


Electronic & Electrical Engineering

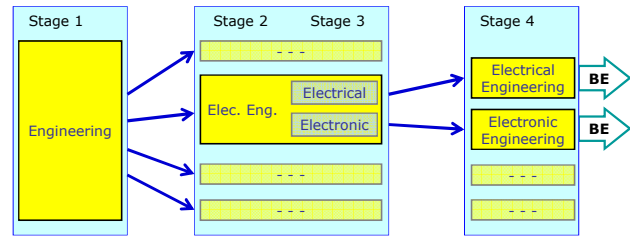
Information for Stage 3 Students

March 2018




UCD School of Electrical and Electronic Engineering Scoil na hInnealtóireachta Leictre agus Leictreonaí UCD

The Traditional BE Degree Programme

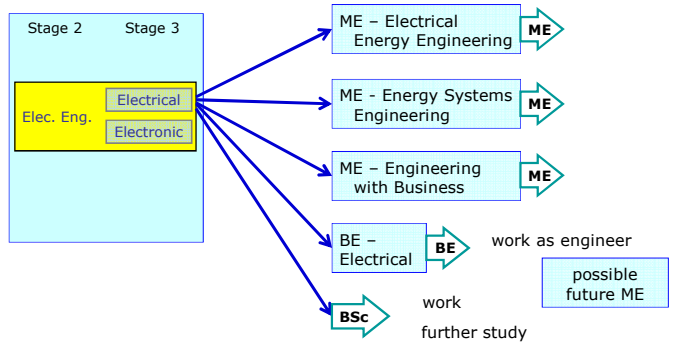


- Choices at end of Stage 1, start and end of Stage 3
 - you chose the Electronic/Electrical major
 - you chose options to prepare for either Electronic Engineering or Electrical Engineering
 - then specialise in Stage 4
 - graduate with BE degree: 240 credits




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Your Choices Now – Electrical

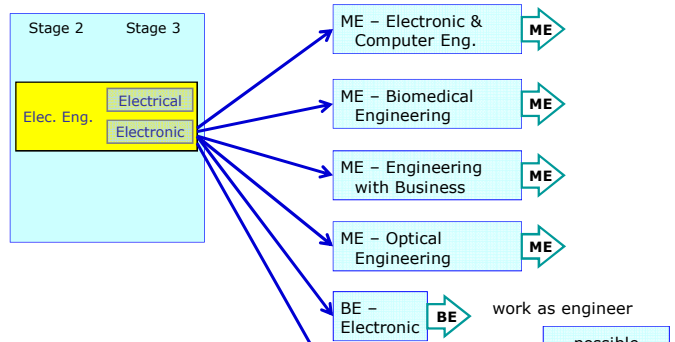


- Continue towards ME or BE, or graduate with BSc
 - these are the obvious choices - there may be more...
 - get BSc (Engineering Science) on route to ME...




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Your Choices Now – Electronic



- Notes as previous page



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Bachelor of Engineering (BE) Degree

- **Traditional qualification in Engineering**
 - still respected in the workplace
 - accredited for MIEI
 - membership of Engineers Ireland, professional body
 - no longer sufficient for Chartered Engineer
 - further study would be needed (later in career?)
- **Four years study in total**
 - stage 4 has some flexibility: 3 or 4 option modules
 - project module: 15 credits through both semesters
 - no formal work placement
- **No extra barrier to entry**
 - normal progression rules apply
 - need to progress (earn 50 credits in stage 3) to register for the project module in stage 4
 - if not, graduation will be delayed...



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BE - Electronic Engineering

- **Core Modules**
 - BE Project
 - Control Theory
 - Digital Communications
 - Professional Engineering (Management)
 - RF Electronics
 - Wireless Systems
- **Choose 2 options, sem. 1**
 - Advanced Signal Processing
 - Analogue IC Design
 - Entrepreneurship in Engineering
 - Optimisation Techniques
 - Optoelectronics
 - Power Electronics Technology
- **Choose 2 options, sem. 2**
 - Adv. Wireless Networking
 - Digital & Embedded Systems
 - Neural Engineering
 - Mixed-Signal Integrated Circuits
 - Professional Eng. (Finance)
- **9 taught modules: 45 credits; project 15 credits**
- **Modules subject to change...**



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BE - Electrical Engineering

- **Core Modules**
 - BE Project
 - Appl. of Power Electronics
 - Control Theory
 - Power Electronics & Drives
 - Power System Design
 - Power System Operation
 - Professional Engineering (Management)
- **Choose 3 options**
 - Entrepreneurship in Engineering
 - Optimisation Techniques for Engineers
 - Power Electronics Technology
 - Power System Dynamics & Control
 - Renewable Energy Systems
 - Energy Economics & Policy
 - Distributed Control & Optimisation over Networks
- **Total 9 taught modules: 45 credits**
- **Project: 15 credits**



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BE Project Modules

- **Separate modules for Electrical, Electronic**
 - we propose a list of projects (in September, week 1)
 - you choose your preferences
 - allocation according to Stage 3 GPA
 - option to propose your own project – act early!
- **Independent work through both semesters**
 - research and/or design, putting theory into practice
 - guided by your supervisor – meet at least weekly
 - work in parallel with 4 or 5 taught modules
 - time management is critical...
- **Assessment through the year**
 - interim report, final report
 - oral presentation, poster presentation
 - interview – supervisor and another examiner



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After the BE...

- **Work**
 - often with further training, specific to employer
 - maybe a higher degree later in career?
- **Taught Master's degree**
 - in engineering or another area
 - minimum 90 credits (three semesters or a full year)
 - fees payable
- **Research Master's degree**
 - 18 months to 2 years...
- **PhD**
 - typically 4 years research, can be more...
 - substantial thesis, original work
 - fees payable, but often scholarship available...



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Chartered Engineer – CEng

- **Used in Ireland, UK, India, ...**
 - US, Canada: PE = professional engineer
 - Australia, NZ: CPEng = chartered prof. engineer
- **Registered title, protected by law**
 - required by law for certain engineering activities
- **Awarded by professional body**
 - Engineers Ireland, and you must also be a member!
- **Requirements:**
 - education to suitable standard - accredited degree
 - from 2013, Master's level or equivalent
 - development of competence in practice
 - minimum 4 years responsible experience
 - continuing professional development - CPD



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Master of Engineering (ME) Degree

- **Professional qualification for the future**
 - level required to become a Chartered Engineer
 - level expected in most of Europe
- **Two years of specialised study in chosen field**
 - making five years in total
 - includes work placement: 7 month or 3 month
 - includes major project at Master level (20–25 credit)
- **Graduate with BSc (Engineering Science) now**
 - then enter ME programme in September
- **Entry requirement based on BSc degree**
 - GPA for stages 2 and 3, weighted 3 and 7
 - minimum GPA 2.8 (equivalent to C grade)
 - a higher GPA is strongly recommended!
 - no easy way back to BE if finding ME too hard...



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Master of Engineering (ME) Degree

- **Full tuition fees payable**
 - currently €7640 per year for EU students
 - increase each year
 - “free fees” only applies to bachelor degree
 - you pay “student contribution”, not full tuition fee
- **Alternative (for now)...**
 - transfer to Engineering Science degree programme
 - but defer graduation – continue to stage 4
 - take modules appropriate to your chosen ME...
 - then graduate with the BSc degree in 2019
 - enter the ME programme in September 2019
 - use the surplus credits from stage 4 of the BSc
 - complete the ME in 1 year
 - pay full tuition fees for the final year only...



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Master of Engineering (ME) Degree

- **Work Placement options**
 - 30 credit, 7 months, start January 2019
 - replaces the entire spring semester
 - 10 credit, summer 2019
 - take modules in spring 2019 to make up credits
 - UCD will arrange these placements
 - competitive process, starts September/October
 - often involves an interview by the employer
 - usually paid a (modest) salary, but not always
 - you may propose your own placement, through UCD
 - different arrangement in Engineering with Business
- **ME Project**
 - runs through last two semesters
 - 20 or 25 credits, depending on programme
 - similar arrangements to BE project
 - but expect Master's-level work...



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BSc (Engineering Science) Degree

- **Bachelor of Science degree**
 - 3 years, 180 credits
 - not a professional engineering qualification
- **To be compatible with the European system:**
 - *first cycle* = Bachelor degree (often 3 years)
 - *second cycle* = Master degree (typically 2 years)
 - *third cycle* = PhD (minimum 3 years)
 - choose this now if you want an ME programme in Europe...
- **To provide an exit from Engineering**
 - it provides strong technical foundation
 - to pursue a career in another field
 - to continue your studies in another area



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Scholarships

- **Industry wants more graduates**
 - so wants to encourage more students
 - willing to offer incentives!
- **Analog Devices Ireland**
 - €2000 to one 3rd-year student continuing to BE Electronic or ME Electronic & Computer Eng.
 - selected by interview from top 3 students on GPA
 - €2000 to one student in 4th year, ME Elec. & Comp.
 - selected by interview from top 3 students on GPA
 - €2000 for best degree result in ME Elec. & Comp.
- **Intel Ireland**
 - €3000 to each of 4 students with best Stage-3 GPA entering ME Electronic & Computer Engineering
- **Terms and Conditions...**



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Your Choices in Brief...

- **Continue in BE programme**
 - you could graduate in 2019
 - you could work as a professional Engineer
 - but not yet qualified for Chartered Engineer...
- **Continue towards an ME in UCD (if eligible)**
 - you could graduate in 2020
 - different modules in stage 4, to support the ME
- **Graduate with BSc (Eng. Sci.) in 2018**
 - if eligible: 180 credits at appropriate levels
 - for work or further study
 - e.g. ME in Europe, qualification in a different field
 - not a professional Engineer
- **Decision needed by Monday 16 April**
 - online form, arranged by the Programme Office




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More Information on ME Programmes


- Engineering & Architecture graduate open day
 - Tuesday 10 April - will be advertised nearer the time
- Programme Coordinators:
 - Prof Anding Zhu, ME Electronic & Computer Engineering
 - Dr Damian Flynn, BE Electrical Engineering, and ME Electrical Energy Engineering
 - Dr David Timoney, ME Energy Systems Engineering
 - Prof Madeleine Lowery, ME Biomedical Engineering
 - Dr Nikolaos Papakostas, ME Engineering with Business
 - Prof John Sheridan, ME Optical Engineering
 - Brian Mulkeen, BE Electronic Engineering

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Electronic & Computer Engineering



- Electronic Engineering
 - using electronics for control, communication, entertainment, computing, etc.
- Work at many different levels
 - IC design - analogue & digital
 - system design - at various scales
 - algorithms, signal processing...
- Traditional focus on hardware
 - but most hardware now involves a computer
 - embedded processor or linked to processor
 - often linked to the Internet...
 - so the computer and software side is important




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ME - Electronic & Computer Engineering

- Core Modules
 - Control Theory
 - Optimisation Techniques
 - RF Electronics
 - Software Engineering
 - Wireless Systems
 - Digital Communications
 - Professional Eng. (Mgt.)
 - ME Project (25 credit)
 - Work Placement
 - 10 or 30 credit
- + 6 or 10 options
 - from a long list
 - details may change...
- Example Options
 - Advanced Signal Processing
 - Analogue ICs
 - Digital & Embedded Systems
 - Distributed Control & Optimisation over Networks
 - Entrepreneurship in Eng.
 - Foundations of Computing
 - Numerical Algorithms
 - Operating Systems
 - Optoelectronics
 - Power Electronics Technology
 - Processor Design
 - Wireless Networking
 - . . .

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Work Placements



- examples from 2017...
- 38 students currently on placement

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Electrical (Energy) Engineering



- **Electrical Engineering**
 - Power system and smart grid sectors
- **Many challenging areas**
 - Power system analysis & design
 - Power electronics applications
 - Sustainable power systems
 - Smart grid communication architectures
 - Electricity market operations
- **Real-world, global revolution**
 - Diverse generation & demand-side technologies
 - Stability & economic operation of future power systems
- **Also available as 90-credit ME**
 - designed to follow BE degree

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Programme Structure

- **Core Modules**
 - Control Theory
 - Applications of Power Electronics
 - Power Electronics & Drives
 - Power System Design
 - Power System Dynamics & Control
 - Power System Operation
 - Renewable Energy Systems
 - Professional Eng. (Mgmt.)
 - **ME Project (25 credit)**
 - **Work Placement**
 - long or short
- **+ 5 or 7 options**

- **Example Options**
 - Advanced Signal Processing
 - Distributed Control and Optimisation
 - Engineering Thermodynamics 2
 - Energy Economics & Policy
 - Energy Systems & Climate Change
 - Entrepreneurship in Engineering
 - Fossil Fuels, Carbon Capture
 - Networks & Internet Systems
 - Numerical Algorithms
 - Optimisation Techniques
 - Power Electronics Technology
 - Power System Stability Analysis
 - . . .

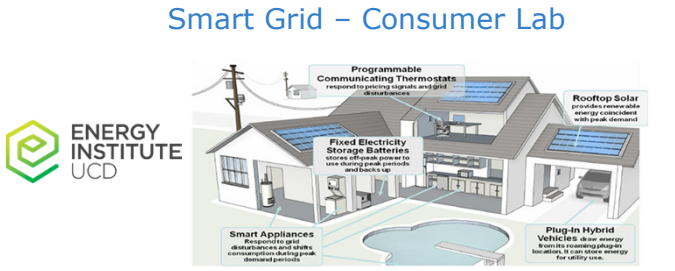

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Work Placements



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Smart Grid – Consumer Lab


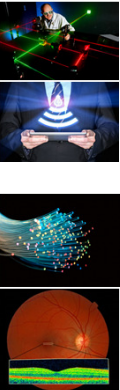
- Temperature controlled store
- Equipment storage area
- 2 No. IoT benches
- 2 No. Simulator benches
- 4 No. Low Power benches
- 3 No. High Power benches
- 2 No. workstations

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Optical Engineering

- **Optical Engineering**
The application of engineering principles to design optical systems.
- **Wide variety of application areas**
 - Optical signal processing & telecommunications
 - Microscopy and medical imaging
 - Industrial inspection, lithography, optical computing, next generation lighting and display ...
- **Foundation in Electrical/Electronic Engineering**
 - Strong links with signal processing and wireless communication
 - Complemented with relevant modules in optics and optical technology

Brought together in specialised Optical Engineering modules

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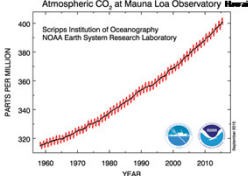
ME – Optical Engineering

- **Core Modules**
 - Optical Engineering
 - Optoelectronics
 - Biomedical Signals and Images
 - Medical Imaging
 - Professional Eng. (Mgt.)
 - ME Project (25 credit)
 - Work Placement
 - 10 or 30 credit
- **Example Options**
 - Advanced Signal Processing
 - Optimisation Techniques
 - Control theory
 - Software engineering
 - Entrepreneurship in Eng.
 - Numerical Algorithms
 - Biological Imaging
 - Spectroscopy and lasers
 - Image analysis in MATLAB
 - Modelling and simulation
 - Hyperspectral imaging
 - Nano-optics and biophotonics

Note: as this is a new programme, the structure is provisional.

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ME - Energy Systems Engineering




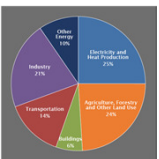
Atmospheric CO₂ at Mauna Loa Observatory

Record Monthly Average Mauna Loa CO₂
August 2014: 397.91 ppm August 2015: 398.82 ppm

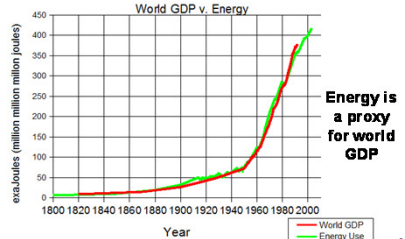
07 JUNE 2015 – SCHLOSS ELMAU

Emissions must be cut 40-70% by mid-century and phased out entirely by 2100





% Share of global greenhouse gas (GHG) emissions



World GDP v. Energy

Energy is a proxy for world GDP

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Energy Systems Engineering

- Aims to prepare graduates to meet the **often conflicting** engineering, economic and environmental **challenges** facing the energy systems of developed countries in the future, taking account of security of supply and climate impact / CO₂ emissions.
- Inter-disciplinary approach needed because of the future interdependence between the electricity system, building energy systems, and transport systems.
- Inputs provided by Mechanical, **Electrical & Chemical Engineering**, and Geological (Earth) Sciences / Physics / Economics / Business
- ~180 graduates since 2010
- Also available as 12-month, 90-credit ME




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ME – Energy Systems Engineering

- Core Modules
 - Energy Systems & Climate...
 - Fossil Fuels & CCS
 - Chem. Proc. Renew. Energy
 - Eng. Thermodynamics II
 - Energy Systems in Buildings
 - Power System Operation
 - Wind Energy
 - Research Skills & Tech.
 - Professional Eng. (Mgt.)
 - ME Project
 - Work Placement
 - long or short
- + 4 or 8 options

- Example Options
 - Energy in Transport
 - Instrumentation & Control
 - Eng. Thermodynamics II
 - Heat Transfer
 - Mechanics of Fluids II & III
 - Nanomaterials
 - Environmental Engineering
 - Air Pollution
 - Entrepreneurial Mgt.
 - Energy Economics & Policy
 - Nuclear Physics
 - Appl. Power Electronics
 - Power System Design
 - Power Electronics & Drives
 - . . .

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ME (Energy Systems) Engineering

Work Placement

Semester 2 of year 1



Companies involved in work placement to date include:

- ESB International
- CES Energy
- Energia
- Eirgrid
- AbbVie
- Mainstream Renewable Power
- Enernoc
- Endeco Technologies
- RPS
- Aecom
- Murex Advanced Technologies
- Dublin Port Company
- Irish Water
- Jones Engineering
- Fingleton White
- Glanbia
- Meinhardt (UK) Ltd.
- Dennison Trailers
- Precision Heating

Biomedical Engineering

- Biomedical Engineering



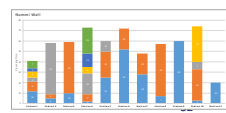

'The application of engineering principles to understand, modify or control biological systems'
- Wide variety of application areas
 - Medical device industry
 - Biosignal and bioimage processing
 - Rehabilitation engineering, orthopaedics...
- Foundation in Electrical/Electronic or Mechanical Engineering
 - Complemented with relevant physiology and anatomy
 - Brought together in specialised Biomedical Engineering modules

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ME – Engineering with Business


- There is a perceived lack of “industry-ready” engineers coming out of 3rd level education.
- Industry leaders have been looking to recruit individuals combining specialist skills with a broad understanding of business.
- Acquiring skills related to advanced digital tools and automation (Digital Manufacturing, Robotics, Industry 4.0, ERP)
- The Programme produces fully qualified and accredited engineers
- ME (Engineering with Business) graduates can also consider careers in technical, management, the financial and IT sectors.

Engineering with Business

- Recommended prior learning:**
 - Professional Engineering (Finance)

Year 1	
Sem 1 <ul style="list-style-type: none"> Management and Org Behaviour Project Management Supply Chain Design 3 Technical Core 	Sem 2 <ul style="list-style-type: none"> Operations Management Entrepreneurship 3 Technical Options
Year 2	
Sem 1 <ul style="list-style-type: none"> Work Placement (June to Dec) Research Methods 	Sem 2 <ul style="list-style-type: none"> Business Information Systems Marketing Professional Eng. (Mgmt) Masters Thesis



Internships



ME with Business – Electrical Engineering

- Core Business Modules**
 - Management & Organisational Behaviour
 - Operations Management
 - Entrepreneurial Mgt.
 - Research Methods
 - Business Info. Systems.
 - Professional Eng. (Mgt.)
 - Marketing Management
 - Work Placement (20 credit)
 - Thesis (15 credit)
- Business Options**
 - Project Management
 - Supply Chain Design
 - Professional Eng. (Finance)
- Core Technical Modules**
 - Control Theory
- Technical Options**
 - Power System Operation
 - Power Electronics & Drives
 - Power System Design
 - Optimisation Techniques
 - Renewable Energy Systems
 - App. Power Electronics
 - Power System Engineering
 - Energy Economics & Policy
 - Distributed Control & Optimisation over networks
 - Power System Stability

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ME with Business – Electronic Engineering

- Core Business Modules**
 - Management & Organisational Behaviour
 - Operations Management
 - Entrepreneurial Mgt.
 - Research Methods
 - Business Info. Systems.
 - Professional Eng. (Mgt.)
 - Marketing Management
 - Work Placement (20 credit)
 - Thesis (15 credit)
- Business Options**
 - Project Management
 - Supply Chain Design
 - Production Systems Analysis
- Core Technical Modules**
 - Control Theory
 - Wireless Systems
- Technical Options**
 - Optoelectronics
 - RF Electronics
 - Power Electronics
 - Optimisation Techniques
 - Advanced Signal Processing
 - Electromagnetic waves
 - Signal Processing
 - Digital Communications
 - Neural Engineering
 - Distributed Control & Optimisation over networks

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Decision Time!

- Online form - to be completed by Monday 16 April
 - continue in BE (default) – assumed if no response
 - specify electrical/electronic
 - transfer to stage 4 Engineering Science
 - specify which ME programme you want
 - conditional on GPA – automatic fall-back to relevant BE if GPA is too low
 - graduate with BSc (Engineering Science) in 2018
 - needs 180 credits at appropriate levels...
- More information?
 - talk to relevant programme coordinators (page 17)
 - postgraduate open day 10 April

