Irish Medtech Skillnet

Masters of Engineering (MEng) in Digitalisation of Manufacturing

Irish Medtech Association
Ibec

irishmedtechskillnet.ie

IRISH MEDTECH SKILLNET

MASTERS OF ENGINEERING (MENG) IN DIGITALISATION OF MANUFACTURING

The Irish Medtech Skillnet and contracting organisation the Irish Medtech Association in collaboration with Limerick Institute of Technology are delighted to present the new Masters of Engineering (MEng)in Digitalisation of Manufacturing.

The Master of Engineering in Digitalisation of Manufacturing is a practice-based professional award for experienced employees in advanced manufacturing facilities.

The majority of the credits and learning outcomes will be work-based, supported by a training programme of masterclasses, delivered through bootcamps, workshops, on-line tutorials, knowledge platforms, guest lecturers and site-visits. The programme is industry-led in conjunction with an Industry Expert Working Group. The programme aims to develop a 'Digital Champion' to operate within a manufacturing enterprise, who can focus on the integration of systems, analysis of key data and the demonstration of opportunities and added value for the business.

In collaboration with:

LIT
ACTIVE LEADERSHIP IN EDUCATION, ENTERPRISE AND ENGAGEMENT

ABOUT IRISH MEDTECH SKILLNET

Working in partnership with Skillnet Ireland and our contracting organisation, the Irish Medtech Association (Ibec sector), the Irish Medtech Skillnet has over the past number of years grown substantially in direct response to the training needs of Industry. Total expenditure (2008 - 2017) is over €6.3 million with 42% contribution from member companies and the remaining 58% funded by the state. Targets of over 8,900 trainees and 46,000 training days have been achieved.

ABOUT IRISH MEDTECH ASSOCIATION

The Irish Medtech Association is a business sector within Ibec that represents the Medical Technology sector and is a proactive membership organisation with over 170 members located throughout Ireland. It works directly with government and policy makers nationally and internationally, to shape business conditions and drive economic growth. Led by a board of 15 industry leaders, and facilitated by a dedicated professional executive staff, our working groups, forums and task forces are the primary enablers of our strategy.

ENTRY REQUIREMENTS

The programme is aimed at existing manufacturing, mechanical or engineering professionals, and those migrating from associated disciplines. The principal entry requirement for the Masters programme is a Level 8 honours degree, at minimum second class honours (NFQ or other internationally recognised equivalent), in a relevant engineering, computing, or technology discipline.

Applicants from other Level 8 degree disciplines who have a minimum of five years experiential learning in an appropriate manufacturing environment (with a demonstrable knowledge of mathematics and computing) may also apply. Their admission to the program will be determined by the Limerick Institute of Technology Recognition of Prior Learning (RPL) Process. A deep knowledge of manufacturing environments and the potential benefits and challenges facing manufacturing from digitalisation would be beneficial.

CERTIFICATION

NFQ Level 9 - 90 credits.

PROGRAMME COSTS

Irish Medtech Skillnet members residing and working in Ireland	€3,750 per year for two years
Non Members residing and working in Ireland	€5,000 per year for two years

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DELIVERY

The delivery of the programme will be predominantly online through the Institutes Virtual Learning Environment (Moodle), Bootcamps and Workshops, and assessed through the (work-based) Applied Research Dissertation.

On-campus Time: 18 contact days per year, structured into two Bootcamps (4 days, Wed-Sat) and four optional Workshops (2 days – Fri-Sat) per year. Regular on-line tutorials will ensure continuous contact with the academic staff. The learner effort over the two years is estimated at approximately 15% of their working commitment, thus strong employer and management support for the learner is vital as is the relevance and potential value of the Applied Research Project to the host enterprise.

COURSE OVERVIEW

The masterclass modules will cover essential elements of digitalisation of manufacturing and their application in practice. The goal of the masterclasses is to provide an expert level appraisal of relevant technologies, tools and techniques in a range of relevant disciplines, so that the Learner can assess current trends and can engage with specialist professionals on an equal footing

The modules include, Database Design & Data Visualisation, Cyber-Physical Systems & IoT, Manufacturing Automation & Robotics, Data Analytics & Machine Learning, Integrated Database Systems, and Digitalisation of Production. All of the modules will be integrated with work-based practice and will be supported by regular on-line tutorials. Successful completion of the masterclasses (30 Credits) may lead to an exit award – a Certificate in Smart Factory Operations (L9 Minor Award).

The applied research project will be structured over the two years and will require completion of a comprehensive range of relevant elements, including; a review of existing knowledge, a personal reflection and professional development plan (PDP), the definition and analysis of a manufacturing digitalisation problem in industry, the design, planning and implementation of a solution within a constrained schedule and budget - cognisant of social and ethical norms, the evaluation of change requirements, the validation of performance (value engineering) and the dissemination of the project's results and impact. The applied research project will be self-directed by the Learner, supported by an industry mentor, academic supervisors (two) and an External Assessment Board (EAB).

The completion of an applied research project will bring significant advances in terms of professional and personal development, communication skills and confidence to present proposals and results. The necessary transversal skills (teamwork, communications, research methods, project management) will be delivered through online, self-directed modules with regular workshops in the Institute.

COURSE OUTLINE

Module	Level	ECTS	Method
Database Design & Data Visualisation	9	5	Blended, WBL
Cyber-Physical Systems & IoT	9	5	Blended, WBL
Manufacturing Automation & Robotics	9	5	Blended, WBL
Data Analytics & Machine Learning	9	5	Blended, WBL
Integrated Database Systems	9	5	Blended, WBL
Digitalisation of Production	9	5	Blended, WBL
Applied Research Dissertation	9	60	WBL, Dissertation, Dissemination

Schedule of Delivery

Year1	Database Design & Data Visualisation	Cyber-Physical Systems & IoT
	Manufacturing Automation & Robotics	Data Analytics & Machine Learning
Year 2	Integrated Database Systems	Applied Research Dissertation
	Digitalisation of Production	

IRISH MEDTECH SKILLNET

MASTERS OF ENGINEERING (MENG) IN DIGITALISATION OF MANUFACTURING

YEAR 1		Modules	Dates
Bootcamp	**December 2019**	DV, CPS	Wednesday 11th to Saturday 14th December 2019.
Workshop		DV, CPS,	Friday 17th & Saturday 18th January 2020
Workshop		DV, CPS, RM	Friday 28th & Saturday 29th February 2020
Bootcamp	**April 2020**	MA, DA,	Wednesday 15th to Saturday 18th April 2020.
Workshop		MA, DA,	Friday 22nd & Saturday 23rd May 2020
Workshop		MA, DA, PM	Friday 19th & Saturday 20th June 2020
YEAR 2			
Workshop		ARD, PM, RM	Friday 4th & Saturday 5th September 2020
Workshop		DP, IDS	Friday 23rd & Saturday 24th October 2020
Bootcamp	**December 2020**	DP, IDS	Wednesday 9th to Saturday 12th December 2020.
Workshop		ARD, PM	Friday 15th & Saturday 16th January 2021
Workshop		DP, IDS	Friday 26th & Saturday 27th February 2021
Bootcamp	**April 2021**	ARD, PM, RM	Wednesday 7th to Saturday 10th April 2021.
Workshop		ARD*	Friday 21st & Saturday 22nd May 2021
Workshop		ARD*	Friday 18th & Saturday 19th June 2021

* Including Dissertation Assessments

MODULE TITLE — DESIGN AND DATA VISUALISATION

MODULE CREDITS

5 ECTS

MODULE LEVEL

Level 9

MODULE DESCRIPTION

Databases: This module adopts an applied learning approach to identify opportunities and work with data through the lens of the relational database model. The aim of this module is to enable the learner to interface with standard industrial systems and collect and interpret datasets for data-driven intelligence. Therefore learners will acquire the skills necessary to design and develop database systems, collect, clean, visualise and interpret data rooted in best data analysis practice.

MODULE LEARNING OUTCOMES

On completion of this module the learner will/should be able to;

- Analyse the application of database technologies and data visualisation in a relevant industrial context.
- Design a database application, including data schemas and data repositories, to capture and store appropriate data streams.
- Collect, clean, structure and transform raw data from industry systems into data repositories. Implement the data definition, data manipulation and data control language components of Structured Query Language in an open source relational database implementation.
- Represent pattern, trends and correlations through appropriate data visualisation techniques, relevant to the learners industrial practice.

ASSESSMENT

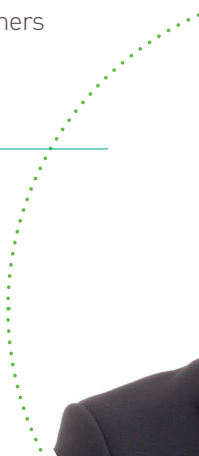
100% CA

MODULE TITLE	CYBER-PHYSICAL SYSTEMS & IoT
MODULE CREDITS	5 ECTS
MODULE LEVEL	Level 9
MODULE DESCRIPTION	This module adopts an applied learning approach to understanding embedded systems, the Internet-of-things (IoT) and the cyber-physical systems (sensors, control boards) necessary for data acquisition in industrial environments. The aim of this module is to enable the learner to programme standard ICT Boards, I/O, sensors and gateways in order to collect time-series data streams. Furthermore, the application of data stream analysis at the Board/Gateway level (edge computing) will be explored.
MODULE LEARNING OUTCOMES	*On completion of this module the learner will/should be able to;* • Analyse the application of cyber-physical systems, the Internet of Things and industrial networks in a relevant industrial context. • Specify and configure a suitable distributed embedded system for a data acquisition application in industry. • Program an application to acquire and log time-series data streams, with appropriate time-stamps, data cleansing and formatting. • Program an edge based data analysis algorithm to provide condensed information for transfer. • Implement an application to capture and analyse relevant real-time industry data, relevant to the learners practice.
ASSESSMENT	100% CA

MODULE TITLE	MANUFACTURING AUTOMATION & ROBOTICS
MODULE CREDITS	5 ECTS
MODULE LEVEL	Level 9
MODULE DESCRIPTION	This module adopts an applied learning approach to understanding the application of automation systems, Programmable Logic Controllers (PLCs), Robotics, Drives and Motors in manufacturing environments. The aim of this module is to enable the learner to programme an industrial control system for reliable data acquisition and storage. Furthermore, the application of control system hierarchies and data exchange with Vision and Robotics Systems will be explored.
MODULE LEARNING OUTCOMES	*On completion of this module the learner will/should be able to;* • Analyse the application of industrial controls, motive power application and automation in a relevant industrial context. • Configure a distributed industrial control architecture with PLCs, Remote I/O, Drive Controllers and a network hub. • Programme an Industrial PLC to acquire digital and analog data and to log the data in an appropriate data historian. • Discuss the application of Robotics and industrial vision systems to manufacturing applications • Integrate industrial data from automation systems to a suitable database application, relevant to the learners practice.
ASSESSMENT	100% CA

MODULE TITLE	DATA ANALYTICS & MACHINE LEARNING
MODULE CREDITS	5 ECTS
MODULE LEVEL	Level 9
MODULE DESCRIPTION	This module will review the application of statistics and experimental design to applications in industry. The aim of the module is to enable the learner to program statistical, and in particular, machine learning applications, based on manufacturing data sets, using standard mathematical tools.
MODULE LEARNING OUTCOMES	*On completion of this module the learner will/should be able to;* • Analyse the application of computational intelligence to decision making problems in a relevant industrial context. • Design an experiment to generate suitable datasets and apply statistical inference to extract valuable information. • Program a statistical software tool to perform time series analysis and forecasting. • Investigate approaches to machine learning and select and develop appropriate algorithms for a specific data stream. • Implement a data analytics application for decision support on an empirical data stream situated in a manufacturing context, relevant to the learners industrial practice.
ASSESSMENT	100% CA

MODULE TITLE	INTEGRATED DATABASE SYSTEMS
MODULE CREDITS	5 ECTS
MODULE LEVEL	Level 9
MODULE DESCRIPTION	This module adopts an applied learning approach to working with data integrated across a range of manufacturing systems, databases, data historians and controllers. The aim of this module is to enable the learner to interface with distributed industry systems and collect, store and interpret datasets based at the edge, locally, remotely or on the cloud. Considerations of best practice in data security, protection, data sharing through supply-chains and data archives will be explored.
MODULE LEARNING OUTCOMES	*On completion of this module the learner will/should be able to;* • Analyse the flow of data between systems and layers, internal or external, in a relevant industrial context. • Design an integrated database application drawing multiple data streams from a range of industry standard sources. • Capture, store and analyse an appropriate data stream on a cloud application and infrastructure. • Implement a data sharing application, with appropriate protection, to provided standardised information across a supply chain or network. • Investigate the long-term archival of industrial data and information, relevant to the learners industrial practice.
ASSESSMENT	100% CA



MODULE TITLE — DIGITALISATION OF PRODUCTION OPERATIONS

MODULE CREDITS

5 ECTS

MODULE LEVEL

Level 9

MODULE DESCRIPTION

This module will investigate the increasing digitalisation of manufacturing, from advanced product design to production process models and the use of visualisation techniques in manufacturing support. The relevant value and application of Design Tools, Digital Twins, Simulation Models, Augmented Reality/Virtual Reality, will be investigated.

MODULE LEARNING OUTCOMES

On completion of this module the learner will/should be able to;

- Analyse the application of digital product design to reduce costs and increase throughput in a relevant industrial context.
- Develop a model simulation of a production process, addressing aspects of optimisation, capacity expansion and what-if scenarios.
- Analyse the application of a Digital Twin Design approach to improving the re-configurability of a production process.
- Review the technologies associated with visualisation of industrial processes and discuss their relevance and effective in manufacturing.
- Evaluate, the impacts (qualitatively and quantitatively) of a manufacturing digitalisation initiative in relation to standard industry benchmarks.

ASSESSMENT

100% CA

MODULE TITLE — APPLIED RESEARCH DISSERTATION

MODULE CREDITS

60 ECTS

MODULE LEVEL

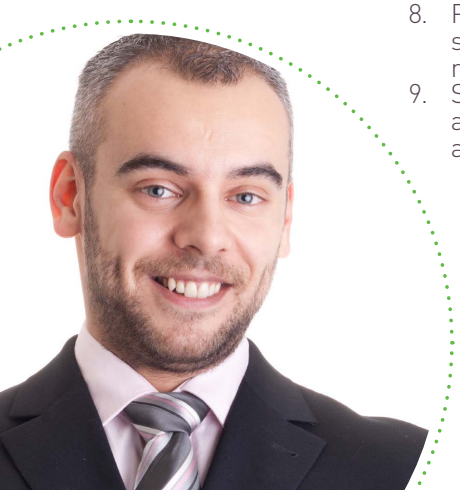
Level 9

LEARNING OUTCOMES

The learner is expected to apply an innovative approach to a complex problem while collaborating with an industrial partner in a professional manner.

On completion of this module the learner will/should be able to:

1. Identify the nature, size and scope of a problem and define appropriate methods for solving the problem.
2. Identify suitable information sources and integrate existing knowledge and practice in the identification of a solution.
3. Design and implement a relevant industry-based solution with the minimum of guidance and support.
4. Practice and integrate effectively in an industrial work context, operating effectively with colleagues.
5. Reflect and report on relevant work activities, training and personnel development in professional practice.
6. Describe the relevant regulatory, ethical and social requirements and impacts of the proposed solution.
7. Maintain a personal diary to track progress, problems and issues that arise in the project
8. Prepare a final project report on the work-based project in accordance with currently accepted standards and assimilate and adopt feedback from the academic supervisors and industrial mentors.
9. Summarise, prepare, communicate and defend (in written and oral form) the outcome of the applied research project while cognisant of issues of plagiarism, confidentiality, data protection and other ethical issues.



Irish Medtech Skillnet

Irish Medtech Skillnet
Gardner House, Bank Place,
Charlotte Quay, Limerick
T: + 353 (0)61 431802
E: michelle.reinecke-quain@ibec.ie
www.irishmedtechskillnet.ie

Irish Medtech Association
Ibec

Irish Medtech Association
Ibec
84/86 Lower Baggot Street
Dublin 2
T: +353 (0)61 605 1500
E: info@irishmedtechassoc.ie
www.irishmedtechassoc.ie

Irish Medtech Association is a business sector within Ibec

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An Roinn Oideachais agus Scileanna
Department of Education and Skills

Skillnet IRELAND