Engineering Courses

Engineering (common entry), with specialisations in:

- Biomedical Engineering
- Civil, Structural and Environmental Engineering
- Computer Engineering
- Electronic Engineering
- Electronic and Computer Engineering (joint programme)
- Mechanical and Manufacturing Engineering
- Engineering with Management
What is Engineering?

Engineering is about being creative in technical problem solving. Engineers make things possible by using mathematical and scientific principles together with analytical and design skills. They tackle existing problems by developing new solutions through innovative technologies. They also expand the frontiers of society by developing advanced materials, sustainable energy systems, construction technologies, transport systems, biomedical devices and telecommunications infrastructure.

Engineering:
The course for you?

We have been teaching Engineering at Trinity since 1841. There have been immense developments since that time, but the continuity of excellence in teaching and learning is a source of pride for us and our graduates. A distinctive feature of Engineering at Trinity is the two-year common programme, in which all students learn the fundamentals of Engineering science and project work prior to choosing a specific Engineering discipline. Trinity is the top-ranked university in Ireland, and our Engineering graduates use this to their advantage all over the world as well as in Ireland.

Engineering is a constantly evolving profession. As an engineer, you will need to be adaptable both to the rapid development of new ideas and technology and to the shifting requirements of industry and society. You will need to be a good communicator and be capable of working as part of a team. Above all, you must be a problem solver. You must be creative and able to synthesise and analyse information from different sources to arrive at efficient and practical solutions.

Engineering @ Trinity

The School of Engineering at Trinity is ranked in the top 200 Engineering Schools in the world and offers outstanding teaching by engineers who are at the forefront of their field worldwide. It has a strong philosophy of research-led teaching and continuously benchmarks itself against the top international engineering schools. The Engineering course offers the opportunity to carry out research as part of your course with the aim of producing graduates capable of participating at the highest national and international levels. There are opportunities for work placements in Ireland and abroad as well as study abroad opportunities as part of the degree programme. The Engineering programme is fully accredited by Engineers Ireland up to Masters level (M.A.I.) and offers excellent career prospects in Ireland and abroad.

Graduate skills and career opportunities

Engineering graduates from Trinity have the capacity to think independently but work in teams. They can use technical understanding to problem solve in a wide range of technical areas. They are able to communicate their technical and creative ideas to other professionals and to society at large. They are able to take responsibility, deal with complexity and ambiguity and successfully face open-ended challenges.

Your degree and what you’ll study

The B.A.I./M.A.I. (Engineering) degree programme is based on two years of general engineering, providing students with a firm grounding in the principles common to all disciplines, followed by two/three years of specialisation. Graduates are professionally accredited engineers with both a broad-based understanding of the whole discipline and a detailed knowledge of their chosen specialist area. The aim is that graduates will be able to continuously train themselves, to adapt and move into related or newly emerging areas as their careers develop after graduation.

Do you enjoy...

Technical problem-solving?

Using an understanding of how things work to make them better?

Using technical know-how, teamwork and creativity to develop new inventions?

Trinity College Dublin, the University of Dublin
SPECIAL ENTRY REQUIREMENTS
Leaving Certificate  H4  Mathematics
Advanced GCE (A-Level)  Grade C  Mathematics

RELATED COURSES
TR038: Engineering with Management, page 146

Engineering Course Structure

Year 1 and Year 2
Common to all Engineering streams

Year 3
Select one of:
- Civil, Structural and Environmental Engineering
- Mechanical and Manufacturing Engineering
- Electronic Engineering
- Electronic and Computer Engineering
- Computer Engineering
- Biomedical Engineering

Year 4 – B.A.I. Programme
- Individual Research Project
- Graduate with B.A., B.A.I. degrees

Year 4 – B.A.I. Programme
- Year at Trinity
- or
- Semester 1 – Trinity
  Semester 2 – Internship
- or
  International Exchange

Year 5 – M.A.I. Programme
- Individual Research Project
- Graduate with B.A., M.A.I. degrees

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Graduate with B.A., M.A.I. degrees
FIRST AND SECOND (FRESHMAN) YEARS
All students follow a common programme for the first two years. The first year comprises introductory courses in engineering science, mathematics, computer science, physics, chemistry, mechanics, electricity and magnetism, graphics and computer-aided engineering, and a group design and build project.

In the second year, students take further engineering science modules and complete two more group design and build projects. This allows you to explore all the possibilities open to you in advance of making your final decision about which specialism to concentrate on.

While every effort is made to allow students to study the course they choose, in some departments the number of places for students of any one year may be limited (this has never been necessary so far).

WHAT HAPPENS NEXT?
At the end of second year you choose one of the six specialist areas:
▶ Biomedical engineering
▶ Civil, structural and environmental engineering
▶ Computer engineering
▶ Electronic engineering
▶ Electronic and computer engineering (joint programme)
▶ Mechanical and manufacturing engineering

THIRD AND FOURTH (SOPHISTER) YEARS
Courses in the third and fourth (Sophister) years aim to broaden and deepen your knowledge and understanding of the specialism you have chosen.

Subjects are studied in much greater detail and students undertake real-life, practical projects. For example, if you choose Civil, structural and environmental engineering you could end up testing the pre-cast concrete used to build the Paddington to Heathrow railway; if you choose Computer engineering, you might find yourself building a microprocessor system.

FIFTH YEAR OPTIONS WITH STUDY ABROAD AND INTERNSHIP OPPORTUNITIES
Engineering students require a Masters degree to be directly eligible for Chartered Engineer status with Engineers Ireland. Therefore the School offers several options for a fifth year leading to a Masters degree (M.A.I.).

▶ M.A.I. (Domestic)
Students can spend the fourth and fifth year in Trinity, undertaking additional modules in their specialisation as well as a group project in fourth year and a significant individual project in fifth year. Students also have the option of spending the second semester of their fourth year undertaking a supervised internship placement. The remainder of their fourth year and the fifth year are spent in Trinity undertaking additional modules in the specialisation. Students complete a significant individual project in 5th year.

▶ M.A.I. (International)
Students have the option to spend their fourth year abroad as part of the Erasmus/International exchange, CLUSTER or UNITECH programmes. As part of the Erasmus/International exchange or CLUSTER programmes, students spend their fourth year abroad at a partner university and return to complete their fifth year at Trinity. Some of our Erasmus/International exchange partner Universities include Institut National de Sciences Appliquées de Lyon – INSA; Universidad Politecnica de Madrid (UPM), Politecnico di Torino and University of Melbourne. The

CLUSTER programme is a consortium of 12 universities including Technical University of Catalonia, Barcelona; Technische Universität Darmstadt; Technische Universiteit Eindhoven; Institut polytechnique de Grenoble; Instituto Superior Técnico Lisbon; Katholieke Universiteit Leuven/Université Catholique de Louvain; Helsinki University of Technology; Karlsruhe Institute of Technology; Ecole Polytechnique Fédérale de Lausanne; Politecnico di Torino; KTH Royal Institute of Technology Stockholm.
The UNITECH programme is a collaboration of 8 partner Universities and 16 multinational corporate partners. Students will spend one semester of their 4th year in a partner university followed by a six month internship with one of the corporate partners and return to complete their 5th year at Trinity. The partner universities are Chalmers University of Technology, Gothenburg; ETH Zurich; Institut National de Sciences Appliquées de Lyon – INSA; Loughborough University; Politecnico di Milano; RWTH Aachen University; TU Delft, The Netherlands.

ASSESSMENT
Assessment in each of the first two years is mostly by means of written examination, primarily at the end of the last term, combined with continuous assessment of coursework during the year. Typically, end-of-year examinations contribute at least 50% towards your grade in each subject. The design projects are assessed entirely by continuous assessment.
Engineering at a glance

All students follow common first and second years. At the end of the second year you will select one of six specialist streams as outlined below.

First (Junior Freshman) year

Lectures – 16 hours per week • Tutorials – 5 hours per week • Laboratory work – 6 hours per week

Junior Freshman modules

- Engineering Mathematics I and II
- Computer Engineering I
- Physics
- Chemistry
- Electrical Engineering
- Mechanics
- Introduction to Professional Engineering
- Engineering Design I: Graphics and Computer-Aided Engineering
- Engineering Design II: Project
- Experimental Methods

Second (Senior Freshman) year

Lectures – 16 hours per week • Tutorials – 5 hours per week • Laboratory work – 4 hours per week

Senior Freshman modules

- Engineering Mathematics III and IV
- Numerical Methods
- Computer Engineering II
- Solids and Structures
- Thermo-Fluids
- Electronics
- Engineering and the Environment
- Materials
- Engineering Design III: Project
- Engineering Design IV: Project

Third and fourth (Sophister) years and M.A.I. Year

For contact hours, please see the individual stream pages (see below).

Sophister modules

- Engineering Mathematics V
- Management for Engineers
- Probability Statistics

Select one of the six specialisations below:

- Biomedical Engineering, page 140
- Civil, Structural and Environmental Engineering, page 141
- Computer Engineering, page 142
- Electronic Engineering, page 143
- Electronic and Computer Engineering (joint programme), page 144
- Mechanical and Manufacturing Engineering, page 145

What our current students say

Conor Young - Mechanical and Manufacturing Engineering (year 5)

“I’ve had a really great experience studying engineering here at Trinity. My first two years gave me a flavour for the different paths in engineering I could go down. The different labs and projects throughout the years encourage you to learn, as well as the enthusiasm and dedication of the lecturers. As part of my degree I was given the opportunity to be involved in an internship where it was rewarding to able to apply the skills I have learned.”

Siddharth Gupta - Computer Engineering (year 3)

“Studying Engineering at Trinity has been one of the most rewarding and challenging experiences of my life so far. In my first two years I was given the opportunity to study topics from a variety of specialised disciplines, giving me a broad foundation skill-set that will stand to me no matter what career I choose- be it within engineering or not. Originally intending to pursue Mechanical Engineering, I found the first two years eye-opening, where I was exposed to many other fields that I enjoyed and excelled in- eventually leading me to choose Computer Engineering as my area of specialisation, where my education is supplemented by the high calibre of teaching from staff that play pioneering roles in their respective fields.”
Biomedical Engineering

What is Biomedical Engineering?

Biomedical engineering is at the intersection of engineering, the life sciences and healthcare. Biomedical engineers take principles from applied science (including mechanical, electrical, chemical and computer engineering) and physical sciences (including physics, chemistry and mathematics) and apply them to biology and medicine. Although the human body is a more complex system than even the most sophisticated machine, many of the same concepts that go into building and programming a machine can be applied to biological structures and diagnostic and therapeutic tools. The goal is to better understand, replace or fix a target system to ultimately improve the quality of healthcare.

Biomedical engineers become involved in research and development, spanning a broad array of subfields: biomechanics, biomaterials, tissue engineering, neural engineering, medical devices, clinical engineering, medical imaging. Prominent biomedical engineering applications include the development of biocompatible prostheses, various diagnostic and therapeutic medical devices ranging from clinical equipment to micro-implants, advanced imaging methods such as MRIs and EEGs as well as development of regenerative tissue and artificial organs.

Biomedical engineering is a challenging professional discipline, requiring knowledge of biology and medicine, as well as understanding of a range of engineering subjects. It is also a very exciting field in which new methods and products are constantly being developed, using the latest technology in materials, mechanics, electronics, mathematical analytical methods and manufacturing processes.

Graduate skills and career opportunities

Biomedical engineering is the fastest-growing career and this trend is expected to continue over the next decade. Ireland’s medical technology sector has evolved into a global leader for medical device and diagnostic products, with exports annually exceeding €8bn. Ireland has over 400 companies involved in developing, manufacturing and marketing medical devices. These include Abbott, Bayer, Becton Dickinson, Boston Scientific, Johnson & Johnson, Guidant, Medtronic and Stryker. These companies have a strong demand for high quality graduates at the Masters and PhD level because of the high technical level of their products. Biomedical engineers also find employment in clinics and hospitals where they work as clinical engineers, responsible for complex, expensive diagnostic equipment and laboratories.

Your degree and what you’ll study

Course topics include areas of both mechanical and electronic engineering, specialised topics in biomedical engineering and courses in basic medical and biological sciences. Example biomedical courses include:

Biomechanics, Biomaterials, Anatomy and Physiology, Cell and Molecular Biology, Medical Device Design, Tissue Engineering, Neural Engineering.

In the Junior Sophister (third) year you will study technical courses in both mechanical/manufacturing engineering and electronic engineering, along with courses in anatomy and physiology. In the Senior Sophister (fourth) year and (optional) Masters (fifth) year you will study a range of technical subjects, including the specialised subject of biomedical engineering (see above).

Project work is an important aspect of this degree and there is an extensive research facility available to students. You will carry out several projects, including a major research project in your final year. Examples of final-year projects include:

- Design of a branch stent for abdominal aortic aneurism
- Finite Element Modelling of 3D Printed Scaffolds for Bone Tissue Engineering
- Next Generation Hearing Prostheses: Improved decoding of attentional selection in a cocktail party environment
- Determination of the effect of freezing on the mechanical properties of decellularised arteries
- Head kinematics in contact sports

What our graduates say

Philip Byrne, 2015 Biomedical Engineering graduate

“Studying Engineering at Trinity was a really great experience for me. I studied Biomedical Engineering, a brand new stream being offered in Trinity. This new course was so interesting and modern and it really suited me. The five years I studied in Trinity flew. I graduated with both a Bachelors and Masters degree in Biomedical Engineering and couldn’t think of anywhere else I would want to spend the last 5 years with all the friends I made. The Pav (campus student bar) also helped come exam time! I’m delighted I now have a great qualification that is recognised and respected worldwide.”

GET IN TOUCH!

www.tcd.ie/bioengineering
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www.facebook.com/Trinity-Centre-for-Bioengineering
Twitter: @TCDBioengineer

Do you enjoy...

Finding out how living things work?
Analysing problems and formulating solutions?
Working with mathematics and numbers?

Trinity College Dublin, the University of Dublin
Civil, Structural and Environmental Engineering

Students who wish to study Civil, Structural and Environmental Engineering apply to the Engineering degree (TR032). The first two years are common to all Engineering students and at the end of the second-year students select Civil, Structural and Environmental Engineering as their specialist area. See page 136 for details of the Freshman (first two) years.

What is Civil, Structural and Environmental Engineering?
Civil, Structural and Environmental Engineering is a very diverse and broad discipline. It offers graduates the chance to work in many different areas, including designing transport systems, looking after the environment, constructing new buildings and bridges and creating the infrastructure on which society depends. Therefore, civil engineers are involved in every aspect of our lives. The skills needed to be a good civil engineer are a logical and systematic approach, good problem-solving and creative abilities, backed up by a mathematical and scientific mind. In addition to these skills a civil engineer needs to be imaginative and inquisitive.

ENVIRONMENTAL ENGINEERING
Environmental engineers design the systems that provide us with water for all purposes, manage our waste and deal with pollution in air, land or water. Environmental engineers also design ways of producing power from renewable resources and ensure that development happens in a sustainable way.

STRUCTURAL ENGINEERING
Structural engineering involves the design and construction of many types of structure, including buildings, bridges, stadiums, and wind turbines. Structural engineers ensure that a building is safe for the area in which it is built and for its intended purpose. It must also be attractive, economical and have a minimum impact on the environment.

TRANSPORTATION
The planning and monitoring of our various transport systems, from cycling to high-speed railways, all come under the brief of the transport engineer. Not only does traffic have to be controlled; understanding the decisions that travellers make, enables the engineer to influence users to make better choices for the environment and for each other.

Graduate skills and career opportunities
Most civil engineering graduates start their careers with engineering consultants working in infrastructure and building design, energy, environmental protection and transport management (e.g. Arup, Akins, Jacobs) and construction companies (e.g. BAM, Sisk). Civil engineers are also often employed in financial services, management consultancy, law firms and in corporate business. The numerical and problem-solving skills and technical expertise of civil engineers are broad based and make them very attractive employees in many different industries.

Your degree and what you’ll study

In the Junior Sophister (third) year, Senior Sophister (fourth) year and M.A.I. (fifth) year, students are offered modules in Structural and Geotechnical Engineering, Environmental Engineering, Transportation and Sustainable Energy. More information can be found at: www.tcd.ie/engineering/current-students

A significant amount of teaching takes place in the laboratory, and the course involves a lot of project work. In the Junior Sophister (third) year, students undertake site visits to civil engineering projects, iconic engineering structures and to areas of environmental interest. This includes a one-week technical visit to an international location. Recent trips have included visits to Paris and Barcelona.

In the Junior and Senior Sophister (third and fourth) year projects, students work in small groups to design a building or piece of major infrastructure. There is also the opportunity to undertake a placement in industry or with a research group or to participate in the Unitech, Cluster or Erasmus exchange programmes.

The optional fifth year allows students to study toward the Masters degree qualification at a more advanced level, including an individual research project and thesis.

What our graduates say
Sharon Farrell, 2011 graduate of Civil, Structural and Environmental Engineering

“Working now as a Geotechnical Engineer the degree and knowledge I gained during my time in Trinity still stands to me today. Having an appreciation of the different areas within engineering is extremely useful when working in the field which is exactly what this course provides even after you specialise. For me, having this understanding has been extremely beneficial on recent projects. Having an understanding of each allows me to manage projects as well as continuing on with geotechnical design elements.”

Would you like to …
Create buildings and cities in which millions of people can live happily and securely?
Develop advanced technical skills and use them in a successful career that directly benefits society?
Help build a sustainable future for everyone while protecting our environment?

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Tel: +353 1 896 1457

www.tcd.ie/study
What is Computer Engineering?

A computer engineer has mastered the necessary knowledge of mathematics and systems to tackle a whole range of real-world problems. Layered on top of these fundamentals is a set of specialist skills in computing that range from how a computer is designed and constructed to the application of computing power to solve a range of problems from social media to navigation, from medicine to space travel, and many more besides.

The impact of computer engineering has been more significant and more pervasive than that of many other disciplines. The smartphone, tablet computers, the Internet and games consoles are all products that were not even imagined 30 years ago, but have now been realised by the ingenuity of computer engineers.

Computer engineers may design computer hardware, write computer programs, integrate the various sub-systems together or do all three. They need good people skills as they often get quickly promoted to management positions.

Graduate skills and career opportunities

The demand for software and system designers will continue to grow within the next decade. When you graduate you will find opportunities for employment in software companies, financial institutions, large industrial organisations, research institutions and multinationals in Ireland as well as in Europe, the US and Asia.

Your degree and what you’ll study

In the third year, you will learn how computer systems are constructed from the ground up. You will study low-level assembly language programming to develop a deep understanding of what lies beneath the C++ and Java programs you have written in earlier years. How operating systems (such as Windows, iOS and Linux) regulate access to hardware and how networks build from simple point-to-point links up to global networks like the Internet are also studied both in theory and in the form of experiments. Encryption and other security-related topics are also covered.

By the time you get to the fourth year, you are ready to undertake a major individual project which you can choose from and extensive menu offered by staff or you can opt to take an internship with an employer in the computer industry (multi-national, local company or start-up). You can choose from a range of modules exploring how computers can render complex graphics, how they can see and understand video images and how this can be used with headset and other links up to global networks like the Internet are also studied both in theory and in the form of experiments. Encryption and other security-related topics are also covered.

By the time you get to the fourth year, you are ready to undertake a major individual project which you can choose from and extensive menu offered by staff or you can opt to take an internship with an employer in the computer industry (multi-national, local company or start-up). You can choose from a range of modules exploring how computers can render complex graphics, how they can see and understand video images and how this can be used with headset and other links up to global networks like the Internet are also studied both in theory and in the form of experiments. Encryption and other security-related topics are also covered.

The fifth (optional) year leads to a master’s degree (MAI) in engineering and it is here that students get to carry out a major dissertation on a topic of their choice. This is a chance to really become a world-class expert in your favourite topic, researching what others have done across the world and building a hardware or software prototype that demonstrates this. As with the 4th year project, the topic could be anything from helping to manage huge cloud computing facilities through novel face-recognition algorithms to uncovering fraud in bitcoin transactions.

To support your work on the dissertation, you can take a number of elective courses in the first semester including: Fuzzy Logic; Formal Methods; Advanced Computer Architecture; Embedded Systems; Distributed Systems; Networked Applications; Artificial Intelligence; Real Time Animation.

For more detail on what is covered in each module, please visit: www.tcd.ie/engineering/current-students

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www.scss.tcd.ie/undergraduate/computer-engineering
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What our graduates say

Tony O’Donnell - 2001
Computer Engineering

“Being a Trinity graduate is a special thing, and the experiences I had in College gave me a sense of intellectual fearlessness and curiosity that have driven me through my career so far. But being a Trinity engineering graduate has an extra secret something. The school is one of the oldest, and has a long tradition of academic excellence, as well as a reputation for slightly anarchic and fun-loving undergraduates. I ultimately chose Computer Engineering, and the blend of high tech skills, along with a firm engineer’s grasp of problem-solving, maths and systems analysis has always helped me succeed in solving complex problems.”
What is Electronic Engineering?

Electronic Engineering involves the use of electricity to perform a wide range of functions and the application of these functions to improve the quality of our lives.

The role of the electronic engineer is to devise suitable circuits and systems for the acquisition, storage, processing and transmission of low-power electronic signals as information-bearing electrical entities.

In today’s Information Age there is an ever-growing use of mobile phones, internet resources, computers, entertainment systems, satellite imaging, optical fibres, and automation. Electronic components and circuits are the cornerstone technology used to monitor or detect, store, process and transmit the information generated by each of these systems. Electronic engineers provide the vital skills and innovation needed to design and develop these remarkable components and systems.

Graduate skills and career opportunities

The careers open to graduates in electronic engineering range from circuit design in semiconductor companies, through network design and management in telecommunications companies, to opportunities in business and financial management, where the analytic and problem-solving skills of electronic engineers have long been appreciated.

Companies employing Electronic Engineering graduates include Intel, Ericsson, Analog Devices, Google, Eirgrid and Accenture.

Your degree and what you’ll study

In the Junior Sophister (third) year you will study a total of seven electronic engineering subjects and four core engineering subjects. There are approximately 16 hours of lectures, 4 hours of tutorials, 3 hours of laboratory time and 3 hours of project time per week.

Junior Sophister (third year) courses cover:

- Core elements of analogue and digital electronics
- Microprocessor systems
- Signals and systems
- Electromagnetism

In the Senior Sophister (fourth) year, in addition to a course in engineering management, you will choose a combination of subjects that allows further specialisation in electronic engineering. Each fourth year student also completes a design project.

A fourth year electronic engineering student typically has a weekly timetable of 14 hours of lectures, 4 hours of tutorials and 3 to 4 hours of laboratory work. Additionally, you will have laboratory access for individual work on your project.

Fourth year courses cover:

- Integrated systems design
- Digital control systems
- Telecommunications
- Digital signal processing
- Microelectronic circuits

There may also be the opportunity to undertake a placement in industry or with a research group or to participate in the Unitech, Erasmus or Cluster programmes.

The optional fifth year of the programme will allow students to study for the M.A.I. Masters degree qualification with more advanced treatment of the topics listed below. Students take a course in research methods and a number of elective courses during the first semester. These courses include:

- Digital media systems
- Speech and audio engineering
- Statistical signal processing
- Wireless networks and communications
- Complex systems science

Each student undertakes a major individual project that is assessed by a presentation and an end-of-year dissertation.
Electronic and Computer Engineering (Joint Programme)

Students who wish to study Electronic and Computer Engineering apply to the Engineering degree (TR032). The first two years are common to all Engineering students and at the end of the second-year students select the joint programme in Electronic and Computer Engineering as their specialist area. See page 136 for details of the Freshman (first two) years.

What is Electronic and Computer Engineering?

Organising both hardware (electronic) and software (computer) components into a useful and productive system is the principal job of the electronic and computer engineer. With a unique combination of both skill-sets, such an engineer is trained to make design decisions that achieve the best results.

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Department of Electronic and Electrical Engineering
www.tcd.ie/eleceng
Email: secretary@mee.tcd.ie
Tel: +353 1 896 1580

What our graduates say


“If you have a natural curiosity, and a capacity for mathematics, then this is the course for you. As an Engineering student in Trinity College Dublin you will find yourself challenged with problems from a variety of technical fields. If you choose Electronic and Computer Engineering at the end of your second year, you will understand the technology that powers our world, from microelectronic circuits to operating systems, to state-of-the-art computer graphics and facial recognition algorithms. You will study the transistor, and the processing of audio and human speech. You will also learn about wireless communication networks, computer security and the video technology used by Youtube and Netflix. You will have the chance to be involved in creating the technological landscape of the future, so don’t miss the opportunity!”

Graduate skills and career opportunities

The variety of careers open to graduates of Electronic and Computer Engineering range from designing embedded processors for a wide range of applications, through network design and management in telecommunications companies, to opportunities in business and financial management where the analytic and problem-solving skills of electronic and computer engineers have long been appreciated. Companies employing Electronic and Computer Engineering graduates include Google, Intel, Movidius and Accenture.

Your degree and what you’ll study

This degree option blends aspects of both the Electronic Engineering (see page 143) and Computer Engineering (see page 142) options into one course.

You will be given a foundation in how analogue and digital electronic circuits work, delve into how information is coded and transmitted across noisy channels (such as the radio links used in mobile phone networks and satellite communication) and learn how these complex channels can be crafted into world-wide networks, such as the Internet - on which we all depend. On the computing side, you will learn how the basic analogue and digital circuits combine to form complex processors (CPUs), how these are programmed at machine level application programmers.

You can choose from a range of modules exploring how computers can render complex graphics, how they can see and understand video images and how this can be used with headset hardware for augmented reality. You can further explore how hackers break into computer systems and how to defend against attack. Students will also have the opportunity to choose specialist telecommunications and signal processing modules.

There may also be the opportunity to undertake a placement in industry or with a research group or to spend some time studying abroad through the Unitech, Erasmus or Cluster programmes.

The fifth (optional) year leads to a master’s degree (MAI) in engineering and it is here that students get to carry out a major dissertation on a topic of their choice. This is a chance to really become a world-class expert in your favourite topic, researching what others have done across the world and building a hardware or software prototype that demonstrates this. As with the 4th year project, the topic could be anything from wireless communications, signal processing systems, biomedical devices and systems, helping to manage huge cloud computing facilities, through novel face-recognition algorithms to uncovering fraud in bitcoin transactions.

To support your work on the dissertation, you can take a number of elective courses in the first semester including:

- Digital media systems; Speech and audio engineering; Statistical signal processing;
- Wireless networks and communications; Distributed systems; Fuzzy logic; Formal methods; Advanced computer architecture; Networked applications, Artificial intelligence and Real-time animation.

Do you enjoy...

Understanding how complex systems work?
Planning and executing the solution to a problem?
Working with computers?
Mechanical and Manufacturing Engineering

Students who wish to study Mechanical and Manufacturing Engineering apply to the Engineering degree (TR032).

The first two years are common to all Engineering students and at the end of the second-year students select Mechanical and Manufacturing Engineering as their specialist area.

See page 136 for details of the Freshman (first two) years.

What is Mechanical and Manufacturing Engineering?

This is often seen as the broadest of all engineering qualifications as the skills required range from mathematics and electronics to metal fatigue and fluid mechanics. Nearly all machines used in everyday life – from the car or washing machine to the most complex aircraft or electricity supply plant to the tiniest surgical instrument – have required the skills of a mechanical engineer. Every industrial plant or manufacturing operation relies on a mechanical engineer for its smooth running and efficiency.

Mechanical engineers are involved in design, testing, inspection and manufacture of mechanical devices and components. As a mechanical engineer you will work as a professional using technology to make the world a better, safer place.

Graduate skills and career opportunities

Our graduates have taken jobs in companies such as: High tech manufacturing (Intel, Pfizer, Depuy, National Instruments, Seagate, Siemens); Automotive (Jaguar, Rover, BMW, Dromone); Engineering and Business Consultancy (Arup, Deloitte, Accenture); Energy (OpenHydro, ESB, Eirgrid, EDF, Vattenfall); and Process engineering (Cameron Flow Control, Proctor & Gamble, Syngenta, Glenbia, Kerry)

Our graduates went on to Masters and PhD in Universities such as: RCSI, Edinburgh; Imperial College London, Brunel, Cambridge, Cranfield University, UK; ETH Zurich; KTH, Sweden; Grenoble, France; and MIT, US.

As well as the potential for a career in mainstream mechanical or manufacturing engineering, graduates have found work in industries as diverse as film production, financial services and airlines. There is also a demand for specialist research and development work in industry, research organisations and universities. Opportunities exist for graduates in mechanical and manufacturing engineering to find employment in Ireland and elsewhere in engineering consultancies, public utilities (transport, power generation) and manufacturing industries in the mechanical, electronic and biomedical sectors.

Your degree and what you’ll study:

- Mechanics - how things like cars, wind turbines and rugby players move, deform and break.
- How to design new machines and technology, for example a phone charger for developing countries
- Advanced manufacturing techniques such as rapid prototyping
- How heat and energy can be captured, used and managed (how to keep electronics cool as they become more powerful and more compact)

Course topics include: Energy; Solid Mechanics; Engineering Materials; Fluid Mechanics; Manufacturing Technology and Systems; Dynamics; Mechatronics; and Engineering Design.

In the Junior Sophister (third) year you will study eight technical modules. In the Senior Sophister (fourth) year and optional Masters (fifth) year you will choose from a wide range of technical and non-technical subjects, tailoring your degree to suit your own interests.

Project work is an important aspect of this degree and there is an extensive research facility available to students. You will carry out several projects, including a major research project in your final year. Some examples of final-year projects include:

- Study of jet engine exhaust noise
- Design and build an entry for ‘Robot Wars’
- Design and construction of energy storage devices for the developing world
- Pedestrian car impact simulation
- Bambo: study of structure and mechanical properties

What our graduates say

James Redmond, 2015 graduate
Mechanical and Manufacturing Engineering

“I decided to complete my BAI and masters degrees in Mechanical and Manufacturing Engineering at Trinity College Dublin due to its reputation for academic excellence, impressive industrial contacts and international recognition but this College gave me so much more. It welcomed me in and quickly turned prestigious but daunting buildings into a prestigious and welcoming home as I found myself surrounded by fun, ambitious, like minded and supportive friends and teaching staff. Trinity gave me all the resources, academic and sporting challenge I needed to develop. I reached levels I didn’t think I was capable of and attained the balance I needed to secure my dream job as a Mechanical Engineer with the BMW Group.”

Do you enjoy…

Imagining new solutions to problems?
Exploring how machines and technology work?
Complex problems?
Using computers and mathematics to apply physics to the real world?
Engineering with Management

What is Engineering with Management?

Engineering with Management is an exciting and wide-ranging engineering programme that is broad in scope and aims to develop both the technical and business aspects of engineering. Engineers are problem-solvers. They apply their practical and analytical skills to highly complex and varied problems. In almost every human endeavour, an engineer has been involved somewhere. They have created the designs and systems to make everything from:

- gliders to space craft
- ball-point pens to laser printers
- matchbox cars to F1 racing cars
- wheelchairs to artificial joints for the human body

Engineering with Management is concerned with the analysis, design, improvement, installation and management of integrated systems of people, finance, materials and equipment. It draws upon specialised knowledge in the principles and methods of engineering analysis and design, together with a number of disciplines such as the management of people, finances, production, project management and communications. Our graduates have the technical skills common to all excellent engineers, with this knowledge augmented by an understanding of the commercial and industrial environment and the ability to generate innovative solutions to the problems of the world.

Do you enjoy...

- Creative, analytical, problem solving?
- Design it, build it, test it, sell it……..can you do that?
- Can you imagine yourself as a tech-entrepreneur?

Engineering with Management: The course for you?

Do you like the creative, analytical, problem-solving focus of engineering? Do you like the diversity of engineering? Perhaps, though, you see your professional life more involved with running a company, managing projects, or being a consultant? If any of these describes you, then you should consider this course. The diversity and flexibility of this course will give you endless possibilities in your professional life, both in what you do and how you do it.

As well as providing the core competencies for employment in research, manufacturing, production, design and engineering consultancy, the breadth of the course equips graduates to compete favourably with general graduates for careers in the business and financial sectors.

Engineering with Management @ Trinity

A key feature of the Engineering with Management programme is that the class size is capped at 20 students. This reflects a core belief in the value of small-group teaching and hands-on exercises, which is delivered through active learning strategies implemented by our world-class staff.

The course is a professional engineering degree, fully accredited by Engineers Ireland, that produces graduate engineers capable of working in the competitive environment of world-class manufacturing. To achieve this, the syllabus integrates management subjects with a proven engineering programme, delivered by one of the elite engineering schools in the world – ranked in the top 200 schools in the world for Mechanical and Manufacturing Engineering in the 2015 QS subject rankings.

The syllabus is ambitious and diverse and will appeal to students who wish to broaden a traditional engineering degree with business and management skills. Students have the opportunity of studying abroad and have the chance to be chosen for a team which travels to Stanford University and the Silicon Valley area to showcase their product design projects (details below).

Graduate skills and career opportunities

Graduates of the programme will have a wide range of skills that will allow them to excel quickly in both the engineering and engineering management fields. Graduates will be suited to jobs in the high-tech sector (e.g. computer, aerospace, pharmaceutical, medical devices, electronic) as well as traditional manufacturing (e.g. design, fabrication, assembly). They often work as project managers on teams with design and test engineers, managers, financial controllers, marketing and sales people. The qualification is also well suited to those who wish to pursue careers in project management and management consultancy as well as in the broader business and financial sectors. Career opportunities are extremely broad, but the following list may give some idea of the range of options available. Past graduates are currently working in DePuySynthes, IBM, Intel, Project Management Group, JP Morgan, Davies Stockbrokers, Pfizer, Jaguar Landrover, Denis Woods Forensic Engineers, PwC Accountancy, Accenture, and Reckitt Benckiser, and many have gone on to create tech start-up businesses.

Your degree and what you’ll study

The course is structured around themes that are developed over the four years. These themes are:

- Engineering Fundamentals
- Business and Management
- Design
- Manufacturing Engineering

Approximately 80% of the syllabus comprises engineering subjects such as design, automation, computer simulation/
modelling, bio-engineering and materials. The remaining 20% comprises management subjects such as marketing, finance, quality systems, supply chain management, and human resources management. Engineering is a busy but exciting course with typically full days in labs, workshops and lectures, as well as working on team and group projects. A variety of assessment techniques ranging from traditional examinations to continuous assessment, project work, design portfolios is used over the 4 or 5 years.

Throughout the course, a strong emphasis is placed on group projects, case studies and teamwork. Many of our 4th years are undertaking the 4E5 (Innovation in Product Development) module. This pairs Trinity students in teams with students from the world’s leading universities (e.g. Stanford in the US); each team consisting of 4 students from each university. The course also involves trips to Stanford and the Silicon Valley area. The teams are working with industrial sponsors, recent examples being SAP and Panasonic, with a mission to create innovative solutions to real customer needs.

Students in their first year study the foundational sciences required for engineering (mathematics, computer programming, physics, and chemistry). They are also introduced to management science and manufacturing engineering and design, and to the practice of engineering through our laboratory programme and a group design project.

Students in their second year build on the foundation sciences learned in first year and are introduced to more applied sciences in terms of how materials and structures behave. A major feature of the second year is the emphasis on small group teaching and project work which integrates design, engineering science and business. All students undertake a major group project – designing and building a metal bodied guitar, which includes not just the technical, but also a business and marketing plan for their product.

In third year students develop further their knowledge in the behaviour of materials and the solution of engineering problems, as well as the systems level information systems required in large modern businesses. Students may choose electives in either biomedical or mechanical engineering and specialist options in energy, communications, machine design or broad curriculum. At the end of year three you make a decision to pursue a Bachelor degree (B. Sc. (Ing)) or a Masters degree (M.A.I.) depending on achieving the necessary academic standards.

Most of our 4th year students are in the first year of a two year masters-cycle leading to the award of an M.A.I. degree (see below). Students can elect to choose from a very broad range of technical and business modules to best suit their own aptitudes and career preferences. Students electing to conclude their studies with a bachelor’s degree (B.Sc. (Ing)) undertake a project. Those continuing to a 5th year have a number of other options such as the innovation projects (see above), industry-based internships, or study-abroad programmes (see below).

Students in 5th year (studying for an M.A.I. qualification) undertake a major individual research project and range of advanced specialist technical modules.

**FIVE YEARS IN ENGINEERING WITH STUDY ABROAD AND INTERNSHIP OPPORTUNITIES**

Students who achieve a satisfactory academic standard in their 3rd year may proceed to a 2-year Master’s cycle, which will lead to the award of an M.A.I. (Masters in Engineering) degree. Those students who choose to graduate after four years with the B.Sc. (Ing) degree will require additional qualifications (e.g. further/alternative postgraduate study) to be eligible for professional accreditation with Engineers Ireland.

4 principal routes are available:

- **The 4th year is taken abroad at an approved partner university** after which students return to Trinity and complete their studies with an appropriate range of advanced level modules and a substantial research-based project.

- **Semester 2 of year 4 is spent in industry on the Engineering project Internship** where students carry out project work in one of Trinity’s internship partner industrial companies based in Ireland or abroad. The engineering project internship is full time from mid January to June. Example companies include: Nokia, DepuySynthes, Ferrari, Glanbia, Deloitte, PWC and many others

- An extended period (approximately 6-8 months) in the 4th year is spent at either an approved partner university (e.g. KTH Stockholm, IST Lisbon, UPC Barcelona, EPFL Lausanne, KUL Belgium), or in a formal industrial placement, after which students return to Trinity and complete their studies with an appropriate range of advanced level modules and a substantial research-based project.

- An integrated 2-year cycle based in Trinity, comprising an approved combination of project work and lectures.

**What our graduates say**

**Rory Stoney – 2010 graduate**

“Life in the Parsons building was always dynamic. There was a great balance between the technical core learning and developing business and presentation skills. From day one we were challenged with the task of becoming problem solvers, critical thinkers but with an acute focus on being able to communicate and present ideas and concepts to others. There was always a very clear connection between the work we did and the real world applications. This was one of the biggest winners for me. We could see where our learning could be applied in the real world. I owe the current continued success of my own company (StoneyCNC) largely to the learning and experience from studying in Trinity. Trinity was a really positive place to spend the college years. I can’t recommend it enough.”