when requested by supervisor. When seeking the academic services of a supervisor, a research student must acknowledge that the supervisor is likely to have other commitments and cannot be expected to drop everything to attend to his/her needs. This is particularly important during period of preparation of research thesis; supervisor and student should devise a timetable, which can be adhered to on both sides.

Additional points

1. Contact your supervisor early in the writing process (2-3 months before submission) to discuss table of contents and structure and overall layout.

2. Do not expect your supervisor to read incomplete or multiple drafts of your work

15. Discipline of Biomedical Engineering (BME) – Late Submission of Coursework Policy

Coursework and assessment are an essential part of a student's learning to reinforce aspects of module content. For all years (JS/SS/MAI/MSc) and **ALL** modules within the Discipline of Biomedical Engineering the following applies:

Individual Coursework

1. Coursework received within two weeks of the due date will be graded, but a penalty will be applied
   - Up to 1 week late = minus 15%
   - From 1 week to 2 weeks late = minus 25%

2. Any submissions received two weeks after the due date will not be accepted and will receive a zero grade.

3. Submission dates may be extended in exceptional and extenuating circumstances. Students must apply directly (via email) to the module coordinator requesting an extension and provide an explanation and/or evidence for such (e.g. medical cert). Please note that the module coordinator reserves the right to refuse granting of an extension.

Group Coursework

1. The same penalties for late submissions will apply to group coursework as outlined for "Individual Coursework".

2. In addition, certain modules may also adopt an additional grading scheme whereby group projects/assignments will be graded as a function of lecture attendance (See graph below as an example). This graph will differ for specific modules depending on the number of lecture/contact hours for that module. Please consult module coordinator.
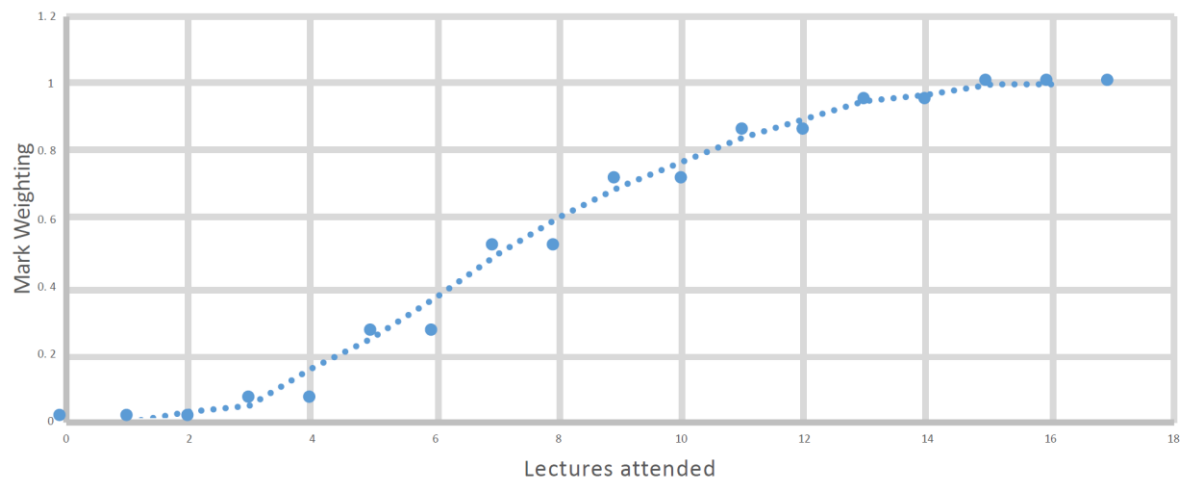
Example: For ME7B24 Experimental and Research Methods in Biomedical Engineering; if you receive 100% in your group project but have only attended 10 lectures your mark is capped at 70% or if you obtain 100% in a group project and attended no lectures your mark is capped at 0%.

16. University Rules and Regulations

Examinations, Assessment and Results

The pass mark for all elements is 50%. The overall mark for the course is the credit-weighted average of the mark awarded for each module. To qualify for the award of the M.Sc. in Biomedical Engineering, students must achieve an overall mark of at least 50%, achieve a pass mark in the dissertation AND pass individual modules amounting to 50 credits.

In the event a student has failed up to 10 ECTS of taught modules it may be possible to "pass by compensation". To "pass by compensation" a student must (i) achieve an overall credit-weighted average mark of at least 50% AND (ii) achieve a pass mark in taught modules carrying a minimum of 40 credits AND (iii) obtain a module mark of at least 40% in any remaining module(s).

Students who have failed the taught modules (by virtue of not achieving the overall average mark of 50% and/or not passing taught modules amounting to 50 ECTS credits) may be re-assessed within the academic year with the agreement of the course coordinator. Re-assessment is only available for failed modules amounting to 20 ECTS where at most 15 ECTS of modules were failed in any one semester and none of these modules could have been compensated.

Those students who achieve an overall average mark of 70% or above in both the taught modules AND the research dissertation will be awarded a Distinction. A Distinction cannot be awarded if a candidate has failed any module during the course. Students who do not pass the taught modules, and do not meet "pass by compensation" rules will be deemed to have failed the course overall and may apply to repeat the course.

A postgraduate diploma may be awarded where a student has completed 60 ECTS of modules. Therefore, in order to obtain the award of a postgraduate diploma, a student will be required to undertake a further 10 ECTS module (in addition to passing 50 ECTS of taught modules). An optional Biomedical Engineering Project module may be taken to enable this. This option will be available from the start of the second semester for students intending to proceed to the Postgraduate Diploma award. Those students who

achieve an overall average mark of 70% or above for the taught modules will be awarded a Postgraduate Diploma with Distinction.

Where a student fails to obtain a pass mark in the dissertation, there will be no time for a student to gain the required additional 10 ECTS for the award of a postgraduate diploma. In these cases, the postgraduate diploma award will be unavailable. Candidates may be required to present their research thesis to the external examiner during a viva voce examination. Both the examinations and the dissertation are subject to external moderation.

External Examiner

The external examiner for the MSc in Biomedical Engineering is Prof. Clark T Hung from Columbia University, New York (https://www.bme.columbia.edu/faculty/clark-hung). For policies and procedures regarding how student assessed work is shared with the external examiner please read Procedure for the transfer to External Examiners of students' assessed work.

Regulations for re-checking/re-marking

All graduate students have the right to discuss their examination, assessment and dissertation performance with the appropriate academic members of staff as arranged for by the Course Director.

Graduate students are entitled to view their scripts when discussing their performance.

Graduate students' examination performance cannot be discussed with them until after the publication of examination results.

To obtain access to the breakdown of their results, graduate students should make a request to their Course Director.

Having received information about their examination, assessment and dissertation results and having discussed these and their performance with the appropriate academic staff members, graduate students may request that their results be reconsidered, within four weeks of their publication, if they have reason to believe:

a. that the grade is incorrect because of an error in calculation of results or

b. that the examination paper specific to the graduate student's course contained questions on subjects which were not part of the course prescribed for the examination or

c. that bias was shown by an examiner in marking the script, assessment or dissertation.

In the cases (a) – (c) above, the request will be made in the first instance to the Course Director, who will discuss the request with the relevant parties and attempt to find a resolution; in the case of (a) above, the decision of the Director is final.

In the case of (b) and (c) above, if the Course Director does not grant the request, the student may ask that the relevant School committee consider their request. In submitting such a case for reconsideration of results, graduate students must state under which of (b) and/or (c) the request is being made. If the student is dissatisfied with the way in which his/her request was handled, he/she may write to the Dean of Graduate Studies clearly stating under which of (b) and/or (c) the request is being made. Once an examination result has been published, it cannot be amended without the permission of the Dean of Graduate Studies. The decision of the Dean of Graduate Studies is final.

Appeals process

Where a graduate student has failed a module, coursework component or dissertation and is dissatisfied with how the material was examined or feels that there are mitigating circumstances, he/she may appeal, in writing, to the Course Director. The reasons for the appeal must be clearly stated and supported where necessary by documentary evidence.

If the Programme Director refuses to grant the request, the student may make an appeal to the School's Director of Postgraduate Teaching and Learning who will, after determining if there are legitimate grounds for appeal, then convene the **School of Engineering Postgraduate Appeals Committee**. If this committee determines that there are valid grounds for the appeal to proceed, it will hear the appeal at a notifiable scheduled time. The student must attend and is entitled to present her/his own case and to be accompanied by an advisor from the Postgraduate Advisory Service or a representative from the Graduate Students' Union.

If the Postgraduate Appeals Committee refuses to grant the appeal or the student is not satisfied with the outcome of the appeal process, he or she may appeal the decision of the School in writing to the **Dean of Graduate Studies**, as outlined in Part III of the Calendar.

The onus is on the student to initiate the appeal, in the first instance to the Course Director, within **four weeks of notification** of the results being published. He/she is advised to liaise with the Postgraduate Student Support Officer (Senior Tutor) and/or the Graduate Students' Union in preparing the appeal.

The School of Engineering Postgraduate Committee is asked to note and approve this proposal for onward consideration by the School of Engineering Executive Committee.

Commendation for Projects

The Course Committee, in consultation with the External Examiner, may award a commendation for projects of exceptional merit. Should you have any queries regarding regulations and guidelines that apply to postgraduate students at Trinity, please consult the Graduate Studies website Graduate Studies - Trinity College Dublin (tcd.ie) or the University Calendar www.tcd.ie/calendar/. This Calendar contains all information concerning graduate studies in Trinity College, Dublin.

Grading Descriptors

The following Descriptors are given as a guide to the qualities that assessors are seeking in relation to the grades usually awarded. A grade is the anticipated degree class based on consistent performance at the level indicated by an individual answer. In addition to the criteria listed examiners will also give credit for evidence of critical discussion of facts or evidence.

17. Guidelines on Grades for Essays and Examination Answers

Mark Range	Criteria
90-100	IDEAL ANSWER; showing insight and originality and wide knowledge. Logical, accurate and concise presentation. Evidence of reading and thought beyond course content. Contains particularly apt examples. Links materials from lectures, practicals and seminars where appropriate.
80-89	OUTSTANDING ANSWER; falls short of the 'ideal' answer either on aspects of presentation or on evidence of reading and thought beyond the course. Examples, layout and details are all sound.
70-79	MAINLY OUTSTANDING ANSWER; falls short on presentation and reading or thought beyond the course but retains insight and originality typical of first class work.
65-69	VERY COMPREHENSIVE ANSWER; good understanding of concepts supported by broad knowledge of subject. Notable for synthesis of information rather than originality. Sometimes with evidence of outside reading. Mostly accurate and logical with appropriate examples. Occasionally a lapse in detail.
60-64	LESS COMPREHENSIVE ANSWER; mostly confined to good recall of coursework. Some synthesis of information or ideas. Accurate and logical within a limited scope. Some lapses in detail tolerated.
55-59	SOUND BUT INCOMPLETE ANSWER; based on coursework 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.
35-39	MARGINAL FAIL; inadequate answer, with no substance or understanding, but with a vague knowledge relevant to the question.
30-34	CLEAR FAILURE; some attempt made to write something relevant to the question. Errors serious but not absurd. Could also be a sound answer to the misinterpretation of a 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.

18. Guidelines on Marking for Project/Dissertation Assessment

Mark Range	Criteria
90-100	Exceptional project report showing broad understanding of the project area and exceptional knowledge of the relevant literature. Exemplary presentation and analysis of results, logical organisation and ability to critically evaluate and discuss results coupled with insight and novelty/originality. Overall an exemplary project report of publishable quality (e.g. peer reviewed scientific journal/patent application in- progress).
80-89	An excellent project report clearly showing evidence of wide reading far above that of an average student, with excellent presentation and in-depth analysis of results. Clearly demonstrates an ability to critically evaluate and discuss research findings in the context of relevant literature. Obvious demonstration of insight and novelty/originality. An excellently executed report overall of publishable quality (e.g. short peer reviewed conference paper such as IEEE in- progress) with very minor shortcomings in some aspects.
70-79	A very good project report showing evidence of wide reading, with clear presentation and thorough analysis of results and an ability to critically evaluate and discuss research findings in the context of relevant literature. Clear indication of some insight and novelty/originality. A very competent and well-presented report overall but falling short of excellence in some aspects. Sufficient quality and breadth of work similar to the requirements for an abstract at an international scientific conference.
60-69	A good project report which shows a reasonably good understanding of the problem and some knowledge of the relevant literature. Mostly sound presentation and analysis of results but with occasional lapses. Some relevant interpretation and critical evaluation of results, though somewhat limited in scope. General standard of presentation and organisation adequate to good.
50-59	A moderately good project report which shows some understanding of the problem but limited knowledge and appreciation of the relevant literature.

	Presentation, analysis and interpretation of the results at a basic level and showing little or no novelty/originality or critical evaluation. Insufficient attention to organisation and presentation of the report.
40-49	A weak project report showing only limited understanding of the problem and superficial knowledge of the relevant literature. Results presented in a confused or inappropriate manner and incomplete or erroneous analysis. Discussion and interpretation of result severely limited, including some basic misapprehensions, and lacking any novelty/originality or critical evaluation. General standard of presentation poor.
20-39	An unsatisfactory project containing substantial errors and omissions. Very limited understanding, or in some cases misunderstanding of the problem and very restricted and superficial appreciation of the relevant literature. Very poor, confused and, in some cases, incomplete presentation of the results and limited analysis of the results including some serious errors. Severely limited discussion and interpretation of the results revealing little or no ability to relate experimental results to the existing literature. Very poor overall standard of presentation.
0-19	A very poor project report containing every conceivable error and fault. Showing virtually no understanding or appreciation of the problem and of the literature pertaining to it. Chaotic presentation of results, and in some cases incompletely presented and virtually non-existent or inappropriate or plainly wrong analysis. Discussion and interpretation seriously confused or wholly erroneous revealing basic misapprehensions.

19. Commencements

All registered postgraduate students expecting to be conferred with a higher degree in the current academic year, are annually invited by email, to make application to the Proctors' Office. The invitation includes provision of all the information necessary to make application. Candidates are advised that closing dates are very strictly adhered to, and late applicants will not be admitted to the selected ceremony; however, they may be admitted to the next available commencement session. Commencement ceremony will take place in April 2025 for the MSc in Biomedical Engineering. Further information about the application process is available at www.tcd.ie/academicregistry/graduation/ or email graduation@tcd.ie

Recommended Reading Material

All recommended reading material will be listed in the module descriptors. Normally, text books for modules are available in the library.

20. Careers in Biomedical Engineering

Where are the jobs?

The medical device and diagnostic industry continues to be a vibrant growth sector and a cornerstone of the Irish economy. Circa 160 companies are involved in developing, manufacturing and marketing a diverse range of products and services from disposable plastic and wound care products to precision metal implants including pacemakers to microelectronic devices, orthopedic implants, diagnostics, contact lenses and stents. Some key facts/ figures:

- There are currently over 300+ medical technology companies in Ireland, exporting €6.8b worth of product annually and employing 32,000 people – Ireland also employs the highest number of MedTech personnel per capita in Europe. https://www.idaireland.com/doing-business-here/industry-sectors/medical-technology

- Exports of medical devices and diagnostics products now represent 8% of Ireland's total merchandise exports; and growth prospects for the industry globally remain good.

- Many of the world's top medical technology companies have invested significantly in Ireland and a number of exciting, research-based, indigenous companies are emerging and competing internationally.

- Over 90 of the companies in the sector are indigenous (ref Enterprise Ireland)

- The Irish government has identified the medical technology sector as one of the key drivers of industrial growth for the future and provides a wide range of supports to encourage and foster this growth.

- The medical technology industry in Ireland is changing from being prominently manufacturing to being more complex and driven by R&D. It now involves intensive collaboration between a broad range of partners, including research institutions, clinicians, manufacturing companies and government agencies.

Ireland is well placed to capitalise on the growing global market for medical technology products and services. The challenge is to continue to develop and integrate the broad

range of strategic competencies and support systems that will enable this island to compete as a mature, high value added economy, with innovation at its core.

Employment in the biomedical engineering industry in Ireland has grown to the level where the industry now directly employs over 12,000 people in Ireland, of which up to 20% are graduate engineers and scientists (see www.ida-ireland.ie). The engineer working in this industry needs to be both technically competent and capable of integrating those aspects of biology and medicine related to the medical device. Many bioengineers are involved in applying science and engineering knowledge to the manufacture of medical products.

Finding Opportunities: recommended resources

www.tcd.ie/Careers

www.gradireland.com

www.prospects.ac.uk

Jobs websites such as

https://www.rftgroup.ie/

https://www.irishjobs.ie/

www.monster.ie/

Professional Bodies IMDA, IEI

Industries - IBEC

https://www.engineersireland.ie/

https://www.engineersireland.ie/students

Graduate Employer Careers Fairs: RDS in June and October

Events | gradireland

CAS surveys on pharmaceutical, chemical & bio industry, medical devices

http://www.tcd.ie/Careers/resources/occupations/

FAME Directory

Scientific and Professional Journals

But…….. Not all jobs are advertised so you need to use creative approaches

Using your networks for information/ advice and opportunities

Information and advisory interviews

Taking the stepping stone approach

Scanning media

Letting people know you are looking

Professional networks – organisations, journals

Work shadowing

Training in area related to your target

Speculative applications to employers

And make use of your network!

21. Student Representation

Student – Staff Committee

The student – staff committee was established as a formal channel of communication between students, researchers and staff and to enhance the experience for researchers and students in the Centre. It is an opportunity for students to express their views and opinions on matters such as facilities in TBSI, resources, teaching etc.

Members of the committee will be elected at the beginning of each academic year for a term of one full academic year and will consist of two staff members, two student members and a secretary. The secretary, will be responsible for convening meetings, drawing up agendas and acting as meeting secretary. You should liaise with the committee members if you would like an issue raised at the Committee.

The Class Rep

A class rep should be appointed by all the class members at the beginning of the academic year. The role of the class rep is to primarily act as a contact point for the class in urgent matters.

Academically, the main tasks of class rep are as follows:
- to create a contact list for class members in case there is a need to contact the whole class or individual class members
- to act as a first contact point for the class should course director need to urgently contact the whole class
- to relay any comments from class to course director and vice versa
- organise social events for the class, although this is normally shared by all in the class.

Graduate Students' Union/Aontas na N-iarchéimithe

Trinity's Graduate Students' Union (GSU) established in 1973 is the representative body for all postgraduate students in Trinity College Dublin, the University of Dublin. The two sabbatical officers of the GSU work full-time and represent postgraduate students on all major committees including Board, Council, Student Life, Graduate Studies committee and Research Committee. The Union's executive committee which includes representatives from all faculties convene on a monthly basis and more often when required. The objective of the Union is to effectively represent postgraduate students within the University, advocate on behalf of Union members on issues that impact your education internally and nationally; and to protect the interests of our union members during their studies. Activities of the Union include: providing social and recreational facilities for postgraduate students; monitoring and developing the study and recreational facilities of the 1937 Postgraduate Reading Room; providing a Graduate common room for postgraduate students (located in house 7) and to provide and manage lockers for students in the 1937 Reading Room (rental is organised through the front office in house 6).

The GSU produces an academic and peer reviewed journal on an annual basis, the Trinity Postgraduate Review (http://trinitypostgradrev.wixsite.com/tcd-ie), and a literary magazine, College Green (www.collegegreenmagazine.com/). It also produces a postgraduate handbook for students with information on supports and services available to postgraduate students. The GSU President works in the area of policy and strategy. The GSU Vice-President acts as the Welfare and Education Officer for postgraduates in TCD and provides confidential one-to-one advice, advocacy and support in areas such as student supervisor relationships and financial hardship. The GSU Communications Officer informs you on a weekly basis of information, postgrad events and updates from the university and the wider metropolitan community through the medium of a digital newsletter titled Postgrad News. The GSU website www.tcdgsu.ie provides the latest updates from the Union, information on elections, campaigns and connections to the Union's social media platforms. Students can arrange meetings with the sabbatical officers via emailing either the GSU President at president@tcdgsu.ie or the GSU Vice-President at vicepresident@tcdgsu.ie. The general website contact details are Contact Us — Graduate Students' Union - Trinity College Dublin (tcdgsu.ie) and the office landline is (01) 896 1169.

22. College Information & Student Supports

Academic Registry

To contact Academic Registry all enquiries should be directed through one of the 4 channels:

- Log an enquiry via ASK AR on the my.tcd.ie portal
- Via email at academic.registry@tcd.ie or here
- Via phone at #4500 [students] or #4501 [staff]

From there they will be answered directly or escalated to the correct team

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.

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

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

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

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

Contact Email: chaplaincy@tcd.ie

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

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 below for more details:

TCDSocieties@tcd.ie

www.trinitysocieties.ie

instagram.com/trinitysocieties

twitter.com/TrinityCSC

facebook.com/trinitysocieties

Trinity College also has a huge range of sports clubs which are governed by the Dublin University Athletic Club (DUCAC). See here for more details.

College Health Service

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

Opening hours: 09.00 - 16.40 with emergency clinics from 09.00 - 10.00.

Tel: 01 896 1591 or 01 896 1556

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

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. Please visit: https://www.tcd.ie/info_compliance/data-protection/student-data/ and Data Protection - Information Compliance : Trinity College Dublin (tcd.ie) for more detailed information on how we obtain, use and disclose student data in the course of performing University functions and services. Information regarding General Data Protection Regulation (GDPR) may be found here: https://www.tcd.ie/dataprotection/GDPR/

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).

https://www.tcd.ie/estatesandfacilities/facilities-and-services/campus-services/security/

Niteline

Niteline is a confidential and anonymous listening service that is run by and for students from Trinity, DCU, UCD, NUI Maynooth, the Royal College of Surgeons in Ireland (RCSI), and the National College of Art and Design (NCAD)which is open every night of term from 9pm to 2.30am. Tel: 1800 793 793
Web: https://niteline.ie/

Postgraduate Advisory Service

The Postgraduate Advisory Service is a unique and confidential service available to all registered postgraduate students in Trinity College. It offers a comprehensive range of academic, pastoral and professional supports dedicated to enhancing your student experience.

Who?

The Postgraduate Advisory Service is led by the Postgraduate Support Officer who provides frontline support for all Postgraduate students in Trinity. The Postgrad Support Officer will act as your first point of contact and a source of support and guidance regardless of what stage of your Postgrad you're at. In addition each Faculty has three members of Academic staff appointed as Postgraduate Advisors who you can be referred to by the Postgrad Support Officer for extra assistance if needed.

Contact details of the Postgrad Support Officer and the Advisory Panel are available on our website: http://www.tcd.ie/Senior_Tutor/postgraduate/

Where?

The PAS is located on the second floor of House 27. We're open from 8.30 – 4.30, Monday to Friday. Appointments are available from 9am to 4pm. Phone: (01) 8961417

Email: pgsupp@tcd.ie

What?

The PAS exists to ensure that all Postgrad students have a contact point who they can turn to for support and information on college services and academic issues arising. Representation assistance to Postgrad students is offered in the area of discipline and/ or academic appeals arising out of examinations or thesis submissions, supervisory issues, general information on Postgrad student life and many others. If in doubt, get in touch! All queries will be treated with confidentiality. For more information on what we offer see our website. If you have any queries regarding your experiences as a Postgraduate Student in Trinity don't hesitate to get in touch with us.

Research Ethics and Good Research Practice

All researchers (staff and students) should reflect on the implications of their work, not just in terms of human (and animal) welfare and dignity, but also the social and cultural impact of their research. All research should be undertaken with cognizance of the Trinity College Guidelines for Good Research Practice.

Skills4Study Campus (S4SC)

Skills4studycampus (S4SC) is a fully interactive e-learning resource, which helps students to develop study skills and is suitable for students on all modules and in any year of study. Published by Palgrave Macmillan, core skills are developed through personalized interactive activities, tests and assessments. Utilised by HEIs in UK and in ROI includes UCC and UCD. Feedback from staff has been very encouraging. Fully embedded by School of Nursing (module handbook, skills module) and end of year analysis of academic performance indicates positive correlation with S4SC usage / module completion.

Study skills can be provided 'anytime, anywhere', fully accessible to students living outside of Dublin, or who commute long distances, have family or work commitments, extensive off campus placements, or heavy timetables. Login will be provided via the link on www.tcd.ie/local, additional links should be added on Student Homepage, Orientation website and the new student portal my.tcd.ie.

Student 2 Student (S2S)

S2S offers trained Peer Supporters if you want to talk confidentially to another student or just to meet a friendly face for a coffee and a chat. Peer Supporters are there to assist with everything from giving you the space to talk about things to helping you access resources and services in the College. You can email us directly to request a meet-up with a Peer Supporter or can pop in to the Parlour to talk directly to one of our volunteers and arrange a meeting. S2S is supported by the Senior Tutor's Office and the Student Counselling Service

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

E-mail: student2student@tcd.ie,

Phone: + 353 1 896 2438

Student Counselling Service

The Student Counselling Service, 3rd Floor, 7-9 South Leinster Street, College.

Opening hours: 9:15 am to 5:10 pm Monday to Friday during lecture term.

Tel: 01 896 1407

Email: student-counselling@tcd.ie

Web: http://www.tcd.ie/Student_Counselling.

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

Students' Union Welfare Officer

House 6, College

Email: welfare@tcdsu.org

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

Trinity Careers Service (See Careers Advisory Service below also)

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. The Trinity Careers Service and the School of Engineering also hold an annual Careers Fair in October which gives students the opportunity to find out about career prospects in over fifty companies.

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

Trinity Disability Service

Postgraduate Supports for Students with Disabilities
Postgraduate students (both taught and research) who have a disability are encouraged to apply to the Disability Service for reasonable accommodation.

Supports for Postgraduate Students includes:

- Academic Support
- Assistive Technology
- Occupational Therapy
- Support on Placements and Internships
- Preparation for Viva Voce examinations

An application can be made through my.tcd.ie via the 'My Disability Service' tab. Additional information is available in a step-by-step How to apply for Reasonable Accommodations guide.

Any postgraduate student in Trinity (or prospective student) is welcome to contact the Disability Service to informally discuss their needs prior to making a formal application. Please email askds@tcd.ie or visit the Disability Service Contact page.

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

https://www.tcd.ie/disability/current/Postgrad.php

Declan Treanor, Disability Services Coordinator

Room 2054, Arts Building. Trinity College Dublin, Dublin 2

Email: disab@tcd.ie

Tel: 01 896 3111

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

Trinity College Students' Union

The Trinity College Students' Union (TCDSU) is run for students by students. TCDSU represent 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/**.

23. Health and Safety

We operate a 'safe working environment' policy and we take all practical precautions to ensure that hazards or accidents do not occur. We maintain safety whilst giving you the student very open access to facilities. Thus safety is also your personal responsibility and it is your duty to work in a safe manner. By adopting safe practices you ensure both your own safety and the safety of others.

Please read the following Safety Documents for working practices in the Department of Mechanical and Manufacturing and Biomedical Engineering:

https://www.tcd.ie/mecheng/assets/pdf/Safety_Statement.pdf

https://www.tcd.ie/mecheng/safetystatement/

https://www.tcd.ie/Engineering/safety/

If you are working in Trinity Centre for Biomedical Engineering Laboratories in Trinity Biomedical Sciences Institute, please contact Simon Carroll, Senior Technical Officer at scarrol6@tcd.ie to complete necessary Health and Safety paperwork prior to completing any laboratory work.

For general safety precautions, please complete the form on the link below. All of the Acknowledgement forms are to be completed online for undergraduates and postgraduate students. The forms can also be found here:

MMBE Safety Statement Student Acknowledgment Form

COMPLETED FORMS MUST BE RETURNED TO THE DEPT SAFETY OFFICER (Gordon O'Brien, Parsons Building – email: gordon.obrien@tcd.ie).

Please ensure you comply with the instructions given in these important documents. Failure to behave in a safe manner may result in your being refused the use of departmental facilities.

Staff/Student Committee

The Staff/Student Committee meets once a semester to discuss matters of interest and concern to students and staff. It comprises class representatives from each year.

It is the Department's policy to ensure, in so far as possible, the health, safety and welfare of all its staff and students in accordance with the College Safety Policy, the Safety, Health and Welfare at Work Act of 2005 and relevant, later, subsidiary legislation and statutory instruments. All reasonable steps will be taken to ensure that no persons – be it staff, students, or others – health, safety and welfare is put at risk by, or as a result of the activities of the Department.

Students are expected to co-operate by taking proper care for their own health and safety and the safety of others who may be affected by their acts or omissions. Students are expected to follow any instructions in safe practices and procedures and ensure they do not intentionally or recklessly interfere or misuse anything provided in the interest of health safety and welfare. Failure to comply with safe procedures or instructions may result in the commencement of disciplinary procedures by the college.

The Safety, Health and Welfare at Work Act 2005 requires that you take all precautions, as far as is reasonably practicable, to avoid endangering yourself or others by your activities. The Health and Safety Statement and Codes of Practice for the Department areas are set out in the MMBE Safety Statement. https://www.tcd.ie/mecheng/safetystatement/safety-statement/ You are required to read, understand, and abide by them. **You must also complete the Safety Statement Acknowledgement Form. Students and staff will be excluded from all laboratories and workshops until they have completed this Acknowledgement.**

The Departmental Safety Statement supplements the University Safety Statement and University Policies which are accessible on the Trinity College Dublin's website.

Risk Assessments

All members of the college must carry out a risk assessment where their work has the potential for harm to themselves and others.

All experimental work requires a risk assessment that:

- includes and addresses any potential hazard, including lone working.
- is updated if there is a significant change to experimental equipment or procedures.
- is reviewed and updated annually.
- is signed by the responsible PI/supervisor.

Preferably, your risk assessments will be included in a Project Safety Statement. The Project Safety Statement will include but is not limited to the following;

- Title block

- Student & Lab info

- Emergency contacts

- Overview of project

- Registered users form

- Activity details

- SOPs

- Safety Data Sheets

- Risk Assessments in 5x5 format

Some projects may require multiple risk assessments. Completed Project Safety Statements should be uploaded to the Projects SharePoint. Previous examples can be found on SharePoint.

New Hazard Safety Document

This document is required for new High-Risk Hazards such as Chemicals, Compressed Gas, Cryogenics, etc. The document should provide an overview of the hazard (why the hazard is required, hazard location, duration the hazard is required for, etc.).

Additionally, an in-depth account of the hazard should include safety information and documentation, MSDS and any additional safety documentation relevant to the hazard. All new hazards will require risk assessments and approval.

After Hours Working

It is now compulsory to use the SafeZone App while in MMBE labs or offices outside of normal working hours. The normal working hours for the Department are 8am to 5pm, Monday to Friday. Outside of MMBE normal working hours, the use of SafeZone app is mandatory. Extended hours for the Department are 5pm to 10pm, Monday to Friday and 10am to 4pm Saturday and Sunday. There will be no access to Parsons Building outside of these hours.

Working on experimental systems (or machinery) outside normal working hours is not permitted without prior authorization of the project supervisor (or person-in-charge) after he/she has conducted a full assessment of risk and devised a safe system of work.

No staff member, postdoctoral worker or student will be permitted to carry out experimental or technical work of any kind in the Department at any time outside normal working hours unless there is another person close by, who is aware of their presence so that they can summon assistance in the event of an accident.

Isolated individuals must never carry out potentially hazardous work or activities and should apply for Lone Working approval.

Please download the SafeZone app and see the University lone working policy and the MMBE Protocol for After Hours Working.

General Safety Action

When you enter a building in the University, MMBE or otherwise:

- Find out how to get out in an emergency.
- Know the location of the emergency evacuation assembly point.
- Know where the nearest alarm call point is.
- Read the hazard information signs (fire, first aid, chemical, biological, radiation, laser etc.).
- Emergency numbers are:
    - 1999 or 01 8961999 – Main Campus
    - 3999 or 01 8963999 – TBSI

Fire Action

What to do if you discover a fire:

- Raise the alarm at the nearest break glass unit or alarm call point.
- Leave your building immediately using the nearest exit route.
- Do not use lifts.
- Close doors behind you as you leave.
- Do not take risks.
- Notify Security at 1999 or mobile 01 896 1999, informing them that the alarm has been raised and in which area. TBSI numbers are: 3999 or 01 8963999.

- Notify a Fire Warden of your findings if there is one outside the building.

- Report to your designated Assembly Point, do not congregate at the building entrance.

  - **Parsons Building & SNIAM**　　　**Point D**
    - Grass triangle ('Flat Iron') at east end of Boardwalk (College Park).

  - **WATTS**　　　　　　　**Point E**
    - Between the Lloyd and O'Reilly Buildings, near the Arches.

  - **TBSI**　　　　　　　**Points G and F**
    - To the sides of the Institute on Cumberland St South and Sandwich Street.

What to do if the fire alarm sounds

- Obey, promptly, all instructions given by the Fire Wardens/Safety Officer.

- Leave your building immediately using the nearest exit route.

- Do not use lifts.

- Close doors behind you as you leave.

- Do not take risks.

- Move away from the building.

- Report to your designated Assembly Point, do not congregate at the building entrance.

- Do not re-enter building for any reason until authorised to do so and fire alarm is switched off

First Aid

First Aid will not take the place of professional treatment. In the case of minor injuries such as cuts or burns, assistance may be sought from members of the Department who possess a qualification in First Aid. For serious injuries during normal office hour's emergency medical attention can be obtained from the University Health Services by contacting Ext. 1556.

Updated lists of first aiders in the Department are located near first aid boxes installed throughout the Department. Make sure to familiarise with the location of the nearest first aid box. Current MMBE first aiders can be contacted through the Mechanical workshop.

Should the local first aiders be unavailable then the emergency services can be contacted on Ext. 1999 for the Main campus or 3999 for the TBSI building.

MMBE Safety Contacts

First Aid

- Mr. Michael Reilly   ext. 1557
- Mr. Alex Kearns   ext. 1463 (workshop) MMBE Safety Officer
- Mr. Gordon O'Brien   ext. 2396   email: gordon.obrien@tcd.ie

Specialist Safety Area contacts (Chemical, Laser, Electrical, Fire Wardens, etc.) and University Safety contacts can be found in Section 6 of the MMBE Safety Statement.

Safety Links

MMBE Website Safety Section

- https://www.tcd.ie/mecheng/safetystatement/

Projects SharePoint Safety Section

- https://tcdud.sharepoint.com/sites/TCDGroup-PeterandGerry/Safety/Forms/AllItems.aspx

SafeZone App

- https://safezoneapp.com/

MMBE Lone and Out-of-Hours Working Policy

- https://www.tcd.ie/mecheng/safetystatement/mmbe-lone-and-out-of-hours-working/

Risk Assessments

- https://www.tcd.ie/mecheng/safetystatement/risk-assessments/
- https://tcdud.sharepoint.com/:f:/r/sites/TCDGroup-PeterandGerry/Safety/Sample%20Risk%20Assessments?csf=1&web=1&e=Fwjfe3

Risk Assessment / Project Safety Statement Upload

- https://tcdud.sharepoint.com/:f:/r/sites/TCDGroup-PeterandGerry/Safety/Completed%20Risk%20Assessments?csf=1&web=1&e=oN6i3X

University Safety Office

- https://www.tcd.ie/safetyoffice/

24. Careers Advisory Service

Postgraduate study opens the doors to many opportunities, but the market is competitive and you will need to differentiate yourself clearly from other candidates.

Resources:

The Careers Advisory Service (CAS) provides a wide range of resources and services to help you make and implement informed choices about your future career direction.

The Careers Information Centre at 7-9 South Leinster Street contains a range of free, career-related booklets and employer materials for you to take away. Online, the resources section of the website (www.tcd.ie/Careers/resources) provides useful information on a range of topics from career choice and planning, to working abroad, taking a year out and everything in between.

As a Trinity College Dublin student you have access to information, support and guidance from the professional team of Careers Consultants throughout your time at Trinity and for a year after you graduate. The support offered includes individual career guidance appointments, CV and LinkedIn profile clinics and practice interviews. The Trinity Careers Service and the School of Computer Science and Statistics also hold an annual Careers Fair in October which gives you the opportunity to find out about career prospects in a wide range of companies.

The careers advisor for the School of Engineering is: Marielle Kelly, Careers Consultant, School of Engineering, School of Computer Science and Statistics
Trinity Careers Service, 2nd Floor, 7-9 South Leinster Street
Trinity College Dublin, the University of Dublin, Dublin 2, Ireland.
01 8963304 www.tcd.ie/careers

Marielle is available throughout the year for individual career guidance and job search support, and the Careers Service is available to support your students with their career direction and applications (CVs, cover letters, LinkedIn, practice interviews, personal statements etc). Students can sign into our MyCareer portal to book appointments and careers workshops, view vacancies, and book their place at employer events including our

annual **Computing and Technology Fair** (Thursday 5th October) and **Engineering and Environment Fair** (Thursday 12th October).

Services:

Individual appointments to meet a Careers Consultant are also available. They work with you to identify how best to approach the next step in your career. They can also review your CV/LinkedIn profile and provide coaching to ensure maximum impact at interview.

Job opportunities from employers currently recruiting Trinity graduates as well as postgraduate courses and funding are available online.

CAS also offers a wide range of seminars; workshops and employer presentations, including postgrad specific events, throughout the year that will help you explore where your postgraduate study can take you.

Trinity Careers Service

- Visit https://www.tcd.ie/Careers/ for career and job search advice
- Sign into MyCareer to book appointments, find information about vacancies and bursaries, and book your place on upcoming employer events.
- Follow the service on Instagram for career news and advice @trinity.careers.service

My Career

An online service that you can use to:

- Apply for opportunities which match your preferences - vacancies including research options
- Search opportunities- postgraduate courses and funding
- View and book onto employer and CAS events
- Submit your career queries to the CAS team
- Book an appointment with your Careers Consultant

Simply login to MyCareer here using your Trinity username and password and personalise your profile

Careers Advisory Service

Trinity College Dublin, 7-9 South Leinster Street, Dublin 2

01 896 1705/1721 | Submit a career query through MyCareer

https://www.tcd.ie/Careers/mycareer/students.php

MyCareer: as above	TCD.Careers.Service	TCDCareers
www.tcd.ie/ Careers/students/postgraduate/	@TCDCareers	tinyurl.com/LinkedIn-TCD-Connecting

Opening Hours

During term: 9.30am - 5.00pm, Monday - Friday

Out of Term: 9.30am - 12.30pm & 2.15 - 5.00pm, Monday - Friday

25. Contact Details

Course Administrator:

Ms. Lisa O'Neill

Parsons Building,

Trinity College, Dublin 2, Ireland

Tel: +353-1-8963393

Email: bioengmsc@tcd.ie
Web: www.tcd.ie/biomedicalengineering

26. Campus Maps

The Trinity Centre for Bioengineering is located on level 3 of the Trinity Biomedical Sciences Institute, 152-160 Pearse Street, Dublin 2
Tel: +353-1-8964214

Legend

- ⬈ Computer Access Point
- ⬇ Campus Entrance
- Food (Snack)
- Food (Meal)
- Off-campus journey of more than 10 min

Important Orientation Locations

1. Ed Burke Theatre (Orientation Talks)
2. ID Card Collection
3. Academic Registry, Fees Office, Admissions Office, Student Records and Global Room

1 Arts Block, Disability Service room 2054

Tallaght Hospital
St. James' Hospital
30 min Luas from James'
15 min Luas from Abbey St
College Green
Foster Place Offices & Innovation Academy
S College Green
Grafton St
Suffolk St
Westmoreland St
College St
D'Olier St
Hawkins St
40 min Bus
Santry Stacks and Sports Grounds
School of Nursing and Midwifery
House 6, SU Offices, Shop & Bookshop
House 5
Regent House
Parliament Square
Accommodation Advisory Service
Chapel
House 8
Atrium
Dining Hall
Provost's House
Provost's Garden
Long Room Hub
Exam Hall
Campanile
Library square
Senior Tutor & Chaplaincy
GMB
Buttery
Botany Bay
Pearse St
Tara St
Douglas Hyde Gallery
Dawson St
Trinity Hall
10 min Luas + 10 min walk from Stephen's Green
Nassau St
1937 Reading Room
Fellow's Square
Lecky Library
Long Library & Book of Kells
Rubrics
House 27
Printing House
Áras an Phiarsaigh IS Services Help Desk
South Frederick St
Berkeley Library
Ussher Library
Museum Building
New Square
Samuel Beckett Theatre
Health Centre
Kildare St
College Park & Cricket Grounds
Rose Garden
Civil Engineering
Simon Perry Building
Luce Hall
Shaw St
Moyne Institute
Pavilion
Rugby Pitch
Fitzgerald
Botany Dept
Naughton Institute & Science Gallery CRANN
South Leinster St
Parsons Building
Chemistry
Anatomy
Zoology
Physiology
Loyola Inst. & School of Ecumenics
SNIAM
Laser Huts
Lloyd Institute
Mark St
Dublin Dental Hospital
Clare St
Lincoln Place
Smurfit Institute
Panoz Institute
Hamilton
O'Reilly Institute
Hamilton JXN
Hamilton Café and SU Shop
Westland Row
Sports Centre
Lombard St East
3 Biotechnology, Offices for Fees, Admissions & Student Records
8-9 South Leinster St, Centre for Deaf Studies, Careers Advisory Service, Clinical Speech and Language Studies, Counselling Service
Trinity Enterprise Centre
Pearse St Dart Station
Goldsmith Hall
JCR & Trinity Access Programme (TAP)
Biomedical Sciences Institute and Medical School office
10 min walk
Advanced Microscopy Laboratory
Lir Academy