Electronic & Electrical Engineering

Information for Stage 3 Students
March 2017

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

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...

Your Choices Now – Electronic

- 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...
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 project module in stage 4
    - if not, graduation will be delayed...

BE - Electronic Engineering

- Core Modules
  - BE Project
  - Control Theory
  - Digital Communications
  - Professional Engineering (Management)
  - RF Electronics
  - Wireless Systems
- Choose 2 options, sem. 1
  - Analogue IC Design
  - Digital & Embedded Systems
  - Entrepreneurship in Engineering
  - Photonic Engineering
  - Power Electronics Technology
  - Processor Design
- Choose 2 options, sem. 2
  - Advanced Signal Processing
  - Neural Engineering
  - Solid-State Electronics 2
  - Mixed-Signal Integrated Circuits
  - Professional Eng. (Finance)
- Total 9 taught modules: 45 credits
- Project: 15 credits

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
  - High Voltage & Protection Systems
  - Energy Economics & Policy
  - Distributed Control & Optimisation over Networks
- Total 9 taught modules: 45 credits
- Project: 15 credits

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 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
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 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...

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, must also be 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

Master of Engineering (ME) Degree

- **Professional qualification for the future**
  - level required to become 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)
  - higher GPA strongly recommended!
    - no easy way back to BE if finding ME too hard...

- **Full tuition fees payable**
  - currently €7490 per year for EU students
  - “free fees” only applies to bachelor degree
    - you pay “student contribution”, not full tuition fee

- **Alternative...**
  - transfer to Engineering Science degree programme
    - but defer graduation – continue to stage 4
    - take modules appropriate to your chosen ME...
    - then graduate with BSc degree in 2018
  - enter ME programme in September 2018
    - use surplus credits from stage 4 of BSc
    - complete ME in 1 year
    - pay tuition fees for final year only...
    - no guarantee that this arrangement will continue!
Master of Engineering (ME) Degree

- **Work Placement options**
  - 30 credit, 7 months, start January 2018
  - replaces entire spring semester
  - 10 credit, summer 2018
  - take modules in spring 2018 to make up credits
  - UCD will arrange placements
  - competitive process, starts September/October
  - usually subject to interview by 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 European system:**
  - first cycle = Bachelor degree (often 3 years)
  - second cycle = Master degree (typically 2 years)
  - third cycle = PhD (minimum 3 years)

- **To provide exit from Engineering**
  - 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**
  - could graduate in 2018
  - could work as professional Engineer
  - but not qualified for Chartered Engineer...

- **Continue towards ME in UCD (if eligible)**
  - could graduate in 2019
  - different modules in stage 4, to support ME

- **Graduate with BSc (Eng. Sci.) in 2017**
  - if eligible: 180 credits at appropriate levels
  - for work or further study
    - e.g. ME in Europe, qualification in a different field
    - not professional Engineer

- **Decision needed by Thursday 13 April**
  - online form, arranged by Programme Office
More Information on ME Programmes

• Engineering & Architecture graduate open evening
  – Tuesday 4 April, 17:30 to 19:30
• Programme Coordinators:
  – Prof. Tony Fagan, ME Electronic & Computer Engineering
  – Dr. Damian Flynn, BE Electrical Engineering, and ME Electrical Energy Engineering
    • represented by Dr. Terence O'Donnell
  – Dr. David Timoney, ME Energy Systems Engineering
  – Prof. Madeleine Lowery, ME Biomedical Engineering
    • represented by Dr. Giacomo Severini
  – Dr. Nikolaos Papakostas, ME Engineering with Business
  – Brian Mulkeen, BE Electronic Engineering

Electronic & Computer Engineering

• Electronic Engineering
  – using electricity 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 computer
    • embedded processor or linked to processor
    • often linked to Internet...
  – so computer and software side important

ME - Electronic & Computer Engineering

• Core Modules
  – Analogue ICs
  – Control Theory
  – 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 18 available
• Example Options
  – Advanced Signal Processing
  – Digital & Embedded Systems
  – Distributed Control & Optim...
  – Entrepreneurship in Eng.
  – Foundations of Computing
  – Numerical Algorithms
  – Operating Systems
  – Optimisation Techniques
  – Photonic Engineering
  – Power Electronics Technology
  – Processor Design
  – Solid State Electronics 2
  – Wireless Networking
  – ...

Work Placements

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

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
- High Voltage & Protection Systems
- 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

Work Placements

- EirGrid
- Cylon Energy
- SSE
- Mainstream Renewable Power
- Premium Power
- Wattics
- Bord Gáis Energy
- ESB Networks
- Energia Group
- USCE Water Group
- Electric Ireland
- EPRI
- Electric Power Research Institute
- ARUP
- ElectroRoute
- GlenDimplex
- EDF Siemens
- NREL

Alternative Designs
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
- ~140 graduates since 2010
- Also available as 12-month, 90-credit ME

ME – Energy Systems Engineering

- Core Modules
  - Energy Systems & Climate Change
  - Fossil Fuels & CCS
  - 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
  - ...

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
- Energo
- 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

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)

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ME with Business – Electrical Engineering

- Core Business Modules
  - Management & Organisational Behaviour
  - Operations Management
  - Entrepreneurial Mgt.
  - Research Methods
  - Professional Eng. (Mgt.)
  - Marketing Management
  - Work Placement (20 credit)
  - Thesis (15 credit)

- Business Options
  - Project Management
  - Supply Chain Design and Analysis
  - Professional Engineering (Finance)

- Core Technical Modules
  - Control Theory

- Technical Options
  - Power Electronics & Drives
  - Power System Design
  - Power System Operation
  - App. Power Electronics
  - Energy Economics & Policy
  - Power System Stability Analysis

ME with Business – Electronic Engineering

- Core Business Modules
  - Management & Organisational Behaviour
  - Operations Management
  - Entrepreneurial Mgt.
  - Research Methods
  - Professional Eng. (Mgt.)
  - Marketing Management
  - Work Placement (20 credit)
  - Thesis (15 credit)

- Business Options
  - Project Management
  - Supply Chain Design and Analysis
  - Production Systems Analysis

- Core Technical Modules
  - Control Theory
  - Radio Frequency Electronics
  - Wireless Systems

- Technical Options
  - Advanced Signal Processing
  - Digital Communications
  - Neural Engineering

Decision Time!

- Online form - to be completed by Thursday 13 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 2017
      - needs 180 credits at appropriate levels...
  - More information?
    - talk to relevant programme coordinators (page 17)
    - postgraduate open evening 4 April