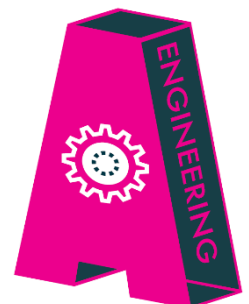




Boost your business *with* an Equipment Systems Engineer Apprenticeship

| An Employers Guide





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Introduction

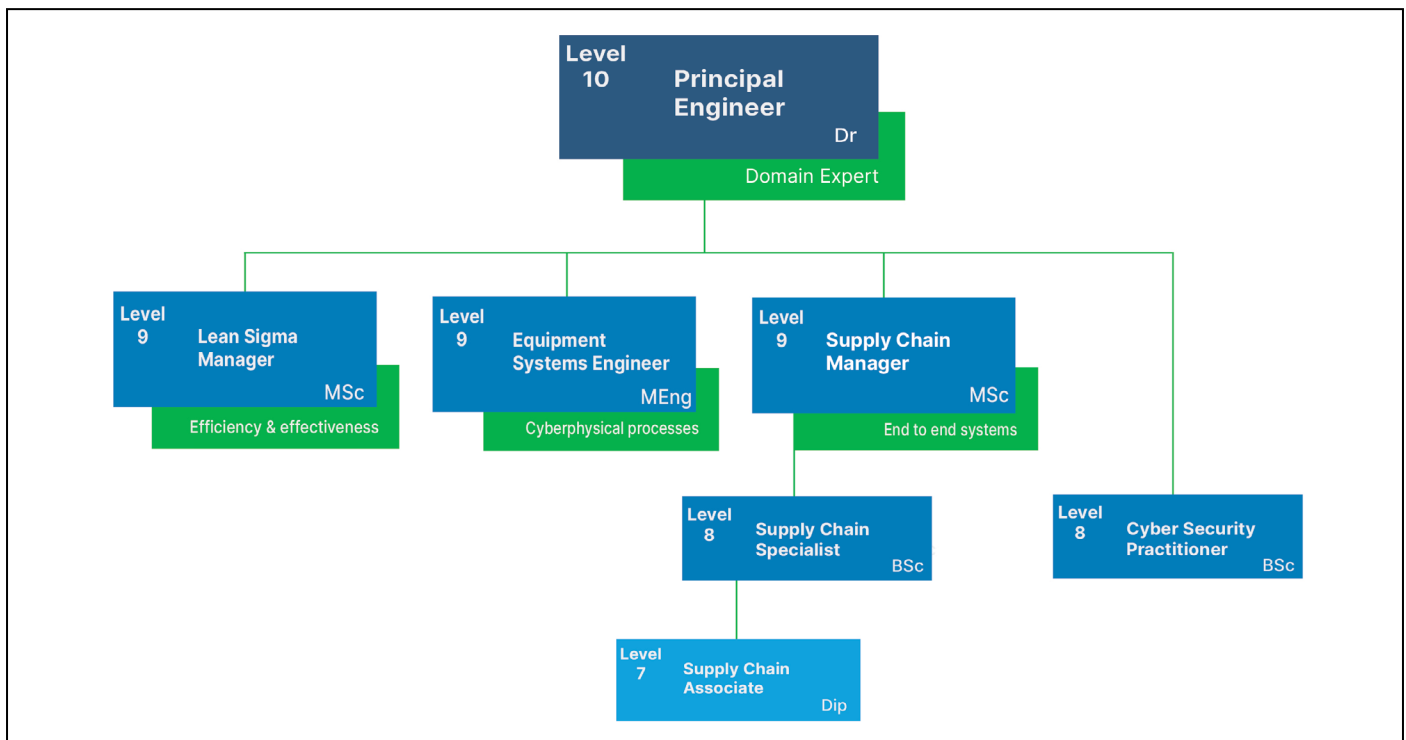
As part of the new National Apprenticeship Programme, the University of Limerick (UL) is Ireland's first University to offer apprenticeships at higher level. Included in the suite of executive programmes, UL offer an Equipment Systems Engineer Apprenticeship.

These qualifications have been created 'by industry for industry' and are aimed at building Ireland's capacity to be world industry leaders through enhancing the skills of its existing workforce.

The programmes at UL are designed for people who are already working and wish to gain additional knowledge and experience within their role. As such, all of our participants already have employment contracts that meet or exceed the duration of the apprenticeship. Extensive consultation with industry has taken place in regards to curriculum content and structure, with high emphasis on real-world skills and employability.

All of the programmes are designed to minimise the student's time away from the workplace using a 70:30 'on-the-job' to 'off-the-job' ratio. This is achieved through the use of blended and online programme delivery for maximum benefit.

The suite of Executive Apprenticeship Programmes on offer at UL



Apprenticeships Consortia

For each apprenticeship programme a Consortium Steering Group (CSG) has been developed. Their role is to ensure that the Apprenticeship programme(s) conforms to, and evolves with, the requirements of the occupational profile and to ensure that it is enterprise-led and meets labour market needs.

Each CSG is composed of relevant stakeholders including employers, programme specific occupational associations, any occupational regulators or relevant professional bodies and the UL. The CSG will undertake periodical reviews of the programme and in particular the learning outcomes so as to ensure relevancy of the programmes and aligning the needs of Industry with skills development. The consortia lead for this programme is E-Cubers.

Equipment Systems Engineer Apprenticeship

The ESE Academy (E-Cubers) has partnered with the University of Limerick (UL) to deliver Ireland's first Equipment Systems Engineering Apprenticeship at Level 9 - Masters of Engineering (MEng).

This apprenticeship programme provides experienced engineers with a comprehensive framework to manage the implementation of Industry 4.0 innovations in their employer's equipment. This two-year MEng, in conjunction with vibrant Communities of Practice (CoP), provides an ideal framework for the learner to comprehensively and efficiently evaluate both disruptive and sustaining innovation solutions.

What is Industry 4.0 Industry?

Globalisation and technology, Artificial Intelligence, advanced manufacturing processes and Big Data have transformed the world's economy. At a strategic level, the EU and national governments are focusing on increasing collaborations between industry and academia to increase export market share from the national system of innovation. Ireland is recognised as a hub for multinational companies. The global players in key sectors are all represented in Ireland, be it in electronics, biopharma, medical technology or automotive.

The future of industry is 4.0, the 4th industrial revolution. The first, and best known, was the mechanisation of production; mass production and automation were the second and third. We are currently in the third revolution, benefiting from the efficiencies and capabilities of highly automated production. However, we are on the brink of Industry 4.0 and this revolution promises to deliver significant improvements by linking production and services in a cyber-physical system.

Industry 4.0 will be based on three elements:

1. The production network – flexible value chains with information available in real time, across company boundaries. This leads to the realisation of flexible value chains, based on powerful manufacturing operations management.
2. The fusion of the virtual and real world – integration of product design and production engineering for a shorter 'time to market'. This leads to the integration of product design and production engineering, based on a common digital enterprise platform.
3. Cyber-physical systems (CPS) – modular, flexible production units with complete and consistent virtual image. These systems enable the physical world to merge with the virtual world, leading to an 'internet of things', data and services. Intelligent manufacturing lines are an example of CPS, where the machine can perform many work processes by communicating with the components. Cyber-physical systems lead to migration, towards a 'plug and produce' integration of automation.

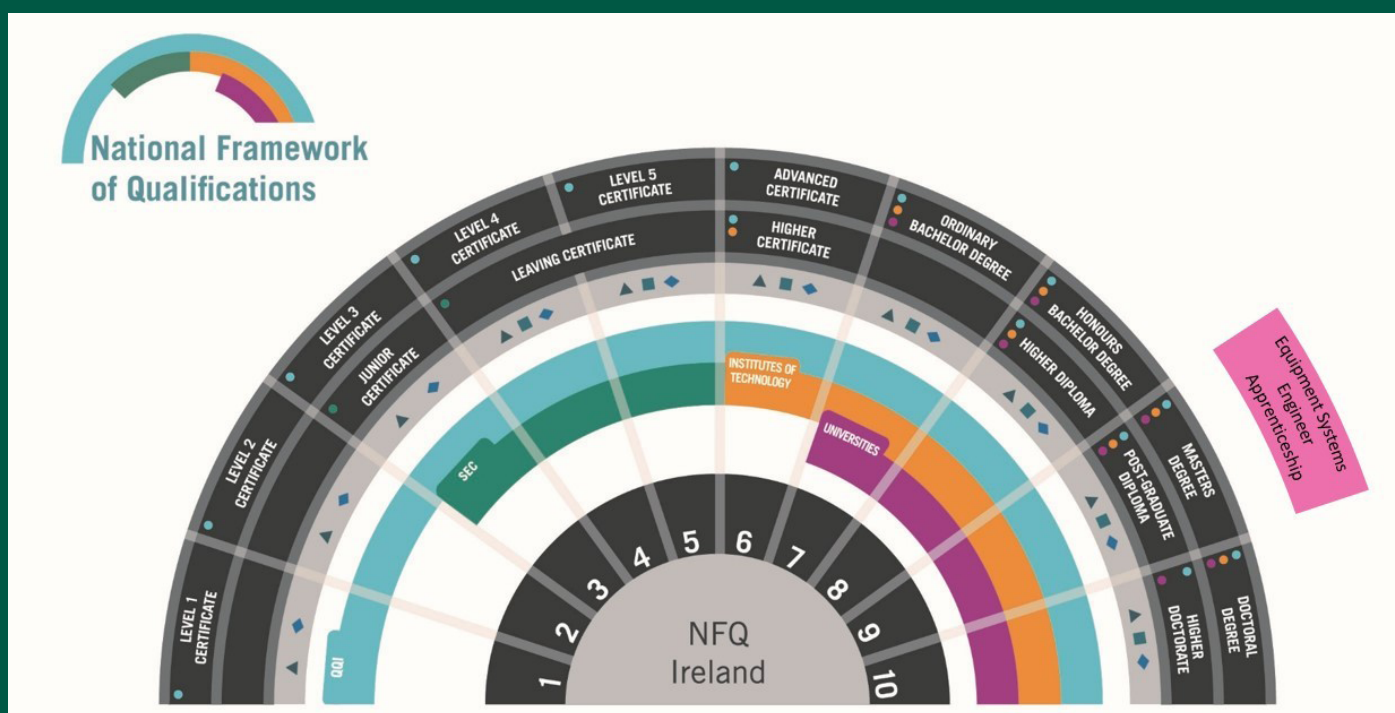
This transition from Industry 3.0 to Industry 4.0 has created the requirement for the role of Equipment Systems Engineer. An ESE will be responsible for the procurement, optimisation and maintenance, of the physical machines and cyber systems that support Industry 4.0. The ESE must possess the necessary knowledge and skills to design, procure, integrate, and support Industry 4.0 Equipment with its inherent Cyber Physical Systems (CPS).

National Framework of Qualifications

National qualifications frameworks (NQF) describe what learners should know, understand and be able to do on the basis of a given qualification. These frameworks also show how learners can move from one qualification, or qualification level, to another within a system. Over 150 countries are now developing, or have developed, a national qualifications framework.

The Irish NQF, is a framework through which all learning achievements may be measured and related to each other in a coherent way and are organised based on their level of knowledge, skill and competence. Because all NQF qualifications are quality assured, learners can be confident that they will be recognised at home and abroad.

Upon completion, the graduate will achieve a Masters in Engineering (MEng), NQF Level 9 Major Award.



Equipment Systems Engineering Overview

The main reason companies need an Equipment Systems Engineer (ESE) today and in the future is DigitALISation (digital transformation of a business). The specific projects that ESEs work on are varied, but most involve automating processes.

Their responsibilities include improving the product development process, making manufacturing less costly and more efficient, improving the quality of products produced, and enhancing the service received by customers. They develop systems and solutions that enable machines and equipment to interact, making them intelligent and autonomous.

An ESE develops, implements, tests, and maintains solutions for manufacturing facilities based on Industry 4.0 principles. This includes developing cyber-physical systems using cognitive computing, the Internet of Things (IoT), cloud computing, and more.

ESEs require traditional mechanical and electrical engineering skills as well as advanced controls skills. They also need inspection and software validation skills as well as skills and knowledge of IT and OT.

ESEs fulfil high-level engineering and operational roles within the company. The role is found across all manufacturing industries, including: Chemical, Pharmaceutical, Medical Devices, Electronics, and Automotive. Factories are only one area where ESEs are needed. In fact, the technologies that ESEs develop, deploy, manage, and support also have applications in farming, construction, infrastructure development, mining, and more.

This Apprenticeship programme provides experienced engineers with a comprehensive framework to manage the implementation of Industry 4.0 innovations in their employer's equipment.

This Programme aims to:

- Introduce learners to the key concepts of Industry 4.0 and digital transformation
- Explore state of the art in several relevant disruptive innovation topics
- Review relevant sustaining innovations from various technology providers
- Provide the learners with access to relevant Communities of Practice (CoP)
- Impart a robust applied research process to the learner
- Assist learners as they develop their *Innovation Concept, Solution, Thesis and Report*



Programme Overview

90 credits (European Credit Transfer System - ECTS)

Duration:

2 years

Delivery:

Blended learning with online and face to face sessions

Year 1	
Boot Camp - on campus event	3 x Day introduction to the programme covering: 1. Research Fundamentals 2. Digital Innovation Transformation 3. Digital Equipment Technologies
Disruptive Innovation Sprints - delivered remotely	Industry 4.0 TOPICS delivered fortnightly via flipped classroom with a live Q&A with an expert practitioner in the topic
Research Proposal Preparation	Define the hypothesis, which will form the basis of your research and thesis
Technology Provider Sprints – delivered remotely	Students are introduced to Provider Platform technologies
Equipment Systems Engineering Research Plan	Students take part in a Thesis in Three to showcase their research to date to their colleagues for peer review
Equipment Systems Engineering Project Review	Supervisor report for project progress
Year 2	
eEXPO – on campus event	After working on their Literature Review, the learner must outline their “ Innovative Solution ” to their peers
Equipment Systems Engineering Research 1	Write-up Masters Thesis for examination
Equipment Systems Engineering Research 2	Write-up Masters Thesis for examination
Equipment Systems Engineering Research 3	Present Masters Thesis for examination

Course Breakdown

Year 1 - Boot Camp

The Boot Camp is held at the beginning of each Apprenticeship Programme. It consists of three days of lectures and workshops at the University of Limerick. It provides the opportunity to introduce all the learners to the academic staff, researchers, commercial technology providers, key technologies, equipment, and facilities at the outset of the programme.

A key feature of the Boot Camp will be the utilisation of innovation workshops. These innovation workshops will assist learners to explore the business model disruption, which can occur when Industry 4.0 innovations are correctly implemented in equipment.



Year 1 - Disruptive Innovation Topics

Disruptive innovation topics will be introduced: fortnightly as appropriate. Each Disruptive Innovation Sprint, will typically consist of both synchronous and asynchronous presentations by expert(s), as well as a structured structured Q&A session. During these sprints, the expert(s) will outline the current working practice(s), explain key innovation triggers, summarise significant research that has been completed and share plans for future research. Such sprints will help to provide the learner with access to relevant material for the literature review component of their academic study.

Apprentices are expected to present their Research Proposal for review at the end of Semester 1.

An example of disruptive innovation topics is shown below. It should be noted that the topics will constantly evolve to meet the needs of both the learners and research community.

eDIGITAL Transformation, DigitIZAtion and DigitALIZAtion	The pace of Digital transformation has increased significantly. It is now imperative that the DigitIZAtion of equipment is closely aligned to the DigitALIZAtion vision of the business. Only then can the required customer experience be achieved.
eANYWHERE on an I4.0 Digitally Connected Supply Chain Network (I4.0-DCSCN)	The traditional I3.0 Linear Physical Supply Chain (I3.0-LPSC) if not fit for purpose in a digital world. Correctly designed I4.0 equipment can now be located anywhere on the supply chain and anywhere on the planet. It is truly disruptive.
ePROCUREMENT Process (ePP) to facilitate digital transformation	The procurement of I4.0 equipment is radically different to conventional I3.0 equipment. Experienced I3.0 PR actioners, armed with an I4.0-EPP can efficiently and effectively manage the optimum DigitIZAtion of equipment.
eCOMPLIANCE for the Irish Life Sciences Sector	High-tech equipment is great, but how can dynamic solutions such as Artificial Intelligence and machine learning be validated? Can I4.0 technologies be leveraged to design equipment which can automatically self-validate?
eCUSTOMIZATION of products	Product customization will become commonplace in a digital world. Equipment will require novel product tracking, recipe management and Real Time Release Testing (RTRT) solutions to meet this requirement.
eSUPPORT Services in real time	Equipment located anywhere on the supply chain will require global digital collaborative support services. This raises new challenges such as Just in Time competencies, security, and safety.
eCLOUD for Big Data Analytics	The cloud can process enormous volumes of equipment data extremely efficiently. Cloud based analytics can “ <i>make sense</i> ” of such equipment data, in a way that was never possible before. These new Business Intelligence (BI) insights will transform your understanding of the equipment thus enabling you to significantly improve its performance.
eloT Internet of Things, from an equipment perspective	The potential of Internet of Things (IoT) often appears limitless. Nevertheless, it is very unwise underestimate the integration and cyber security issues. Industrial Standards provide an ideal framework to mitigate such risks.
eDATA at the Edge	I4.0 technologies now make it possible to create extremely rich contextualized data at the edge. Explore how I4.0 technologies such Time Sensitive Networks and intelligent devices can provide new data insights at the edge.
ePROCESS Control for Customization	Batch engines provide the process industries with virtually limitless customization. Recent advances in I4.0 technologies now enable the same control philosophies to be embedded in equipment. You just define the process.
eBASIC Control of the Equipment	There has never been so much choice. Basic Control can now be provided by Intelligent Devices such as robots, Programmable Automation Controllers (PACs) or even Edge Devices. Which is the correct one? And even more importantly, why?

Year 1 -Technology Provider Topics

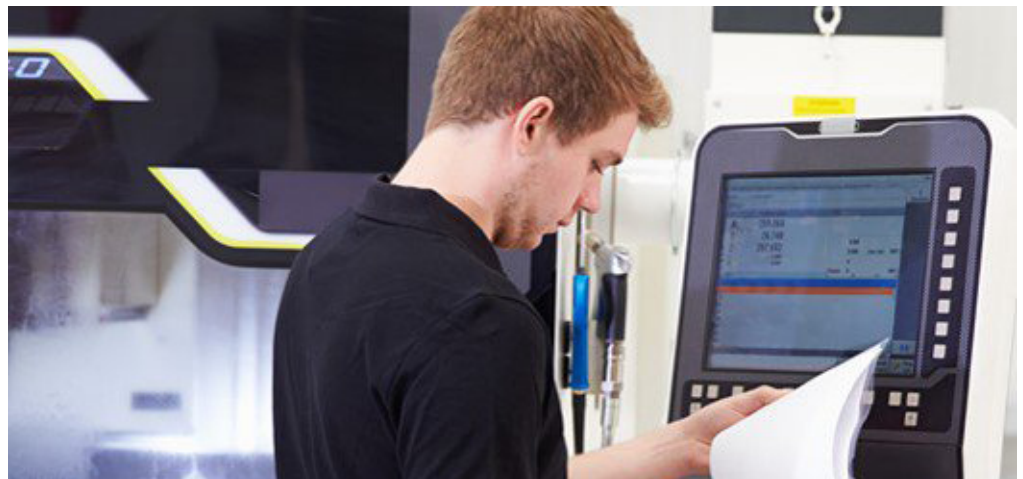
In this year students are introduced to the key technology providers in Industry 4.0 innovations.

Technology providers will demonstrate how their technology could be used to answer students research problems and provide an explanation of how to leverage their training material for Novice, Proficient and Independent learners. Such sprints will furnish the learner with relevant material for the selection of the most suitable technology for their organisation.



Year 2 - Proof of Principle (PoP) of an Innovative Solution

During this year, the apprentice will design an experiment that robustly challenges the key principle(s) of their innovative solution. The apprentices may conduct their experiment in the cyber world, physical world, or a combination of both. They must design their experiment so that it is “generic” in nature and does not contain any confidential information. This will allow the output to be disseminated to the widest possible audience, for the benefit of the relevant Communities of Practice.



Year 2 -Innovative Solution Thesis & eEXPO

The learner will be required to complete an Innovation Solution Report and present it to the wider engineering community at the annual eEXPO held by UL. The eEXPO is the highlight of the Equipment Systems Engineering calendar. It provides apprentices with a unique opportunity to disseminate their work to a wider engineering audience, who may decide to leverage key innovations which they wish to diffuse throughout their own corporations.

Apprentices will also be required to submit an Academic Thesis which is deemed as sufficient for the award of a Level 9 MEng by research. Each apprentice must submit their written thesis and undergo an oral examination (Viva) by an external examiner (individual or panel) at the completion of their work. The decision to award or not is based on this examination process.

Employer Duties & Responsibilities



Embarking on the Equipment Systems Engineer Apprenticeship

Before undertaking an apprentice on the Equipment Systems Engineer programme, an employer should first consider the following questions:

1. **Can you provide the apprentice with continuity of employment (both On-the-Job and Off-the-Job over a 2-year period)?**

The apprenticeship runs for 2 years. Your potential apprentices must have a contract of employment that meets or exceeds their time on the programme. All organisations who employ apprentices must adhere to the guidance provided in the Apprenticeship Code of Practice. This Code of Practice is intended to assist both employers and apprentices to understand their duties and responsibilities relating to the apprenticeship programme. As part of the employer approval and apprentice registration processes, employers and apprentices agree to comply with this Code of Practice.

A copy of the code of practice can be found at:

[Apprenticeship Code of Practice for Employers and Apprentices](#)

2. **Can you provide adequate resources such as the time, facilities and equipment necessary to support the apprentice in respect of both on and off-the-job learning in your organisation?**

On-the-job learning requires working in an environment where the apprentice can practice the tools and techniques that they are learning on their programme.

This also includes releasing the apprentice for Year 1 three day Boot Camp, eEXPO's and regular virtual Sprints with sector experts and technology providers.

3. Can you provide a qualified or experienced staff member who will act as the apprentice's Workplace Mentor and whose key role is to enable the concepts learned to be embedded and to provide advice and guidance on projects?

Each apprentice is allocated an Industry Mentor (a maximum of 4 apprentices to 1 mentor) whose key role is to support and enable the apprentice to complete the programme and the project work.

The role of the 'in-company mentor' is not to formally assess any part of the Masters apprenticeship programme. However, they fulfil a vital role as advocate/facilitator/enabler depending on their role in the company and specific experience. The in-company mentor may have one or more of the following:

- Enabling capacity – to ensure the candidate dedicates enough 'on-the-job' time to the programme to ensure successful completion in the given timeframe. This person will most likely be a member of the management team.
- Subject matter knowledge in the area of study.
- Academic expertise through having completed a Masters or Doctorate.

An apprentice may have more than one in-company-mentor if they wish, though this is not compulsory.

Mentors must agree to have regular documented meetings with the apprentice throughout the programme and these form part of the learner's e-portfolio.



Role of the Workplace Mentor

- Familiarise themselves with the Equipment Systems Engineering apprenticeship programme.
- Facilitate the apprentice's learning in the workplace by conducting a minimum of 4 mentoring meetings per year.
- Promote independence and autonomy in learning and in the completion of workplace projects.
- Foster a supportive environment to complete workplace projects.
- Facilitate peer learning with other experienced members of staff.
- Attend a mandatory briefing day workshop prior to the apprentice commencing.
- Participate in and/or contribute to the National Programme Board.
- Liaises with the academic supervisor and the apprenticeship programme manager.

Registering an Apprentice

The employer must be approved by UL and SOLAS in order to register an apprentice on this programme.

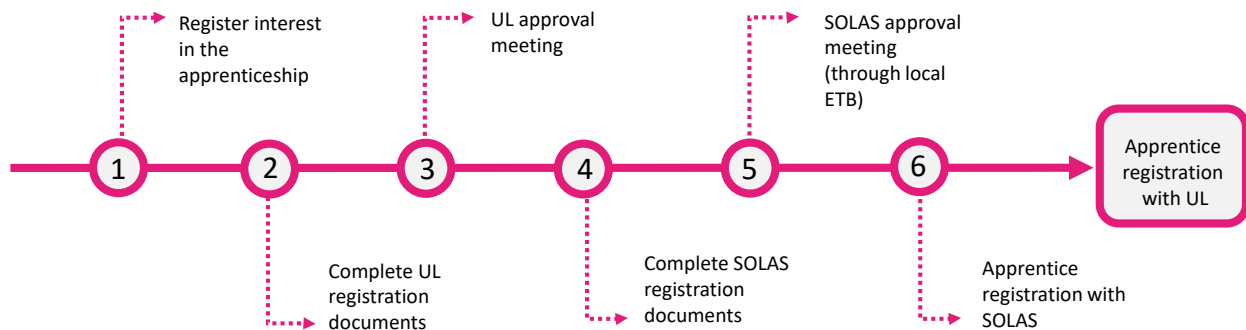
The Role of SOLAS



SOLAS, as the further education and training authority, is the lead agency responsible for apprenticeships on behalf of the Government. They work in close partnership with employers, the Higher Education Authority, Quality and Qualifications Ireland, industry and education and training providers across further and higher education.

SOLAS' responsibility includes maintenance of a national register of employers approved to take on apprentices and a national register of apprentices. SOLAS have authorised the network of over forty authorised Officers (AO) located within Education and Training Boards (ETB) around the country, to carry out key employer assessment and liaison activities for the apprenticeship system, along with apprentice registration and ongoing support and monitoring duties.

For an employer to gain approval to train apprentices in a particular occupation, s/he must demonstrate that they have the capacity and the ability to provide quality, relevant on-the-job training to apprentices as per the requirements of the national apprenticeship programme and the statutory apprenticeship system overall.



Stages to become an Approved Employer

Stage 1:

1. Register interest by completing the [Expression of Interest form](#) or by emailing apprenticeships@ul.ie.
2. Complete and return the following UL company registration forms and documentation:
 - a. UL Apprenticeship Application form
 - b. In-company mentor CV or template
 - c. Proof of mentor qualifications (photo/scan of parchment(s))
 - d. Apprentice CV
 - e. Proof of apprentice qualifications (photo/scan of parchment(s))
3. Attend an approval visit with UL programme manager, mentor, apprentice and person responsible for apprenticeships in the organisation.
4. Following UL approval, the UL programme manager will send all documentation to the local ETB.

Stage 2:

1. ETB arranges a second approval visit and will ask the employer to complete the following:
 - a. SOLAS Suitability to Train form
 - b. Apprentice registration form
 - c. Provide apprentice photo (signed)
2. Following Solas approval*, the UL programme manager will provide the apprentice with a link to apply to UL as a student and register on the programme.

Apprentice/Student Registration

1. Apprentices apply to UL by completing the online application form and uploading the following:
 - a. A copy of passport (in the event of not having a passport, a copy of birth cert will be accepted)
 - b. An official copy of qualifications, undergraduate and postgraduate (transcripts and parchments required)
 - c. English language certificate if English is not their first language
 - d. A copy of most recent CV
 - e. Online registration fee of €35
2. Apprentices will receive an official offer letter for the programme which they must accept by doing one of the following:
 - Pay €250 acceptance fee (which comes off your total fee payable)
 - Attach a letter of sponsorship on headed paper which must be signed and stamped by your company
3. On receipt of payment or sponsorship letter, the apprentice will be sent instructions on how to enrol onto their course and register for their modules to officially become registered students of UL.

The company registration with UL and SOLAS is a one-off process and any additional apprentices who wish to register in subsequent years can express an interest by emailing: apprenticeships@ul.ie.

There is no limit on the number of apprentices that an organisation can have. Each approved mentor may have up to 4 apprentices



* If the employer is deemed unsuitable, the SOLAS Authorised Officer will identify what requirements remain to be met and subsequently, a re-visit can be scheduled to re-assess.

Entry Requirements

Who is this programme suitable for:

Existing employees seeking to progress within their organisation and develop skills relevant to the workplace and for professionals who:

- Procure, design, manufacture, commission, support or optimise Industry 4.0 equipment for the high-tech manufacturing sector in Ireland.
- Have significant expertise of Industry 4.0 technologies as applied to manufacturing equipment.
- Wish to collaborate with others to broaden their overall access to emerging research, technologies and best working practice to meet the challenges of Industry 4.0.
- Wish to improve their abilities to perform applied research in the high-tech manufacturing equipment domain.
- Have a strong desire to be recognised as technical leaders in a topic relevant to Equipment Systems Engineering.
- Have been selected by their employer to apply the knowledge gained during this course for the procurement or optimisation of manufacturing equipment in accordance with Industry 4.0.
- Have a degree and/or considerable industrial experience in the field.

Apprentice Entry Requirements

- Must be employed by a SOLAS 'Approved Employer' and registered as an apprentice.
- Aged 18 or over.
- Must have achieved a 2.2 honours or above at NFQ Level 8 or above in a relevant area.
- Certified and non-certified Recognition of Prior Learning will also be considered.
- International applicants with an Irish contract of employment must present the equivalent of a full NFQ Level 8 qualification or higher.
- English is the language of tuition and assessment. Apprentices for whom English is not a first language must demonstrate proficiency in English as per UL requirements.
- Non-EU applicants are subject to work permit regulations.



Frequently Asked Questions

What type of industry would benefit from the Equipment Systems Engineer apprenticeship?

This programme has been developed to meet current and future demand for Equipment Systems Engineers employed across all industry sectors including and not limited to:

- Pharmaceutical
- Medical Devices
- Food Production
- Chemical
- ICT
- Engineering
- Construction
- Logistics & Transport
- Electronics
- Manufacturing
- Mining
- Farming
- Automotive
- Infrastructure Development
- Security

Is there a cost associated with taking on an apprentice?

There is a €900 student contribution attributed to this programme which can either be paid by the organisation or the student.

Does the apprentice have to leave work for long periods to attend college?

No. This two-year MEng, in conjunction with vibrant Communities of Practice (CoPs) provides an ideal framework for the learner to comprehensively and efficiently evaluate both disruptive and sustaining innovation solution. It has been designed to minimise the time spent away from employment.

- 3 Day Boot Camp at the beginning of Semester 1
- Remote learning workshops and recorded material for review in Semesters 1 and 2
- 1 day industry eExpo which will take place on site at the University in Year 2
- Online meetings as required with Academic Supervisor and in-company Mentor

Each apprentice must submit their written thesis and undergo an oral examination (Viva) by an external examiner (individual or panel) at the completion of their work.

We recommend a study time of approximately 15 to 20 hours per week.

What qualification does the apprentice get?

Upon successful completion of the programme, the apprentice graduate will be an Equipment Systems Engineer with a NFQ Level 9 Masters in Engineering (MEng).

Progression opportunities are available for those who wish to continue their studies into the Professional Doctorate Programme (Level 10). Indeed, apprenticeships are acknowledged as vital elements in the economic regeneration of countries across the globe. The continued expansion of apprenticeships into new occupational areas will enhance their image and profile and are a real option to academic-only learning pathways.

Contacts

If you would like to discuss apprenticeships with one of our programme managers, please contact us using one of the following methods:

Email: apprenticeships@ul.ie

Tel: Philomena Kelly 083- 3505399

Further information on our apprenticeship programmes can also be found at:

Web: <https://www.ul.ie/ulearning/flexible-learning-courses/apprenticeships>

