

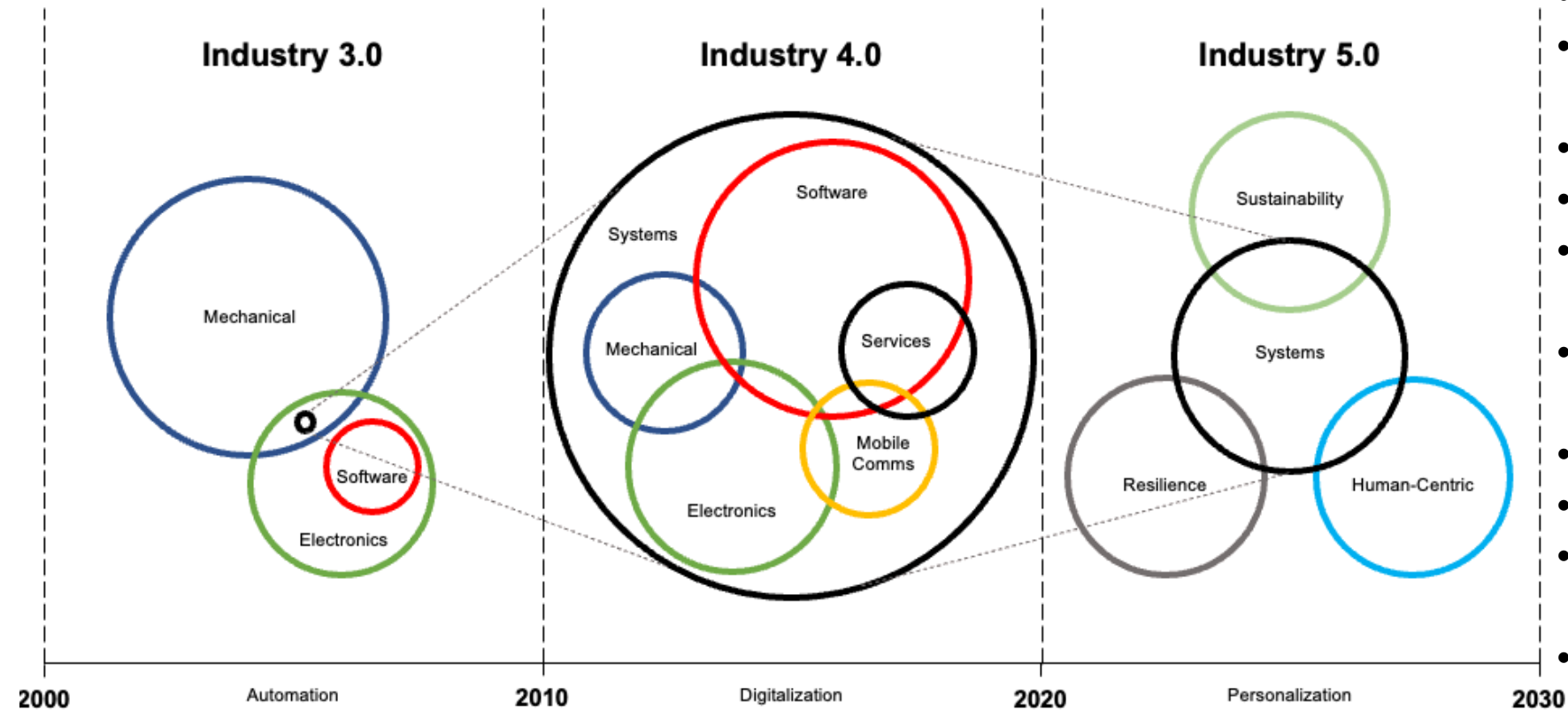
# ISSC Workshop on Smart-Edu4.0

Dr Eoin Hinchy & Prof. Conor McCarthy

Fri 10<sup>th</sup> June 2022



# Advancing Digital Talent in S+E @ UL



## Some highlights

- Mechatronics M.Eng.
- Equipment Systems Engineering (ESE) MEng
- ESE Professional diploma
- PD-Eng in Principal Engineering
- Industrial Masters in Equipment Systems Engineering;
- Confirm's Structured PhD programme
- MSCA co-fund SMART 4.0
- **Erasmus SmartEdu4.0 programme**
- Over 70 undergraduate and postgraduate programmes
- All-Island Digital Manufacturing PhD programme white paper
- SALI Chair in Digital Manufacturing

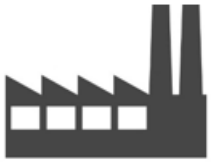


- HEA Senior Academic Leadership Initiative
- Support improved gender balance at senior academic levels
- 1 of only 10 funded nationally in 2022
- Based on Digital engineering, Mechatronics and AI
- Competition currently open





- FWCI 2.08
- 70.2% of publications in Top 25% Journals
- 15.6% of output in the Top 10% Citation %iles



- €3.5M target hit within the first 2 years
- €4.2M industry cash committed to date
- 32 different projects, ¼ SME funded



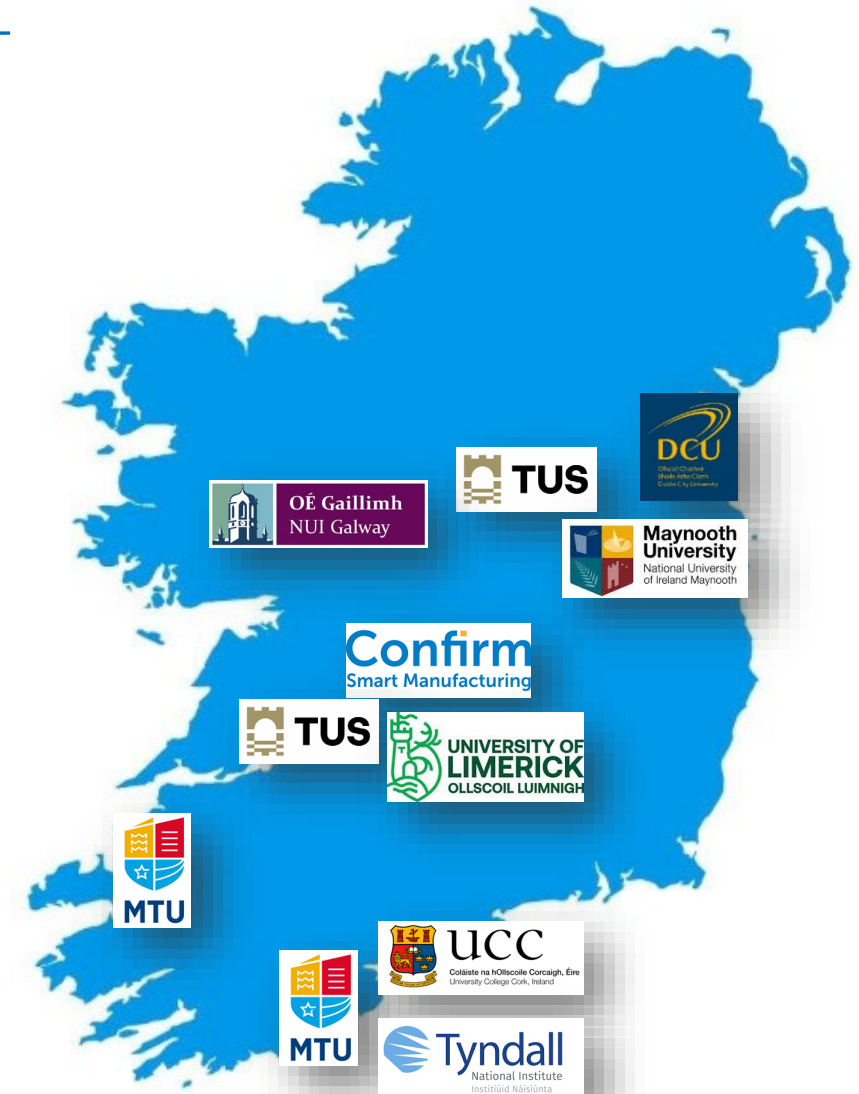
- €8.8M to date
- 17 EU grants coordinating 4



- 3 Spin Out Companies vs target of 1
- 20 Commercialisation Grants – strong pipeline



- >300 EPE activities in 2021 alone
- EPE participation @ 55.8% vs target of 40.3%



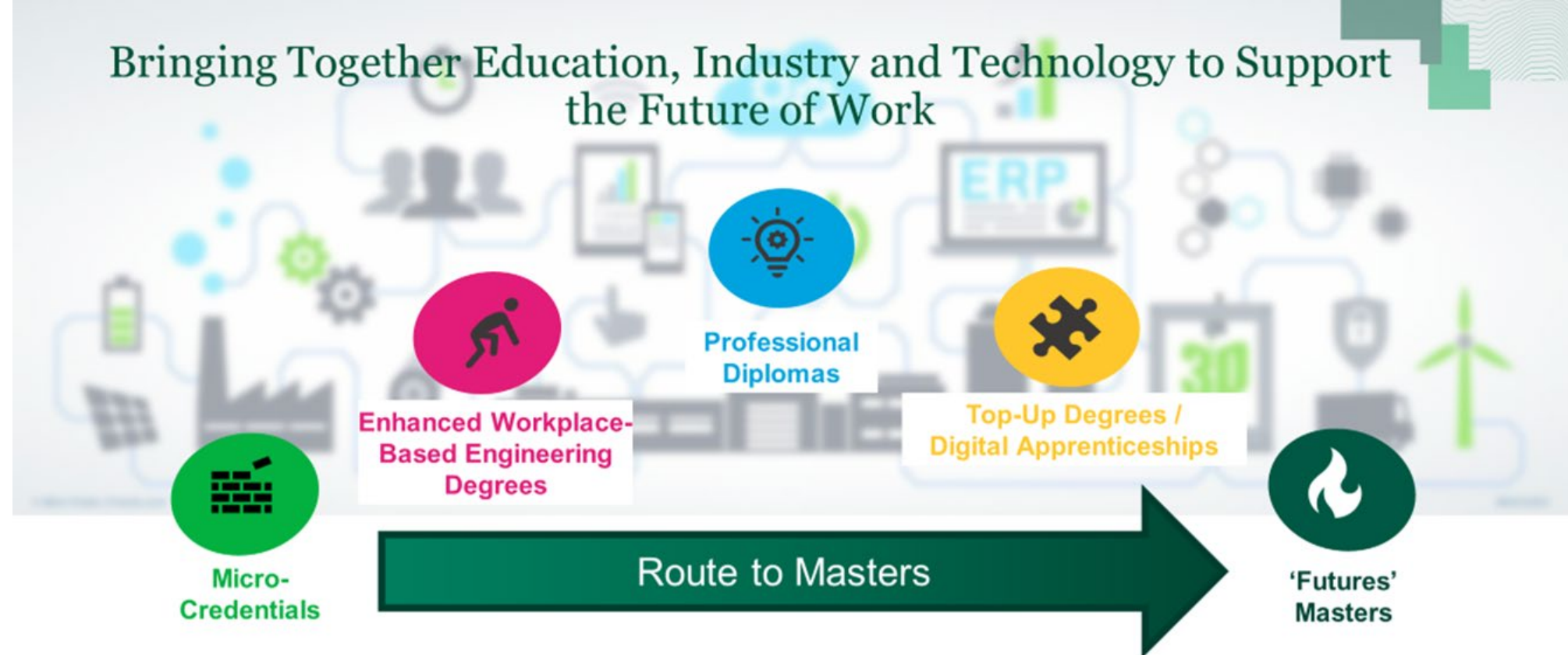


# Confirm Centre Research Labs

J&J Industry embedded

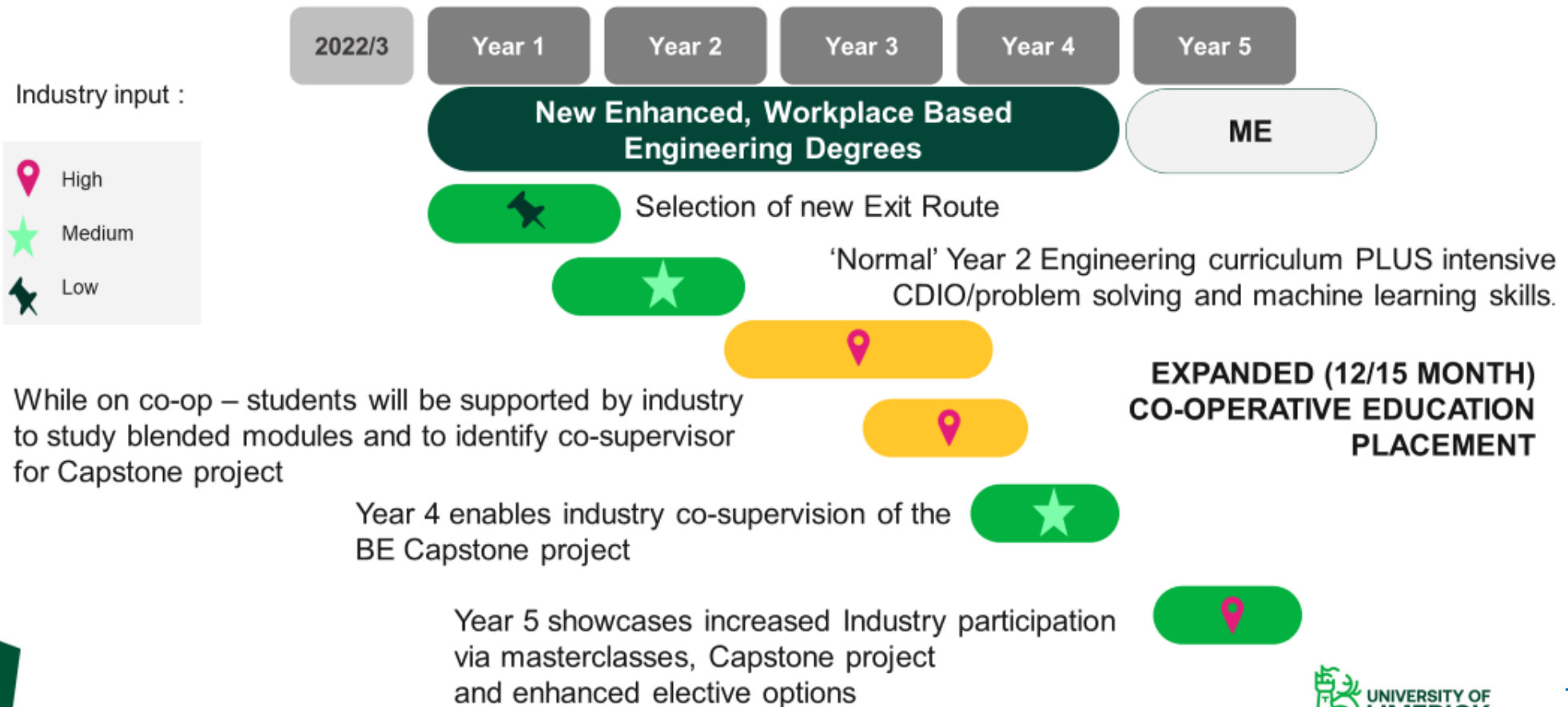


S&E Faculty Capital Equipment funding



Industry co-Designed **Micro Credentials** and **Professional Diplomas** can be stacked to realise an accredited Masters in Digital Futures

## New Engineering Degrees - Provide highly motivated students with new, alternative exit pathways from UL Common Entry Engineering





1. Scoping and Market Research
2. Development of UG and PGT Programmes in Manufacturing Mechatronics
  1. Outline of PGT Mechatronic Masters @ UL
  2. Development of BE/ME in Digital Mechatronic Engineering @ UL
3. New CPD Programmes in Smart Manufacturing
  1. Masters Apprenticeship in Equipment Systems Engineering (MEng – ESE)
  2. Professional Diploma in Equipment Systems Engineering (PDip – ESE)





# 1. Scoping and Market Research



## ► UG & PG Courses related to Mechatronics

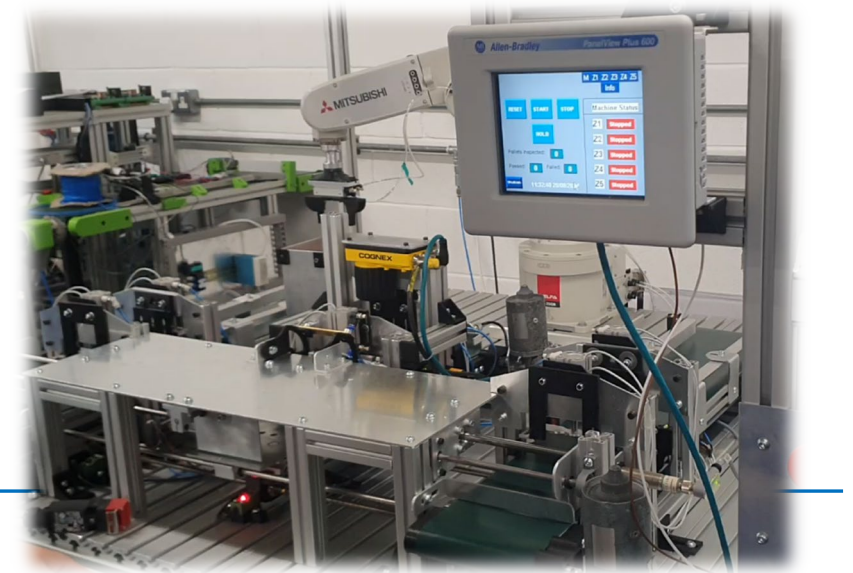
NTUA*	Industrial Ergonomics	Automatic Process Control	Robotics I: Analysis Control Laboratory	PG Automation Systems
	Manufacturing Systems I	Industrial Electronics	Robotics II: Intelligent Robotic Systems	
	Systems of Manufacturing processes II	Sensors and Microsystems Technology	Intelligent Control in Robotics and Industry	
	Elements of Machining	Sensors and Microsystems Technology	Virtual Reality, Haptics and Applications in Telerobotics	
QUB	<b>No UG or PG mechatronics programme at present</b>			
SERC	Pearson BTEC HND in Engineering (General) – SERC (FT)	Pearson BTEC HND in Engineering (General) – SERC (PT)	Ulster University Foundation Degree in Mechatronic Engineering – SERC (FT)	Higher Level Apprenticeship in Mechatronics - SERC
UL	MEng Mechatronics	MEng Equipment Systems Engineering	Professional Diploma ESE Equipment Systems Engineering	

## 2. Development of UG & PGT Programmes in Manufacturing Mechatronics

- Overview of UL MEng in Mechatronics
- 90 ECTS Taught Programme over three consecutive semesters (Sept to August)

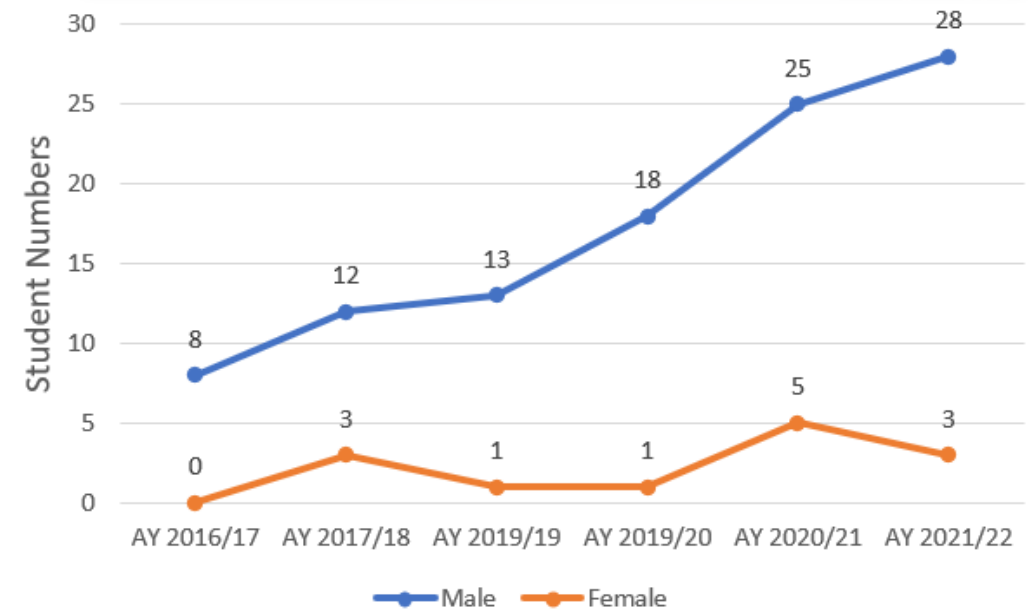


Autumn	Spring	Summer
<ul style="list-style-type: none"> <li>• Low Cost Automated Systems</li> <li>• Automated System Design</li> <li>• Project Management In Practice</li> </ul>	<ul style="list-style-type: none"> <li>• Mechatronics Project 1</li> <li>• Digital Control</li> <li>• Global Business Strategy</li> <li>• Machine Vision</li> </ul>	Mechatronics Project 2
<b>Path A - Automation</b> <ul style="list-style-type: none"> <li>• Advanced And Emerging Manufacturing Technologies</li> <li>• Automation And Control</li> </ul>	<b>Path A – Automation</b> <ul style="list-style-type: none"> <li>• 3d Cad Modelling And Machine Design</li> <li>• System Integration</li> </ul>	
<b>Path B – Information Technology</b> <ul style="list-style-type: none"> <li>• Computer Networks 1</li> <li>• C++ Programming</li> </ul>	<b>Path B – Information Technology</b> <ul style="list-style-type: none"> <li>• Web-based Application Design</li> <li>• Real-time Systems</li> </ul>	



## 2. Development of UG & PGT Programmes in Manufacturing Mechatronics

- ▶ Industry closely involved in delivery of course
  - ▶ State of the Art technology
- ▶ Dedicated Lab with industry standard hardware and software modelling Industry 4.0 manufacturing systems
- ▶ Practical student work dealing with real life situations and issues
- ▶ Broad Range of knowledge and skills



## 2. Development of UG & PGT Programmes in Manufacturing Mechatronics

### Proposed UG in Digital Mechatronic Engineering

- ▶ Integrated BE/ME (4/5 Year, May Finish)
- ▶ Workplace Based (extended Co-Op Placement)
- ▶ **240/300** ECTS Credits
- ▶ Common Entry through LM116
- ▶ Start-of-the Art Labs (Mechatronics M.Eng, UL @ Work, Confirm Centre)
- ▶ Strong links to Industry
- ▶ Strong links to R&D
- ▶ Will seek accreditation through Engineers Ireland





### 3. New CPD Programmes in Smart Manufacturing

- ▶ Masters Apprenticeship in Equipment Systems Engineering (MEng – ESE)
- ▶ Professional Diploma in Equipment Systems Engineering (PDip – ESE)



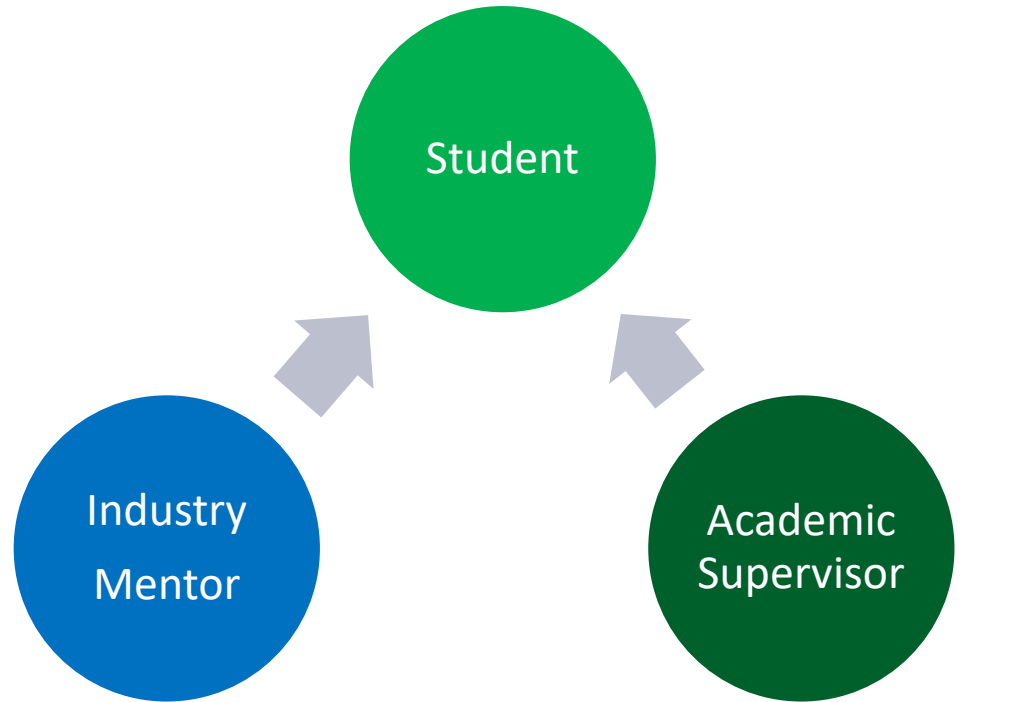
# Masters Apprenticeship in Equipment Systems Engineering

## Programme Overview

- ▶ 2 year programme
- ▶ Level 9 Masters in Engineering (MEng)
- ▶ The ESE Academy (ECubers) is the consortia lead
- ▶ 70% on the job learning / 30% on campus or online
- ▶ Study and project write up time up to 15+ hours per week



# Masters Apprenticeship in Equipment Systems Engineering



Role:

- Enabling capacity
- Subject matter knowledge
- Mentorship meetings

Role:

- Technical writing
- Lit review
- Research & Analysis
- Thesis completion

Year 1	
<b>Boot Camp</b>	3 Day introduction on Campus
<b>Disruptive Innovation Sprints</b>	Industry 4.0 Topics delivered remotely
<b>Research Proposal Preparation</b>	Define Hypothesis
<b>Technology Provider Sprints</b>	Students are introduced to provider platforms
<b>ESE Research Plan</b>	Thesis in three event
<b>ESE Project Review</b>	Supervisor report for project progress

Year 2	
<b>eExpo</b>	Students outline innovation solution
<b>ESE Research 1</b>	Write-up Masters Thesis (1)
<b>ESE Research 2</b>	Write-up Masters Thesis (2)
<b>ESE Research 3</b>	Present Masters Thesis



# Masters Apprenticeship in Equipment Systems Engineering

<b>eDIGITAL Transformation, DigitIzation and DigitALIZATION</b>	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.		
<b>eANYWHERE on an I4.0 Digitally Connected Supply Chain Network (I4.0-DCSCN)</b>	The traditional I3.0 Linear Physical Supply Chain (I3.0-LPSC) is 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.		
<b>ePROCUREMENT Process (ePP) to facilitate digital transformation</b>	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.		
<b>eCOMPLIANCE for the Irish Life Sciences Sector</b>	High-tech equipment is great, but how can dynamic solutions such as Artificial Intelligence and machine learning be validated? Can I4.0 be leveraged to design equipment which can automatically	<b>eCLOUD for Big Data Analytics</b>	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.
<b>eCUSTOMIZATION of products</b>	Product customization will become commonplace in a digital world. This will require novel product tracking, recipe management and Real Time Testing (RTRT) solutions to meet this requirement.	<b>IoT Internet of Things, from an equipment perspective</b>	The potential of Internet of Things (IoT) often appears limitless. Nevertheless, it is very unwise to underestimate the integration and cyber security issues. Industrial Standards provide an ideal framework to mitigate such risks.
<b>eSUPPORT Services in real time</b>	Equipment located anywhere on the supply chain will require real time collaborative support services. This raises new challenges in terms of competencies, security, and safety.	<b>eDATA at the Edge</b>	I4.0 technologies now make it possible to create extremely rich contextualized data at the edge. Explore how I4.0 technologies such as Time Sensitive Networks and intelligent devices can provide new data insights at the edge.
		<b>ePROCESS Control for Customization</b>	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
		<b>eBASIC Control of the Equipment</b>	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?

Example of Industry 4.0  
Sprint topics



# Professional Diploma in Equipment Systems Engineering

## Programme Overview

- ▶ 1 year programme (Autumn & Spring) starting Sept 2022
- ▶ Formal qualification attained Level 9 - Professional Diploma
- ▶ The ESE Academy (ECubers) is the consortia lead
- ▶ 100% online course
- ▶ Study required 12-15 hours per week



# Professional Diploma in Equipment Systems Engineering

Autumn	Spring
<ul style="list-style-type: none"> <li>Disruptive Innovation Sprints</li> <li>Automated System Design</li> <li>Digital Futures Lab</li> </ul>	<ul style="list-style-type: none"> <li>Technology Trajectory Strategy</li> <li>System Integration</li> <li>Digital Futures Lab</li> </ul>

Weeks	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10	WEEK 11	WEEK 12
Topic	eDigital	Masterclass	eAnywhere	Masterclass	eProcurement	Masterclass	eMachine Control	Masterclass	eCompliance	Masterclass	eData	Masterclass
Assessment & feedback	0 Introduction	3 E-tivity	0 Introduction	3 E-tivity	0 Introduction	3 E-tivity	0 Introduction	3 E-tivity	0 Introduction	3 E-tivity	0 Introduction	3 E-tivity
Synchronous activity	1 Lecture + Discussion	1 Masterclass + Discussion	1 Lecture + Discussion	1 Masterclass + Discussion	1 Lecture + Discussion	1 Masterclass + Discussion	1 Lecture + Discussion	1 Masterclass + Discussion	1 Lecture + Discussion	1 Masterclass + Discussion	1 Lecture + Discussion	1 Masterclass + Discussion
Asynchronous activity	1 Sprint Videos	1 YouTube Videos	1 Sprint Videos	1 YouTube Videos	1 Sprint Videos	1 YouTube Videos	1 Sprint Videos	1 YouTube Videos	1 Sprint Videos	1 YouTube Videos	1 Sprint Videos	1 YouTube Videos
Independent Work	3 Review Supporting Documents (1)	2 Review Supporting Documents (2)	3 Review Supporting Documents (1)	2 Review Supporting Documents (2)	3 Review Supporting Documents (1)	2 Review Supporting Documents (2)	3 Review Supporting Documents (1)	2 Review Supporting Documents (2)	3 Review Supporting Documents (1)	2 Review Supporting Documents (2)	3 Review Supporting Documents (1)	2 Review Supporting Documents (2)
Total Time =	5	7	5	7	5	7	5	7	5	7	5	7

**Thank you**

Dr Eoin Hinchy & Prof. Conor McCarthy

Fri 10<sup>th</sup> June 2022