GENERATION APPRENTICESHIP
Engineering | www.apprenticeship.ie

Manufacturing Engineering Apprenticeship
Ibec

Employer Handbook

Bachelor of Engineering in Manufacturing Engineering (Apprenticeship), Level 7

Higher Certificate of Engineering in Manufacturing Engineering (Apprenticeship), Level 6

ENGINEERING

TUS
MTU Ollscoil Teicneolaíochta na Mumhan Munster Technological University
GMIT Institiúid Teicneolaíochta na Gaillimhe Maigh Eo Galway-Mayo Institute of Technology
IT Sligo An Institiúid Teicneolaíochta, Sligeach

SOLAS learning works
An Roinn Oideachais agus Scileanna Department of Education and Skills
HEA Higher Education Authority An tÚdarás um Ard-Oideachas
QQI Quality and Qualifications Ireland

www.apprenticeship.ie

Contents

Welcome

I am proud that the Ibec Medtech and Engineering was at the vanguard of the modern apprenticeship development with the Manufacturing Engineering Apprenticeship selected by the Department of Education and Skills to be one of the first 25 programmes launched in 2017 by the Government.

The Manufacturing Technician (level 6), and Manufacturing Engineer (level 7) programmes were developed to offer access to world class talent to global and homegrown manufacturing businesses in Ireland to help them achieve their vision for growth.

The manufacturing industry in Ireland is an integral part of our economy as a location of choice for investment, and a driver of job creation with 30,000 jobs added in the past couple of years. Ireland boasts the highest share of employment in the hi-tech manufacturing industries in Europe with 260,000 people working across 4,000 businesses.

The strength of manufacturing has been underscored by our model of substance with Ireland standing out as the only country in Europe which saw export growth in 2020 while Covid-19 shocked the world. And despite only accounting for 1% of the EU's population Ireland accounts for 5% of its global manufactured good exports.

To sustain our success and reman globally competitive we need to continue to develop talent to ensure that they are equipped with both the practical and technical skills needed to stay ahead of the latest manufacturing trends.

As we look to the future, the Ibec Medtech and Engineering Group will continue to work with companies to offer them the supports they need and lobby the Government to create the right policy environment for business.

Our recommendation to ensure the sustainability of these programmes have highlighted the importance of increasing the incentive scheme to bring the modern apprenticeships in line with the craft programmes, calling for a bursary to encourage more girls to use the programmes as a gateway to STEM careers, and advocating for a streamlined registration process to help more employers register apprentices.

We believe that with these recommendations, these programmes will help the Department of Education and Skills' ambition to deliver 50,000 apprenticeship and traineeship registrations, as well as support the continued growth of the industry across Ireland.

Lastly, I would like to take this opportunity to thank our academic partners for their support in developing and delivering these programmes. I'd like to thank our co-ordinating provider Galway-Mayo Institute of Technology, along with the Munster Technological University, Limerick Institute of Technology, and Institute of Technology Sligo.

Sinead Keogh
Ibec Medtech and Engineering Director

Introduction

The Manufacturing Engineering Apprenticeships were developed by the Irish Medtech Association to meet the needs of a broad range of manufacturing sectors, from medtech, biopharma, and polymer technology, to engineering, machinery, construction and even food, to meet the needs of businesses both large and small. These earn and learn programmes combine on-the-job learning and academic education with the Galway-Mayo Institute of Technology as the lead provider.

The Manufacturing Engineering Apprenticeships are an excellent way for companies to upskill talent with businesses using these apprenticeship programmes to help both new hires and existing staff achieve their career goals. While the potential of the apprenticeships to act as an alternative to traditional university degrees is highlighted by the fact that to date the apprentices have earned grades 10%-20% higher than the corresponding full-time students.

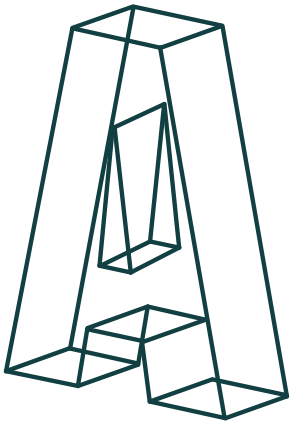
With no upper age limit to entry onto the programmes they provide a structured way towards acquiring a Level 6 or Level 7 qualification covering a broad range of subjects such manufacturing automation, engineering science, and lean manufacturing. The apprentices earn while learning and gain a national qualification with which they achieve an excellent career route. Through their study towards professional qualifications and the application of these learnings in the company, apprentices are building their technical knowledge which in turn feeds back into the business.

The feedback from companies engaged to date has been exceptional, companies note the apprentices moving from an observing phase to a questioning phase and onwards to an engineering thought process to solving complex issues within the manufacturing environment.

There are also the potential for cost savings for businesses as a result of the apprentice improvement projects. I encourage companies to consider these apprenticeships as a route towards growing your own well-managed talent pipeline as the long-term benefits far outweigh the initial company investment.

Trish Breen
Ibec Medtech and Polymer Apprenticeships Project Manager

What is an Apprenticeship?



An apprenticeship is a programme of structured education and learning which formally combines and alternates learning in the workplace with learning in a third-level education institution or training centre.

It is a dual system, a blended combination of on-the-job employer-based learning and off-the-job learning.

In particular, this is a cognitive apprenticeship, as opposed to a craft apprenticeship. Apprentices learn to "think like an engineer or technician". Engineers are people who make things that work, and make things work better.

The emphasis is on learning engineering problem-solving skills – or the ways in which engineers and technicians go from problem to solution. In the workplace, Industry Mentors help apprentices to observe and engage in problem-solving. Mentors demonstrate their own problem-solving approaches to apprentices, provide coaching and a learning structure. The apprentices then, through describing their own reasoning and reflecting on their own problem-solving methods (e.g. by comparing them to those of the Industry Mentor or other engineer), develop deeper understanding of this cognitive process. They enhance their problem-solving skills and develop new approaches, increasingly operating under their own initiative.

The learning process also helps to develop the common traits of engineers and technicians, for example, the ability to collaborate and communicate, an optimistic outlook, curiosity, resourcefulness, open-mindedness, rigor, resilience and mindfulness of ethical considerations. The cognitive apprentice further seeks to foster the "engineering mind-set", which includes, for example, creative problem-solving, a relentless drive for improvement, systems thinking, visualisation and adaptation

Key features of this cognitive Apprenticeship:

- Industry-led by a consortium of industry and education partners
- Leads to an award at Level 6 and 7 on the National Framework of Qualifications (NFQ)
- Two or three in duration
- Minimum 50% on-the-job learning
- Apprentices are employed under a formal contract of apprenticeship
- The employer pays the apprentice for the duration of the apprenticeship
- Minimum entry age limit but no upper age limit.

About the Apprenticeship

The purpose of this programme is to provide high quality manufacturing engineering technicians and engineers to support the local and national manufacturing industries (particularly in highly regulated industries) and to provide opportunity to prospective students to acquire rewarding and progressive careers.

Apprenticeship programmes combine on-the-job learning and academic off-the-job education for those entering the workforce. Apprenticeship programmes are also identified as sandwich programmes or dual education programmes.

Apprenticeship differs from internship in that: apprentices are paid employees; salary may increase as the apprentice completes parts of the programme; the time spend on the job is much longer; and the apprentices are generally guaranteed a job at the end of their studies (although this is not part of the apprentice contract).

These programmes offer unique benefits and advantages for companies and apprentices. The apprentices earn while learning and gain a national qualification with which they achieve an excellent career route. The employers can tailor the programmes and their participation in the programmes, address skill shortages, improve staff retention and avail of government training subsidies.

It is often assumed that apprenticeship is an easier form of education and learning, but the workload can be very heavy on the students. The sandwich or alternate education structure offers the advantage over full-time study modes by providing curriculum contextualisation that strengthens student commitment, motivation and conviction, which in turn strengthen student learning. Indeed, the apprentice must achieve the same programme outcomes as a full-time student with less formal class contact time. To limit the student's potential difficulties, it is essential that a robust selection process is used by employers for apprentice recruitment.

On completion of this programme, the students will be awarded a Higher Certificate or a Bachelor of Engineering in Manufacturing Engineering.

Apprenticeship Structure

	Higher Certificate in Engineering in Manufacturing Engineering	Bachelor of Engineering in Manufacturing Engineering
Duration	2 years	3 years
Award Level	Level 6	Level 7
Duration of Academic Blocks	15 weeks per year	15 weeks per year
Duration of Industry Blocks	6 weeks Induction Block 37 weeks Industry Block 1 31 weeks Industry Block 2	6 weeks Induction Block 37 weeks Industry Block 1 37 weeks Industry Block 2 31 weeks Industry Block 3
Programme status (FT/PT)	Full Time	Full Time
Location of Academic Block delivery	Galway Mayo Institute of Technology Limerick Institute of Technology Cork Institute of Technology Institute of Technology Sligo *(Programmes will expand to other regions depending on demand)*	Galway Mayo Institute of Technology Limerick Institute of Technology Cork Institute of Technology Institute of Technology Sligo *(Programmes will expand to other regions depending on demand)*
Number of Apprentices per class	16	16
Entry requirements	Industry Interview SOLAS apprentice approval Pass (Grade O6 or better) in five leaving certificate subjects 250 CAO points. *Mature students (over 23yrs) exempt from needing the Leaving Certificate*	Industry Interview SOLAS apprentice approval Pass (Grade O6 or better) in five leaving certificate subjects 250 CAO points. *Mature students (over 23yrs) exempt from needing the Leaving Certificate*

GMIT Institiúid Teicneolaíochta na Gaillimhe Maigh Eo Galway-Mayo Institute of Technology

MTU Ollscoil Teicneolaíochta na Mumhan Munster Technological University

IT Sligo An Institiúid Teicneolaíochta, Sligeach

TUS

Industry Engagement

Manufacturing is a vital part of the Irish economy with more than 4,000 businesses employing 260,000 people. Ireland is recognised as a global leader in manufacturing thanks to our supportive business environment and the availability of top talent, but to compete we need to ensure the sustainability of this pipeline.

The new Manufacturing Engineering Apprenticeships offer new routes to high-tech manufacturing industries such as medtech and engineering. As we look to the future, we need to ensure the sustainability of the new apprenticeship programmes. To do this we need to encourage ambitious young people to choose apprenticeships to kickstart their career, as well as encourage business both big and small to develop worldclass teams,"
Sinead Keogh, Ibec Medtech & Engineering Director.

"This programme has given apprentices the opportunity to gain unique qualifications by studying subjects such as, computer aided design, engineering science, and lean manufacturing. The Manufacturing Engineering Apprenticeships not only has a high completion rate but are also performing exceptionally well. As an ex-army apprentice, I know from personal experience how far an apprenticeship can take you,"
Barry Comerford, Chair of the Manufacturing Apprenticeship Consortium and CEO Cambus Medical.

Minister of State at the Department of Education Mary Mitchell O'Connor TD celebrating the first graduating class of the Manufacturing Engineering Apprenticeship in September 2019.

Testimonials

Company Testimonials

"The Manufacturing Engineering Apprenticeship is a great fit to meet the diverse engineering requirements we have at Stryker Ireland. The industry and academia partnership, course content and the mentorship structure are all focused on developing a pipeline of talent to meet the needs of our industry today and into the future."

David Quaid, Programme Manager, Stryker

"At Zimmer Biomet we are committed to developing and upskilling our team members, and the Manufacturing Engineering Apprenticeship provides us with the opportunity to follow through on this commitment. As we grow our business, it is key that we create those high-end opportunities for our team members. Industry collaborating with academia has resulted in a well-designed program. It enables us to deliver a constant pipeline of talent to meet current and future needs of the business."

Claude Costelloe, Site Director, Zimmer Biomet

Mentor Testimonial

"I would strongly recommend the Manufacturing Engineering Apprenticeship program to any companies considering adding to existing employee development programs. By Combining workplace practical learning with academic award, participants have a great opportunity to learn "on the job" and advance their careers. The apprenticeship also offers internal mentorships which further enhance the development model. I was delighted to act as mentor and there is a great sense of fulfilment watching apprentices learn and develop. I can use my own experiences to actively support and guide them to be successful within Abbott."

Tracey Powell, Strategic Project Manager and Apprenticeship Mentor, Abbott

Apprentice Testimonial

"The Manufacturing Engineering Apprenticeship has been a great experience for me. It is a perfect way of learning new skills suited to a wide range of roles within such a strong industry. We also have the added bonus of earning while you learn. The practical experience of on the job learning means we can see different sides of the business and it gives us a chance to see where our strengths lie."

Aislinn Smith, Apprentice, Johnson & Johnson Vision Care

Who is the Apprenticeship for?

Apprentice

The minimum entry requirement for the programme are as follows:

School leaver applicants

The minimum Leaving Certificate requirements for entry into the proposed programmes is a pass (Grade O6/H7 or better) in five Leaving Certificate subjects with a minimum of 250 points, or equivalent.

Current (pre-2017) Leaving Certificate Grading Scale	New Leaving Certificate Grading Scale	New points at Higher Level	New points at Ordinary Level
A1	**H1 / O1**	100	56
A2	**H2 / O2**	88	46
B2			
B2	**H3 / O3**	77	37
B3			
C1	**H4 / O4**	66	28
C2			
C3	**H5 / O5**	56	20
D1			
D2	**H6 / O6**	46	12
D3			
E		33	0

Mature applicants

Mature applicants do not have to meet the leaving certificate entry requirements for the programmes, and they are assessed based upon their previous education and work experience pending a demonstration of their ability and competence to undertake the programme.

Employer

The Manufacturing Engineering Apprenticeships are open to all companies within the manufacturing sector in Ireland. The company must have a manufacturing process which allows the apprentice to achieve all the learning outcomes set out in the occupational profile. SOLAS Authorised Officer will conduct an on-site 'suitability to train' visit with the employer.

Apprenticeship Schedule

Depending on demand, the apprenticeship will be delivered in four Institutes of Technology. They are as follows;

1. **Galway-Mayo Institute of Technology**
2. **Limerick Institute of Technology**
3. **Cork Institute of Technology**
4. **Institute of Technology, Sligo**

There are two possible schedules for the Manufacturing Engineering Apprenticeship. A summer intake and/or an autumn intake. A decision will be made by the consortium on which IoT's will run the apprenticeship each year and how many intakes there will be in each institute. This decision will be based solely on demand from industry within a given region and the availability of the third level institute in question.

Option 1: Summer Intake

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
						Initial block		Academic Block 1			
Industry 1								Academic Block 1			
Industry 2								Academic Block 2			
Industry 3											

Option 2: Autumn Intake

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
										Initial block	
Academic Block 1				Industry 1							
Academic Block 2				Industry 2							
Academic Block 3				Industry 3							

NOTE: Depending on demand for the Level 7 Manufacturing Engineering Apprenticeship, it may be necessary to complete the year 3 academic block in an Institute of Technology outside of your region. Limerick Institute of Technology will deliver the Manufacturing Technician Apprenticeship (Level 6) ONLY.

Registering an Apprentice

To register an apprentice the company must follow the steps below:

1. Populate a 'Company Commitment form' and return to the apprenticeship team in Ibec (include form as appendix A).

2. Contact your local ETB office and they will then assess you in the following areas:
   - The Authorised Officer will assess your company's suitability ability to train a Manufacturing Engineering Apprentice. He/she will then register the apprentice, ensuring he/she meets the minimum entry requirement.

3. The company must have the Apprentice and Mentor selected prior to the commencement of the apprenticeship.

4. The company must appoint a Mentor for the Apprentice (Please see Mentor registration form attached. Appendix B).

5. Apprentice must register with their chosen Institute of Technology and submit their associated GDPR forms (Apprenticeship Manager to facilitate).

Employer Approval

For an employer to get approved to train apprentices in a particular occupation, he/she 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. Employers must allow the Apprentice to attend all classroom / online learning days and these days count as workdays. To gain approval, an Authorised Officer (AO) from the employer's local Education and Training Board (ETB) carries out a site visit where the employer is formally assessed (e.g. apprentices employed in Limerick region will be assessed by an AO from Limerick Clare ETB). It is important that Industry Mentors and apprentices show the AO that they are very familiar with the programme and understand their own roles and responsibilities. The AO makes a recommendation to SOLAS on the employer's suitability to deliver the programme. We provide the AO with the contact details of all Industry Mentors and then the AO will then make contact with the mentors to carry out a visit.

Please have the following information ready for the AO visit:

Industry Mentor Details (Manufacturing Technician Apprentice Level 6 programme)

1. Mentor Name and Contact details (Phone and Email)
2. Copy of a level 6 qualification or higher in a cognitive discipline plus evidence confirming a minimum of 4 years relevant industry experience. (The completed Industrial Mentor form will provide this evidence).

Industry Mentor Details (Manufacturing Engineer Apprentice Level 7 programme)

1. Mentor Name and Contact details (Phone and Email)
2. Copy of a level 7 qualification or higher in a cognitive discipline plus evidence confirming a minimum of 4 years relevant industry experience + holding a position of technical responsibility in the organisation. (The completed Industrial Mentor form will provide this evidence).

Apprentice Details

1. Apprentice name and contact details (home and work address, email and phone)
2. Qualification Certificates (e.g. Leaving Certificate)
3. Letter from employer if required (e.g. if the Apprentice does not have a level 5 qualification, they need a letter on headed paper, confirming they have a minimum 3 years work experience)
4. 2 Passport ID Photos (signed by Apprentice)
5. Photocopy of Personal Identification (e.g. Passport or Driving Licence) clearly showing all details
6. Apprentice PPS number

Employer Details

1. Employer Tax Number
2. Number of employees employed in branch
3. Date Trading commenced

How to get involved

Step 1: Preparation

- Register your interest via email to: **info@manufacturingapprenticeships.ie**
- Organise a meeting with the Manufacturing Engineering Apprenticeship team to discuss the programme.
- Decide on suitable apprentice role and how many apprentices you will recruit.

Step 2: Process

- Identify suitable employees to act as mentors to the apprentices. Mentors will be provided with training.
- Ensure that you are able to release the apprentice for 15-week block for academic training.
- Ensure that you can give the apprentice access to relevant systems and processes to support the learning outcomes.
- Managers and mentors will familiarise themselves with the SOLAS code of practice, the learning objectives of the programme, as well as the responsibilities of taking on an apprentice.
- SOLAS conducts a site visit to confirm the company is capable of facilitating an apprentice.
- Begin recruitment process.

Step 3: Recruitment

- Each company conducts their own recruitment process, it is important for you to find the right candidate.
- Marketing materials and support will be provided by Manufacturing Engineering Apprenticeship team.
- Companies can advertise for free their new hire apprentice positions on Solas website. E-mail: **info-apprenticeshipjobs@solas.ie**
- Shortlist candidates and begin interview process.
- Once you have selected your apprentices, their details will be given to SOLAS and the college.
- The apprentices will begin the Industry block and following this, they will commence their academic cycle. *(The starting date for intakes will depend on demand from industry and college availability).*
- The Manufacturing Engineering Apprenticeship team will provide continuous support to both industry and apprentices throughout the course of the programme.

Apprenticeship Stakeholders

Apprenticeship is a national programme which is managed and delivered by a number of education partners, Government bodies, the Department of Education and Skills, employers and unions.

1. **SOLAS** has statutory responsibility for the designation of apprenticeships as part of the statutory apprenticeship system, which is organised in Ireland by SOLAS, the Department of Education and Skills, the Higher Education Authority, employers and unions.

2. **Employers** are responsible for the employment of an apprentice and for the delivery and facilitation of the Industry-Block learning elements of an apprenticeship, including supporting Industry Mentors and development of Learning Plans.

   The employer must:

   (a) Ensure the apprentice is released to attend induction presentation and 'off the job' blocks.

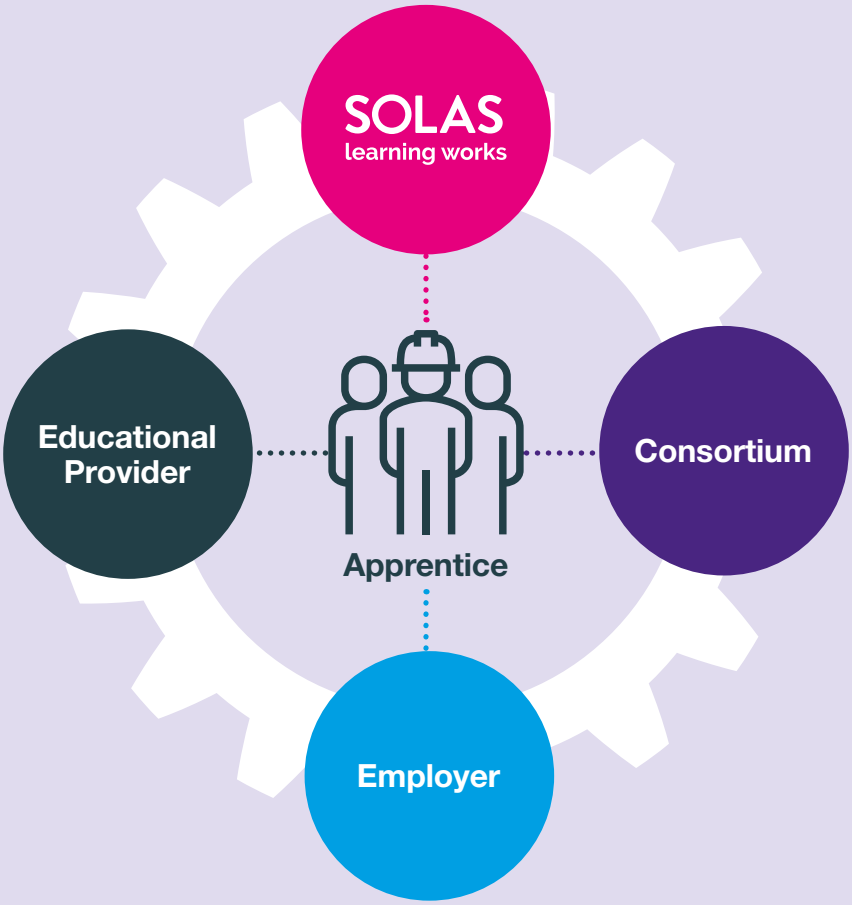
   (b) Provide access for the apprentice to the appropriate equipment and resources to complete the 'on the job' elements of the programme.

   (c) Assign a person qualified in the occupation to act as a mentor to the apprentice for 'on the job' elements.

   NOTE: A registration fee must be paid to the Institute of Technology per apprentices per year. This can be paid by either the company or the apprentice. This should be agreed locally.

3. **Education Institutes** are responsible for the delivery of the learning and education elements of an apprenticeship.

4. The **Apprenticeship Consortium** is made up of representatives from industry, the academic providers, SOLAS representatives and the apprenticeship team.



Key roles and responsibilities

Title	Role
Apprenticeship Manager	• Manages the apprenticeship programme
College Co-ordinator	• Delivers the off-the-job / College-Based blocks
Academic Supervisor	• Visits each apprentice in their workplace • Supports the apprentice in the workplace (Industry Module activities) • Support for Industry Mentor
Industry Mentor	• Mentors, facilitates & guides apprentices at work • Develops apprentice Learning Plan • Meets weekly with apprentice and reviews weekly Reflective Logbooks • Meets with the Academic Supervisor when he/she visits. • Attends 1-day training organised by the Apprenticeship Manager
Company Sponsor	• Point of contact in the company
External Examiner	• Reviews a sample of assessments

The role of the Industry Mentor

An Industry Mentor (IM) is an experienced person, qualified in the occupation, who will guide and support the apprentice whilst they are completing their 'On-the-job' learning. They will also develop a Learning Plan for the apprentice.

The Industry Mentor will be an engineering role model, who will demonstrate the use of technical skills and problem-solving at technician and engineer level, as appropriate. He or she will ensure that the apprentice performs engineering work to the highest standard – with accuracy, rigor, discipline and due care. A data-based and engineering approach to problem-solving will be emphasised. The importance of an ethical approach to engineering work will also be a core theme of the learning.

The Industry Mentor will help the apprentice to become an effective engineering contributor to the organisation. This will involve understanding "how things get done around here" - who they need to talk to, and how they need to approach them, as well as "the big picture" – how all the departments work together to service customers. As part of the Performance Evaluation Rubric, integration into the workplace is assessed by the Industry Mentor. Here, the apprentice's ability to communicate, effectively escalate issues, work in a team and other soft skills are assessed and feedback is given. For specific assessments, which will be marked by the academics, the Industry Mentor may offer guidance to the apprentice on how to approach problems but will not complete the tasks for them.

Manufacturing Technician Apprentice (Level 6):
The Industry Mentor should have a minimum of a level 6 qualification in a cognate discipline or be a level 6 qualified technician with the required depth of technical knowledge (minimum 4 years' post qualification experience). In the case of a Level 6 technician acting as an Industry Mentor, the apprentice should fall under the supervision of an engineer.

Manufacturing Engineer Apprentice (Level 7):
The Industry Mentor should have a level 7 in a cognate discipline with 4 years' post qualification experience, holding a position of technical responsibility in the organisation.

Mentor Training

Each Industry Mentor will receive the following training:

- Mentoring Training: Apprenticeship Consortium
- Introduction to Apprenticeship Programmes and Mentor responsibilities: Institute of Technology

As part of this training provided by the consortium, the Industry Mentor will learn how to support the apprentice in his or her learning.

For example, they will learn how to ask and answer questions as a mentor. How a mentor asks these questions can help to develop the “way of thinking” for the technician or engineer. An example of this is asking open ended questions which helps the mentee to figure out solutions for themselves and to “think outside the box”.

Specifically, the training workshop will help the mentor to:

- Gain an in-depth knowledge of the technician and engineering manufacturing programmes.
- Understand the structure of a professional mentoring session, including how to interact with the apprentices and progress relationships appropriately.
- Gain expertise in the techniques of mentoring.
- Understand how to work with a number of mentoring tools.
- Understand the ‘on the job’ modules the apprentice will complete while based in industry.
- Understand the apprentice assessment and evidence -based capturing processes.
- Prepare a Development Plan for their mentee.

The Industry Mentors will have access to information for their apprentice’s assessments, deadlines and performance.

The role of the Academic Supervisor

Every apprentice will be assigned an Academic Supervisor from the academic provider to support the apprentice through their experiential learning. The Academic Supervisor is responsible for the Industry Module assessments. The Academic Supervisor is the primary contact in the Institute of Technology for the Industry Mentor, and for the apprentices in following their progress through online logbooks.

There will be at least one visit by the academic supervisor to the apprentice in the company. This will happen within eight weeks of the start of each Industry Block. The apprentice may be expected to make a presentation during the visit.

Academics will interact with the apprentice during their Industry Block, primarily using an online learning platform (e.g. Moodle). This will allow for knowledge to be shared, course work, reports and the Reflective Logbook to be uploaded and reviewed, and feedback given. The Academic Supervisor will guide the apprentice through the Process Study and Technical Project exercises and review the Reflective Logbook.

Apprenticeship Objectives

Manufacturing Engineering Technician

On completion of this programme, the students will be awarded a Higher Certificate in Engineering in Manufacturing Engineering.

Intended learning outcomes of the Higher Certificate Programme

On completion of the programme, the graduate will have the ability to:

1. Solve routine technical problems related to manufacturing environments through the application of fundamental engineering principles.
2. Conduct routine analysis of components, processes, and systems through the application of engineering principles and practices.
3. Interpret and prepare graphics and other technical documents to appropriate engineering standards.
4. Use computer hardware and software to support automated engineering environment.
5. Apply knowledge of processes, tools and automation to design solutions that will improve the performance of systems for the manufacture and assembly of products.
6. Follow quality control and quality assurance procedures as required.
7. Comply with and describe the environmental, economic, legal, safety, and ethical implications of working in a highly-regulated industry.
8. Use and maintain documentation, inventory, and records systems.
9. Communicate effectively with the engineering community and society and work effectively as a team member in the planning and implementation of, and reporting on a manufacturing project.
10. Evaluate the role of a manufacturing engineering technician in the business, and the need for high ethical standards in the practice of engineering, including the responsibilities of the engineering profession towards people and the environment, assess the limitations of their own individual competence, and review their need for life-long learning.

Apprenticeship Objectives

Manufacturing Engineer

On completion of this programme, the students will be awarded an Ordinary Bachelor's Degree in Manufacturing Engineering.

Intended learning outcomes of the Ordinary Bachelor's degree Programme

On completion of the programme, the graduate will have the ability to:

1. Develop innovative solutions to routine technical problems related to manufacturing environments through the application of engineering principles.
2. Conduct routine analysis of components, processes, and systems through the application of engineering principles and practices to improve Overall Equipment Effectiveness.
3. Interpret and prepare graphics and other technical documents to appropriate engineering standards.
4. Use computer hardware and software to support an automated engineering environment.
5. Apply knowledge of operations management, lean engineering and six-sigma to the design, validation, optimisation and control of manufacturing processes.
6. Apply knowledge of processes, tools and automation to contribute to the design of components, systems and processes to improve the manufacture and assembly of products.
7. Develop quality control and quality assurance procedures as required.
8. Ensure adherence to and review the environmental, economic, legal, safety, and ethical implications of working in highly regulated industries, for example the Medical Devices industry.
9. Design and maintain documentation, inventory, and records systems.
10. Communicate effectively on broadly defined engineering activities with the engineering community and with society at large, and lead the planning and implementation of, and reporting on a manufacturing project.
11. Evaluate the role of a manufacturing engineer in the business and in society, and the need for high ethical standards in the practice of engineering, including the responsibilities of the engineering profession towards people and the environment, assess the limitations of their own individual competence, and review their need for life-long learning

Programme Structure

The Teaching and Learning strategy of the Apprenticeship revolve around Kolb's Experiential Learning Theory in general, and the Theories of Situated Learning and Cognitive Apprenticeship in particular, in transferring the acquisition of some of the skills and most of the competences to the workplace. In his theory of Experiential learning, Kolb argued that learning is most effective when following the cycle presented in the figure below:

INITIAL Block (6 weeks)

The aims of the **INITIAL** Block (**IN**duction to **I**ndustry and **T**hird-level **I**ndependent, **A**ctive **L**earning) are to introduce the apprentice engineer or technician to the company and their future role, and to prepare them for third level education. The INITIAL block is held in industry and lasts for 6 weeks.

- The apprentice needs to achieve a basic level of proficiency in IT and an awareness of basic CAD functions. This is vital for their success during the intense 15-week Academic Block.
- He or she also needs to complete, and submit to their Industry Mentor for review, a first draft of an INITIAL Block Report, and to make a five-minute presentation on the report. This will help them to develop skills in word processing, presentation formatting and basic PC file management.
- They must also have weekly progress meetings with the Industry Mentor and produce two Reflective Logbooks for review by their Industry Mentor.
- The Mentor should facilitate the learner getting an introduction to very basic mathematical concepts, which will be applied in three modules during the Academic Block: Engineering Science, Electrical Science and Mathematics.
- The apprentice must also prepare themselves for Third Level education where they will be the main drivers of their own learning. They must also familiarise themselves with the programme structure and syllabi.
- Apprentices will need access to a laptop and a PC for the duration of the apprenticeship, including during the INITIAL Block. They will also need a calculator. It is also recommended that they be provided with designated desk space in the company, where they can work and store files.

Academic Blocks

During these 15-week Academic Blocks, more traditional teaching and learning strategies will be used such as lectures, tutorials and laboratories, and will apply to generic engineering modules such as Mathematics and Engineering Sciences.

However, more discipline-specific modules, such as Quality, will take advantage of the “Concrete Experience” acquired in the industry, and concentrate on the “Reflective Observation” and “Abstract Conceptualisation”, giving them the knowledge, skills and guidance necessary to progress through Kolb’s cycle, and preparing them for the “Active Experimentation” phase. At the end of each Academic Block, four of the modules will continue into the Industry Block where students will have to complete a project, facilitating the “Active Experimentation” phase of the cycle.

Modules

There are four types of modules on the programme. Please see below:

1. **100% of assessment done during the Academic Block**
   These are modules that are either mainly dealing with engineering/scientific/mathematical principles that are best delivered in an academic setting, or where the consortium believes that it might be difficult to replicate the necessary learning equipment in each host company.

   The apprentice acquires this learning and completes all assessment before entering the workplace.

   The assessment strategy of these modules will be a combination of:

   - In-class/lab assessments such as tutorial sheets or online quizzes
   - Self-directed assessments such as lab reports, online quizzes and homework assignments
   - Exam type assessments at the end of the Academic Block

Each year will include up to three Type 1 modules. In general, these modules learning outcomes will be in the knowledge and skills categories.

2. **20-25% of assessment done during the Industry Block**
   These are modules where the learner will benefit from some application in industry of the techniques learned in the Academic Block. They may also contribute to the Process Study or Technical Project.

   The assessment strategy of these modules will be a combination of:

   - In-class/lab assessments such as tutorial sheets or online quizzes
   - Self-directed assessments such as lab reports, online quizzes and homework assignments in the Academic Block
   - Exam type assessments at the end of the Academic Block
   - A project to take place during the Industry Block, worth 20%-25%.

3. **70-75% of assessment done during the Industry Block**
   These are applied modules (e.g. Lean Manufacturing and Six Sigma) where the learner will be given the basic principles, tools and techniques in the academic phase, but most of the learning will take place in industry, while applying them.

   The assessment strategy of these modules will be a combination of:

   - In-class/lab assessments such as tutorial sheets or online quizzes
   - Exam type assessments at the end of the Academic Block
   - A project to take place during the Industry Block, worth 20%-25%.
   - Exam type assessments at the end of the Industry Block worth 50%, to encompass the learning acquired in the workplace.

4. **Industry Modules: 100% of assessment done during the Industry Block.**
   These modules have been designed to test the integration of the apprentices' learning across all modules and to evaluate their resultant contribution to the organisation.

   The assessment strategy of these modules will be a combination of:

   - Process study
   - Technical Project
   - Reflective Logbook
   - HR Performance Evaluation

Below is a list of modules that will be covered throughout the apprenticeship:

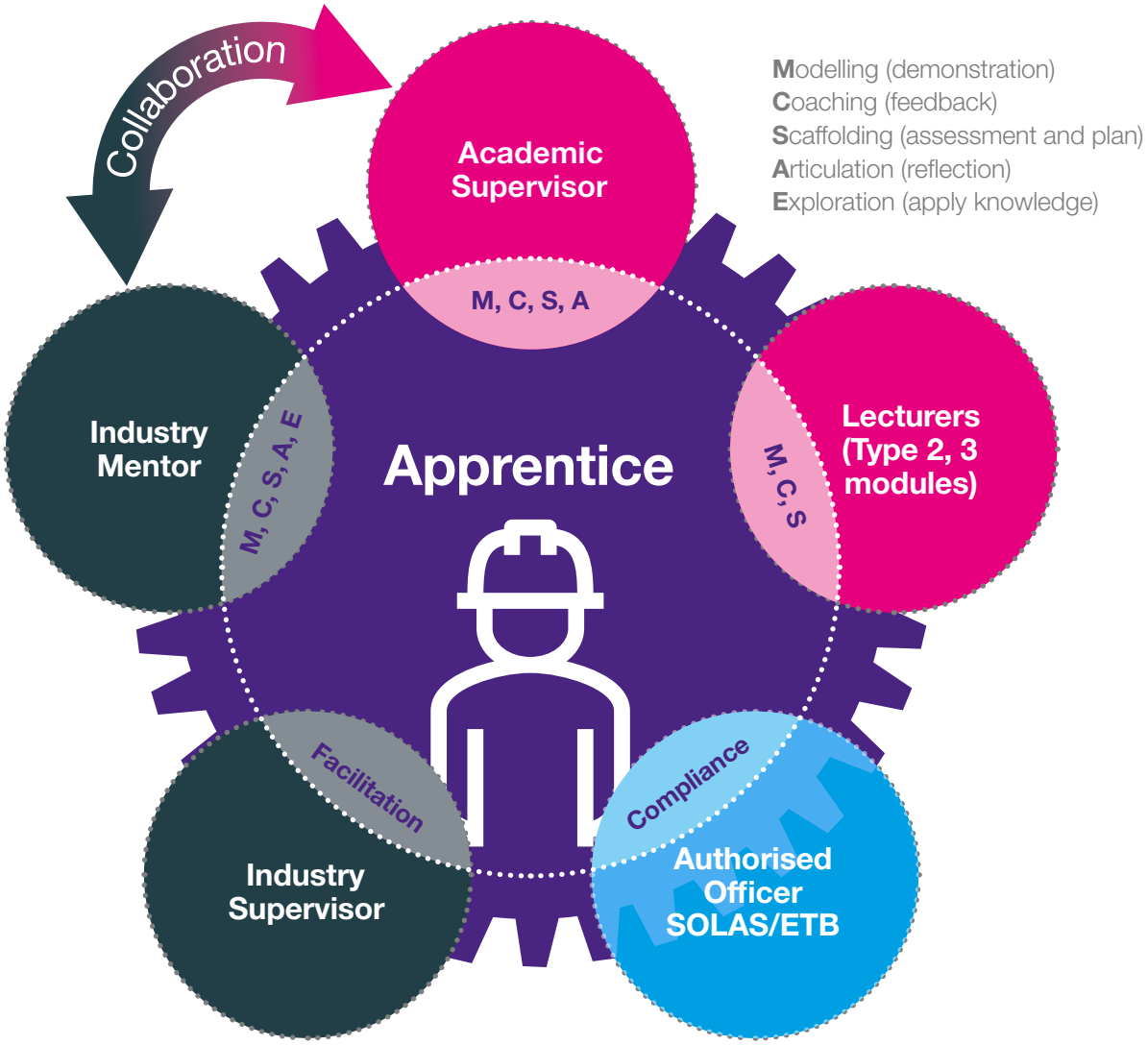
Year 1	Year 2	Year 3
Engineering Mathematics 1	Engineering Mathematics 2	Robotics and Control
Manufacturing Engineering 1	Metrology	Manufacturing Process Planning
Computer-Aided Design 1	Manufacturing Design of Fixtures	Advanced Manufacturing Processes
Learning Innovation Skills (LIS)	Maintenance and Safety	Polymer Processing Technology
Electrical Science	Manufacturing Automation	Engineering Software Systems
Engineering Science	Manufacturing Engineering 2	Six Sigma Quality
Quality 1	Quality 2	Operations Management
Industry Module 1	Lean Manufacturing	Project Management
	Industry Module 2	Industry Module 3

Students will have a workload of **28 hours per week** in their Academic Blocks, which is marginally higher than traditional programmes; for example, students in a Mechanical Engineering Programme could have on average, 27 contact hours in first year.

Taking into consideration that some of the module assessments have been transferred to the industry block, it is estimated that students will also have 22 hours of self-study per week.

Industry Block

Despite the variability in potential roles in different companies, each apprentice must be given tasks and an environment that are appropriate to the kind of learning required to achieve a Level 6 or Level 7 engineering award. The apprentice will be supported in this Cognitive learning by their Industry Mentor, Industry Supervisor, Academic Supervisor, Academic Lecturers, and the SOLAS/ETB Authorised officer, as shown below.



Assessment methods

In preparing the assessment strategy, the programme design team reflected again on Kolb's experiential learning cycle. If the Industry Module could clearly provide a "concrete experience", and the Institute facilitate the "abstract conceptualisation", the two other elements of the cycles were not as straight forward. There is a need for students to develop their reflective skills as well as their ability to implement "active experimentation". In order to guide students through the "active experimentation process", each year, as well as the Industry Module, up to five academic modules will continue on into the Industry Block. In these modules, students will have to complete assessments that will assist their active experimentation. In order to reduce the workload and to highlight the relationship between some of the modules, some of the assessments will be integrated.

The apprentice will be assessed by a number of different methods during this period. Please see below:

1. **Reflective Logbook**
2. **HR Performance Evaluation Rubric**
3. **Process Study**
4. **Technical Project**

HR Performance Evaluation Rubric (40% of industry module. Year 1-3)

On completion of each Industry Module the Industry Mentor will evaluate the performance of the student using a HR evaluation rubric. The Academic Supervisor will use this rubric as well as the Reflective Logbook (see below) to mark the HR performance of the student. In case of discrepancies, an interview might be required.

Note: A template for the HR evaluation rubric will be provided.

Reflective Logbook (20% of Industry module. Year 1-3)

Learner reflection is an important part of the programme, as it allows the apprentice to track his or her development as an engineer or technician. The basis for the reflection is:

- How have I met the learning outcomes of the module?
- What challenges have I encountered, and how did I respond?
- How am I developing the ability to think and act like an engineer or technician?

During the industry block, the apprentice will be asked to complete a number of reflective logbooks. Both the Academic Supervisor and Industry mentor will have access to this Logbook, which will be uploaded to Moodle. They will be able to track the progress of the learner, and to help him or her to develop the ability to reflect. This will be done by coaching, and by reviewing the Logbook and giving learners constructive feedback on where and how to better incorporate reflection.

The ability to reflect on learning is specifically identified as a Learning Outcome in all three of the Industry Modules (in years 1,2 and 3). As the learning progresses, the reflection deepens, until, by year 3, the learner is also devising self-learning strategies.

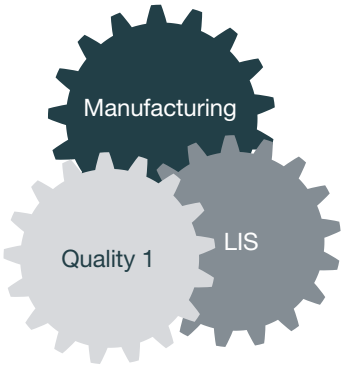
- Year 1: Learning Outcome #7: Reflect on their experiential learning.
- Year 2: Learning Outcome #6: Reflect on their experiential learning, and their ability to solve problems using a structured technical approach and identify gaps.
- Year 3: Learning Outcome #6: Reflect on their experiential learning and their ability to solve problems using an engineering approach, identify gaps and devise self-learning strategies

Note: A template for the Reflective Logbook will be provided.

Process Study (10% of Industry Module. Year 1-3)

Each year the student will compile a Process Study. This will take the form of a short report, which will describe a relevant aspect of the company. As the apprentice progresses from first to third year, the level of critical review will increase. In first year, the report will be descriptive in nature. By third year, the student will be commenting on the process, outlining shortcomings and making recommendations

Industry Module 1
Manufacturing
Process Study



Industry Module 2
Regulatory
Constraints Study

Industry Module 3
Process Plan
Study

Note: A template for the Process Study will be provided.

Technical Project (30% of Industry Module. Year 1-3)

Each year the student will conduct a Technical Project as part of their Industry Module. The project will be specified by the student and the Industry Mentor before the end of the Academic block, and a Project Charter drawn up. This will then be reviewed by the HEI Academic Supervisor, and once approved, the student is expected to be ready to start the project as early as possible during the Industry Block. The Technical Project report will be submitted to the Academic Supervisor before the end of the Industry Block period.

Industry Module 1
Technical Project Process
Characterisation

Industry Module 2
Technical Project
Operational Excellence

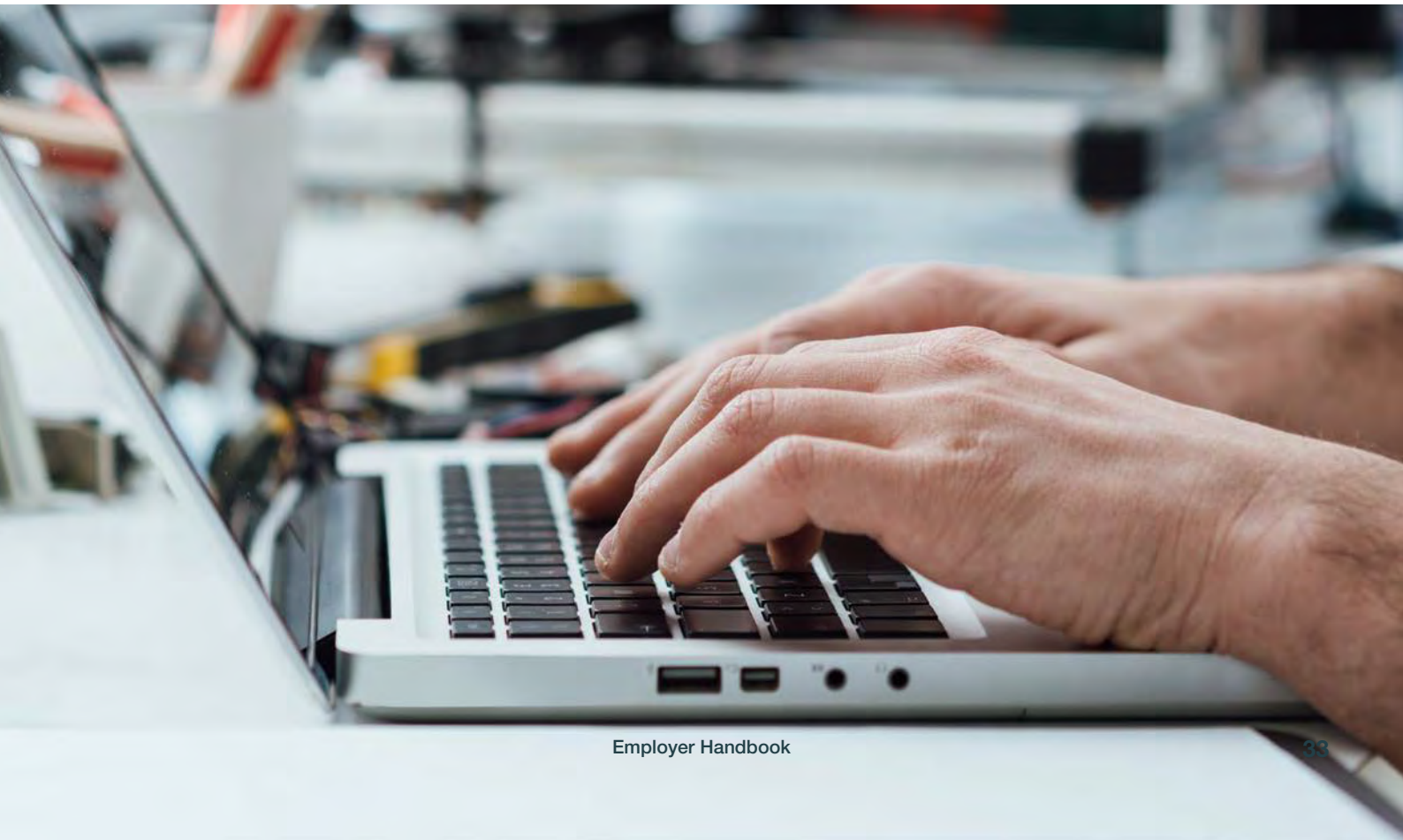
Industry Module 3
Technical Project Problem
Root Cause Elimination

Year 1
The scope of this project will be limited to a single workstation - for example, an automated process. The goal of the project will be to engage in data collection and Process Characterisation, so that the behavior of the process can be recorded (quality, repeatability, accuracy, cycle time, efficiency, availability, WIP levels, etc.). The work may be done by the student on his or her own, if appropriate, with guidance from the Industry Mentor. The learning will be at the knowledge and comprehension levels.

Year 2
The scope will be expanded to a work cell, or related group of process steps. The theme of this project will be Operational Excellence. Using identified techniques, including Lean Manufacturing tools, the student will be required to conduct tasks such as: identifying and eliminating non-value-added activities, eliminating waste, reducing cost, reducing lead time and improving product flow. It is expected that the work will involve problem-solving with machines (e.g. finding optimum process settings) and with methods (e.g. improving procedures and practices). The student will work as part of a team. The learning will be at the application and analysis levels.

Year 3
The scope of the project will range over an assembly line or value stream. The theme of this project will be Problem Root Cause Elimination. It is expected that the student will use the Six Sigma DMAIC approach to solving the problem. Even if Six Sigma is not used by others within the company, the rigour of applying the stages of Define, Measure, Analyse Improve and Control will help the student to structure their work and achieve their goal. Project management techniques, such as the development and updating of a Gantt chart and tracking project resources will also be employed. The student is expected to play a significant role in a team, or to lead the team. At this level, there will be more innovation by the student and evaluation of their own work.

Note: A template for the Technical Project will be provided.



Appendices

Manufacturing Engineering Apprenticeship
Ibec

Company Commitment Form Manufacturing Engineering Apprenticeships

Date:

Company Name:

Company Location:

Key Point of Contact Details:

Name:

Job Title:

E-Mail:

Phone:

Please select Apprenticeship Programme:

Manufacturing Technician L6. ☐ How many people do you wish to enrol?

Manufacturing Engineer L7. ☐ How many people do you wish to enrol?

Institute of Technology:

Are your proposed apprentices existing or new staff (please tick)?

Existing ☐ New☐

Please let us know where you heard about the apprenticeship programmes?

Can you provide your apprentices with the following?

Experienced **engineering** staff members to act as Mentors (mandatory): Yes ☐ No ☐

In-company support during 6-week INITIAL Block (Induction and 3rd-Level Preparation) Yes ☐ No ☐

Release apprentices for 'off-the-job' training of 15-week/year for duration of programme: Yes ☐ No ☐

Apprentice Industry-Block Learning Plans, developed by the Mentors: Yes ☐ No ☐

Access to equipment/processes and a range of engineering work for 'on the job' learning Yes ☐ No ☐

Provide appropriate time/resources for Mentor support: Yes ☐ No ☐

Provide appropriate time/resources to the Apprentice to complete Academic work: Yes ☐ No ☐

Manufacturing Engineering Apprenticeship
Ibec

INDUSTRIAL MENTOR FORM

MENTOR NAME:	
COMPANY NAME:	
COMPANY ADDRESS:	
CURRENT POSITION:	
EMAIL ADDRESS:	
COMPANY SPONSOR:	
EMAIL ADDRESS:	

ACADEMIC AND/OR OTHER QUALIFICATIONS:

Title	College	Year

WORK EXPERIENCE:
Please include relevant duties and responsibilities, such as team leadership roles, previous tutoring/mentoring roles, etc.

Employer	Year	Position Held	Duties/Responsibilities

OTHER REQUIREMENTS:

	YES	NO
Are you willing to undertake a mentor training programme?		
Have you completed at least four years relevant work experience?		
Have you read Employer Handbook outlining the tasks and assessment criteria for the Manufacturing Engineering Apprenticeship?		
If so, do you feel that you have the required experience to mentor and assess an apprentice in the outlined areas?		

OTHER RELEVANT INFORMATION:

SIGNED: DATE:

Please return by email to:

Email to: trish.breen@ibec.ie

Replacement Mentor Process

To ensure continuity of high-quality support to the apprentice, in the event of a change of Industry Mentor, it is important to ensure that replacement mentors go through the same formal process as initial mentors.

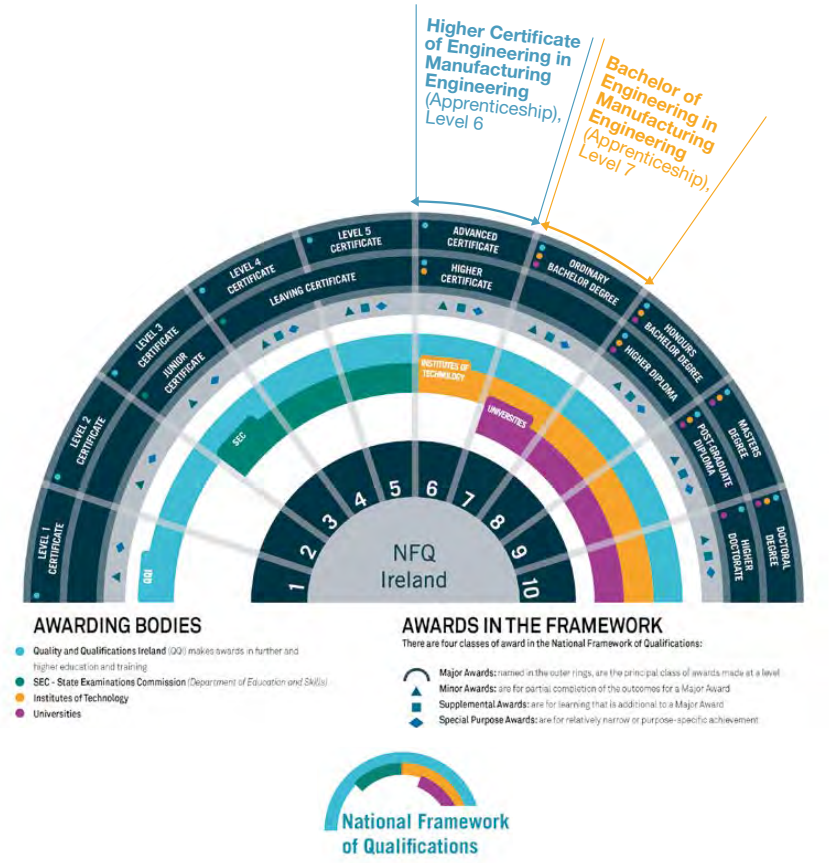
Mentor requirements:

Manufacturing Technician Apprentice (Level 6):
The Industry Mentor should have a minimum of a level 6 qualification in a cognate discipline or be a level 6 qualified technician with the required depth of technical knowledge (minimum 4 years' post qualification experience). In the case of a Level 6 technician acting as an Industry Mentor, the apprentice should fall under the supervision of an engineer.

Manufacturing Engineer Apprentice (Level 7):
The Industry Mentor should have a level 7 in a cognate discipline with 4 years' post qualification experience, holding a position of technical responsibility in the organisation.

Steps to replace mentor:

1. Company Sponsor informs Ibec Project Manager, copying the academic provider of the upcoming change of Mentor (ideally 4 weeks' notice).
2. Company Sponsor identifies suitable replacement, who fills out the "INDUSTRIAL MENTOR FORM".
3. Company Sponsor sends the "INDUSTRIAL MENTOR FORM" to Ibec.
4. Ibec reviews the "INDUSTRIAL MENTOR FORM" and approves/rejects mentor.
5. Ibec informs the company of their recommendation.
6. Company Sponsor informs the academic provider, and SOLAS Authorised Officer of the new approved mentor.
7. The Company Sponsor facilitates Mentor-Handover Training between outgoing and incoming Mentors.
8. New approved Mentor undergoes formal Ibec training.
9. New approved Mentor goes on the Ibec, academic provider and SOLAS databases.
10. New approved Mentor interacts with Academic Supervisor (associated with their apprentices) for overview of Programme-specific academic details, Student deliverables etc.



GMIT
INSTITIÚID TEICNEOLAÍOCHTA NA GAILLIMHE MAIGH EO
GALWAY-MAYO INSTITUTE OF TECHNOLOGY

MTU
Ollscoil Teicneolaíochta na Mumhan
Munster Technological University

IT Sligo
An Institiúid Teicneolaíochta, Sligeach

TUS

Manufacturing Engineering Apprenticeship
Ibec

84/86 Lower Baggot Street Dublin 2
www.ibec.ie

T: +353 87 715 7967
E: info@manufacturingapprenticeships.ie
W: www.manufacturingapprenticeships.ie