VALIDATION REPORT

1.	Title of Programme(s): (incl. Award Type and Specify Embedded Exit Awards)	Higher Certificate in Automation and Robotics BEng in Automation and Robotics
2.	NFQ Level(s)/ No. ECTS:	Levels 6, 7 120/180 ECTS
3.	Duration:	2/3 years
4.	ISCED Code:	0714
5.	School / Centre:	School of Engineering
6.	Department:	Department of Mechanical and Industrial Engineering
7.	Type of Review:	Differential Validation
8.	Date of Review:	10th May 2022
9.	Delivery Mode:	Blended
10.	Panel Members:	Dr Brendan O'Donnell, Niall Morris, Camila D Bastiani, Neasa Flannery, Dr Des Foley
11.	Proposing Staff:	Carine Gachon Aurora Dimache David Gorman Jack Saad Stephen Foy Gabriel Farragher Michael Kelly Niall O'Connor Nireeksha Karode (not sure if she attended)
12.	Rationale for Changes:	Following a request from industry, the programmes were developed and approved in 2020 as a part-time programme where students complete 60 credits per year. All students in the programme are employed in the manufacturing industry and are released by their employer to attend classes. They undertake 20 credits in each of the two traditional academic semesters and a 20 credits Industry module in a third semester. The experience of delivering the programme since inception has suggested the necessity for some changes. In addition, following feedback from students and the newly appointed internal examiners, a number of issues have been identified such as: • lack of relevance of some topics, duplication, gaps in material, • learning outcomes too ambitious, • sequencing of modules and industry training
13.	Overview of Changes:	It is proposed to move the module Programming with Python to year 2 and move Programming with C& C++ to year 3. The C& C++ module is more suited to the level 7 as some concepts like object-oriented design, basic algorithm are better introduced if students have already done some programming. Also, moving Python programming in years allows contextualisation of programming as students will program robotic arms.

		Mechanical Systems where motors are introduced is being moved to semester 1 so students will learn about motors first and then they will learn how to control them in semester 2. For the purpose of this review, the programme was divided in strands and the modules mapped to each strand. Then, each strand was reviewed for sequencing, overlap and gaps. Special attention has been given to the review of the Industry modules. The experience of the delivery has highlighted the need for more structure in the delivery of the technical project as well as more integration with the Project Management and Six Sigma module in year 2 and 3 respectively. Also, the training included in the Industry module were reviewed by the Automation lecturers, who attended the training, in collaboration with the trainer. The flow between trainings, projects, and academic modules was analysed and the training needs adapted. Changes outlined in full in Appendix A.	
14.	Resource Implications:	No additional resources are required.	
15.	Findings and Recommendations:	General:	
		The panel approve the proposed changes with the commendations listed below and subject to the following condition(s) and recommendation(s):	
		Commendations:	
		The team is commended for its proactive and timely approach to this review	
		Special conditions attaching to approval (if any):	
		No conditions	
		Recommendations of the panel in relation to award sought:	
		Topics are excellent but programme board will need to review level of content and expectation being placed on student. SDG Goals need to brought out more in the document	
16.	FAO: Academic Council:	Approved:	
		Approved subject to recommended changes:	X
		Not approved at this time:	
	Signed:	[signature]	[signature]
		Chair	Secretary

Appendix A

Appendix AStrand	Mathematics	Instrumentation	Mechanical Design of an automated cell	PLC	Robotics	Analog Control (Temperature and Motion)	Programming	System Integration	Transversal skills
Stage									
1	Mathematics Fundamentals	Electrical Principles and Automation Industry Module 1	CAD Engineering Science Electrical Principles and Automation	Electrical Principles and Automation Industry module 1	Industry module 1				LIS Industry Module 1
2	Mathematics 2	Instrumentation & Control Industry module 2	Automation 2	Automation 2 Industry Module 2	Programming with Python	Instrumentation & Control	Programming with Python (Previously in year3)	Networking Technology	Regulatory Affairs Project Management Industry Module 2
3	Six Sigma Green Belt Quality	Industry module 3	Mechanical systems Industry module 3	Industry Module 3	Industrial Robotics (previously) Automation 3) Industry module 3	Control Systems Industry module 3	Programming with C & C++ (Previously in year 2)	Internet of Things Project	Six Sigma Green Belt Quality Industry Module 3

Mathematics strand

Stage	Module name	Current Learning Outcomes mapping to this strand	Proposed Changes
1	Mathematics Fundamentals	1. Perform simple arithmetic operations. 2. Work with mathematical formula and functions. 3. Draw graphs of standard functions and interpret graphs. 4. Work with trigonometric, logarithmic, and exponential functions in solving problems. 5. Perform simple differentiation. 6. Perform calculations involving complex numbers in Cartesian and polar form. 7. Work with vectors and matrices. 8. Work with data and perform simple statistical analyses.	No change
2	Mathematics 2	1. Differentiate single variable functions requiring a combination of rules. 2. Determine the partial derivatives of functions of two variables. 3. Apply differentiation to solve rates of change and 1ecognize1on problems. 4. Select and apply appropriate techniques of integration to evaluate integrals. 5. Solve first order differential equations by direct integration and separation of variables. 6. Analyse the behaviour of systems and processes in engineering to 1ecognize when differential equations are appropriate, formulate the problem, creatively model these behaviours in order to solve the problems, interpret and clearly communicate the results.	No change

		7. Apply the rules of probability and use probability models for data analysis.	
3	Six sigma Grenn Belt Quality Name changed to Six Sigma Quality as the Green Belt certification is not included.	1. Explain the Define, Measure, Analyse, Improve and Control steps in Six Sigma. Describe lean engineering and the origins of Six sigma. 2. Use 'Define' phase tools to decide on the process improvement of a Six Sigma project 3. Determine the current performance using a variety of 'Measure' tools 4. Use the 'Analyse' tools, including inferential statistics to determine the issues to be addressed. 5. Use the 'Improve' tools, to experiment and assess the process optimisation. 6. 'Control' the process to verify the variances are corrected, select appropriate statistical process control (SPC) techniques.	The module learning outcomes were changed to align with Professional Accreditation requirements, and the syllabus of the module has been stream-lined to adapt to the requirements of the programme. The TLA and Assessment strategy were reviewed to reflect the way the module is delivered.

Instrumentation strand

Stage	Module name	Current Learning Outcomes mapping to this strand	Proposed Changes
1	Electrical Principles and Automation	1.Analyse basic circuits using the fundamental laws of electrical science. 2. Describe the technology and use of common electrical and electronic components. 3. Illustrate and discuss the technology and use of common sensors and actuators. 5. Apply basic safety principles 6. Specify, select, build and troubleshoot basic electrical/instrumentation circuits using microcontrollers. LO4 relates to the Mechanical Design Strand	3. Illustrate and discuss the technology and use of common actuators. 6. Specify, select, build, program and troubleshoot basic PLC circuits. Rationale: The PB decided to introduce PLC from first year as it is the principal controller used in industry. Students will learn the electrical and electronic background required to understand the sensor technology. They will use sensors in their PLC circuits, but the detailed study of sensors and sensor technology will be covered in year 2. The syllabus was updated to reflect the LO changes.
1	Industry module 1	5. Undertake a basic technical project demonstrating a skill acquired in their training. Other LOs relate to the Transversal skills and robotics strands.	There is no change to the LO, but the brief of the project was expanded on to make sure that students use inputs (sensors). In first year, the equipment will be supplied by GMIT to add consistency into the projects. New text added *The scope of this project will be limited to a single operation. The output will be the production of an artefact that the student will demonstrate to their industry mentor and academic supervisor. The project should include a PLC and a minimum of 4 inputs and outputs. Students should have a 2D*

			CAD wiring diagram, a 3D model of their design. A minimum of one fixture should be 3D printed.
2	Instrumentation and Control	1. Explain the mode of operation of key sensors and transducers and implement appropriate calibration and signal conditioning. 2. Measure, record and analyse data with a range of sensors and transducers. 3. Interpret instrument specifications correctly, verify that instruments are operated safely and within specifications. 4. Choose the optimum sensor and /or instruments for specific applications and make sensible decisions on the purchase of suitable scientific equipment to meet requirements. Four other LOs relate to Control Systems	No change to the Instrumentation LO, the 3 of the 4 other LOs in the original module were removed as they were far too ambitious for a 5 credits module and were more specific to Control Systems. This module will introduce the overall concept of control systems but will concentrate on the instrumentation side. (See control system strand for more details)
2	Industry module 2	4. Program and troubleshoot a PLC, integrating inputs and outputs. Other LOs relate to the Transversal skills strand.	4. Program and troubleshoot a PLC, integrating inputs and outputs. Second LO added : 5. Design and build an automated rig for a basic operation, including safety features The brief of the project was expanded on to give a better structure to the delivery of the project and increase consistency between projects. New text: *Students will have to draw up the project specification by the end of week 4 of semester 2, to be agreed with their academic supervisor and their industry mentor by week 6, The bill of material*

			should then be submitted by week 8 of semester 2. The student is expected to be ready to start the project as early as possible into the Industry Block. The scope of this project will be to demonstrate their knowledge of designing, building and programming an automated system that includes a minimum of 8 inputs and 8 outputs. An HMI and element of networking must also be included. Safety features must be present in the project. The output will be the production of an artefact that the student will demonstrate to their industry mentor and academic supervisor. Students should have a 2D CAD wiring diagram of an input card and a 3D CAD model of a minimum of one component of their project
3	Industry module 3	1. Design an automated cell integrating a robotic arm, PLC control, vision systems and safety features This LO is covering Instrumentation, PLC, Robotics, Mechanical Systems and Control Systems strands. Other LOs relate to the Transferrable skills strand.	1. Design an automated cell integrating hardware such as robotic arm, PLC controller, drive or vision systems as well as safety features. Drive was added to reflect the content of the Control System module. The Description of the project was expanded on to give more structure to the delivery and increase consistency. New text: *Students will have to draw up the project specification by the end of week 4 of semester 2, to be agreed with their academic supervisor and their industry mentor by week 6, The bill of material should then be submitted by week 8 of semester 2. The student is expected to be ready to start the project as early as possible into the Industry Block.*

			The output of the project will be the design of an automated cell that will comply with industry standards and safety regulations. The cell should integrate a minimum of three hardware element (PLC, Robotic arm, drive, I/O link and/or vision system), demonstrate the manipulation of data of a minimum of two process variables as well as visualisation on HMI. In the programming of the PLC, students should demonstrate ability to use more than one programming language (Ladder, SFC, structure text, etc..). The technical project is also integrated with the Six Sigma module and the DMAIC project. In the assessment strategy more weight is given to the technical project, as some of the DMAIC project is assessed in the Six Sigma module.

Mechanical Design of an Automated Cell strand

Stage	Module name	Current Learning Outcomes mapping to this strand	Proposed Changes
1	CAD	1. Use three dimensional solid modeling software (CREO 3.0) in the design of engineering components. 2. Apply engineering graphics standards. 3. Use various technical commands and be able to select the appropriate methodology (design intent) required for the creation of a solid model. 4. Create drawing files displaying orthographic layouts from the solid model as well as dimensioning and applying dimensional and geographic tolerances to the drawing file. 5. Select and use the optimum software techniques to create parts and assemblies models. 6. Use standards parts libraries for the selection of appropriate standard components in the design / assembly process. Teaching and Learning Strategies All Los in this strand	No change
	Engineering Science	1. Identify the physical principles relevant to specified problems. 2. Solve theoretical and practical problems. 3. Work on optical, mechanical, and thermodynamic experiments using best laboratory practices. 4. Select appropriate instrument(s) for specific tests/measurements. 5. Identify anomalous results and make decisions regarding the source of the anomaly.	No change to the learning outcomes Assessment breakdown

		6. Record results in compliance with standard practice including measurement uncertainties. 7. Conduct experiments in accordance with safe practice. 8. Independently read instructions and accurately follow a pre-determined methodology. All Los in this strand	
	Electrical Principles and Automation	4. Explain the basic principles of electrical power generation. All other Los in the Instrumentation and PLC strands	No change
2	Automations 2	1. Demonstrate competence in standards used in schematic symbols and drawing layouts 2. Construct schematic diagrams for basic industrial automated applications using the correct standards in pneumatic, hydraulic, electrical, electro-pneumatics, electro-hydraulics areas 3. Simulate circuits to verify operation. 4. Analyse circuit design for faults and errors 5. Optimise circuit design Other LO's in the PLC strand.	1. Demonstrate competence in standards used in automation, including machine building standards 2. Construct schematic diagrams for basic industrial automated applications using the correct standards in pneumatic, electrical, electro-pneumatics areas 3. Analyse and 8ptimize circuit design using simulation. The reference to Machine Building Standard was added in LO 1following feedback from Industry. LO 3, 4 and 5 were consolidated into 1.
3	Mechanical Systems	1. Describe the industrial uses, feasibility and cost effectiveness of types of mechanical systems 2. Examine motors to show the construction, operation and applications of each 3. Illustrate and discuss mechanical systems components technology and anatomy	Los to 2 to 4 were reworded to better reflect the Industry need. 5 and 6 were removed as these LO are already covered in other modules. 2. Select the components of a mechanical system for different automated applications 3. Define actuators' specifications for different applications.

		4. Inspect drive systems to show the construction, operation and applications of each 5. Analyse sensors to show the applications of each 6. Integrate sensors/actuators	4. Define conveyors' specifications for different applications.
	Industry module 3	1.Design an automated cell integrating hardware such as robotic arm, PLC controller, drive or vision systems as well as safety features. This LO is covering Instrumentation, PLC, Robotics, Mechanical Systems and Control Systems strands. Other LO’s in the Transversal skills strand.	1. Design an automated cell integrating hardware such as robotic arm, PLC controller, drive or vision systems as well as safety features. As the DMAIC project is being integrated with the Six Sigma module and the technical project, the breakdown of marks was changed to increase the weighting of the technical project

PLC strand

Stage	Module name	Current Learning Outcomes mapping to this strand	Proposed Changes
1	Electrical Principles and Automation	6. Specify, select, build and troubleshoot basic electrical/instrumentation circuits using microcontrollers.	6. Specify, select, build, program and troubleshoot basic PLC circuits. See Instrumentation strand for rationale
	Industry module 1	3. Wire and troubleshoot a Programmable Logic Controller using best practice. 5. Undertake a basic technical project demonstrating a skill acquired in their training. LO 5 already featured in Instrumentation Other LOs relate to the Transversal skills and Robotics strands.	There is no change to the LOs apart for the word “training” being replaced by the word “Programme” The brief of the project was expanded as described in the Instrumentation strand. The PLC training included originally included was moved to year 2 to better integrate with the advanced PLC module (Automation 2). The intro to PLC is now covered in Electrical principles and automation.
2	Automation 2	6. Describe the industrial uses, feasibility and advantages/disadvantages of a PLC. 7. Describe PLC technology using the correct terminology 8. Construct ladder logic programmes using Boolean Logic, IOs, timers, counters, sequencing	4. Describe the industrial uses, feasibility and advantages/disadvantages of a PLC 5. Describe PLC technology using the correct terminology 6. Construct ladder logic programmes using Boolean Logic, IOs, timers, counters, sequencing, and advanced functions. Advanced functions were added to the last LO. As better integration of the OEM trainings and academic modules is allowing for more advanced features to be included.
	Industry module 2	4. Program and troubleshoot a PLC, integrating inputs and outputs.	4. Program and troubleshoot a PLC, integrating inputs and outputs.

		This LO already featured in Instrumentation Other LOs relate to the Transversal skills strand	Second LO added : 5. Design and build an automated rig for a basic operation, including safety features The brief of the project was expanded on to give a better structure to the delivery of the project and increase consistency between projects. See instrumentation strand for more details.
3	Industry module 3	1. Design an automated cell integrating a robotic arm, PLC control, vision systems and safety features This LO is covering Instrumentation, PLC, Robotics, Mechanical Systems and Control Systems strands. Other LOs relate to the Transferrable skills strand.	1. Design an automated cell integrating hardware such as robotic arm, PLC controller, drive or vision systems as well as safety features. Drive was added to reflect the content of the Control System module. The Description of the project was expanded on to give more structure to the delivery and increase consistency. See details in Instrumentation strand.

Robotics strand

Stage	Module name	Current Learning Outcomes mapping to this strand	Proposed Changes
1	Industry module 1	2. Operate a robotic arm in a safe manner. Other LOs relate to the PLC, Instrumentation and Transversal skills strands	2. Program and operate a robotic arm in a safe manner. The Robotics training was originally divided between the three years and some of it was duplication from Automation 3. Students will complete all of the trainings on one type of robotic arm in year 1and they will do a more advanced dedicated module in year 3 that will be based on a different brand of robotic arm and will also include the 3 D model and simulation.
2	Programming with Python (this module was originally in year 3 and now moved to year 2)	1. Develop Python code, incorporating fundamental programming principles and techniques.	1. Develop Python code, incorporating fundamental programming principles and techniques, for robotic technology. Taking into consideration the feedback from students, the team decided to give more context to the programming module by using python to program robotic arms
3	Automation 3 This module is being renamed Industrial Robotics to highlight the focus of the module and to offer it as a stand-alone module.	3. 3D modelling of cell design. Complete automation of cell and equipment used including valves, sensors, actuators, motors, robots etc. 4. Report the industrial uses, feasibility and cost effectiveness of robotic systems. 5. Illustrate and discuss robotics technology and anatomy	4. Program and troubleshoot a PLC, integrating inputs and outputs. Second LO added : 5. Design and build an automated rig for a basic operation, including safety features

		6. Develop and simulate advanced robotic program using inputs and outputs 7. Describe the industrial uses of vision systems. 8. Integrate robotics/ vision systems with additional sensors/actuators	The brief of the project was expanded on to give a better structure to the delivery of the project and increase consistency between projects. See instrumentation strand for more details.
3	Industry module 3	1. Design an automated cell integrating a robotic arm, PLC control, vision systems and safety features This LO is covering Instrumentation, PLC, Robotics, Mechanical Systems and Control Systems strands. Other LOs relate to the Transferrable skills strand.	1. Design an automated cell integrating hardware such as robotic arm, PLC controller, drive or vision systems as well as safety features. Drive was added to reflect the content of the Control System module. The Description of the project was expanded on to give more structure to the delivery and increase consistency. See details in Instrumentation strand.

Analog Control strand

Stage	Module name	Current Learning Outcomes mapping to this strand	Proposed Changes
2	Instrumentation and Control	5. Explain the differences in performance between open- and closed-loop control systems and explain the principles involved in such systems. 6. Describe the function of a process controller and the use of proportional, derivative and integral control laws. Explain PID control and how such a controller can be tuned. 7. Define the term transfer function and explain how it is used to relate outputs to inputs for systems. 8. Model dynamic systems by means of differential equations. Characterise the response of first-order systems to inputs. Three other LOs relate to Instrumentation	1. Explain the differences in performance between open- and closed-loop control systems and explain the principles involved in such systems. Tthe 3 other LOs in the original module were removed as they were far too ambitious for a 5 credits module and were more specific to Control Systems. This module will introduce the overall concept of control systems but will concentrate on the instrumentation side.
3	Control Systems	1. Explain the differences in performance between different types of control systems and explain the principles involved in such systems. 2. Give reasons for the implementation of P, PI or PID control. Assess the effect of dead time on the behaviour of a control system. Examine the uses of cascade control and feedforward control. 3. Model 2nd-order physical systems using differential equations 4. Represent 2nd-order system responses using Laplace Transform method. 5. Design closed-loop feedback systems.	1. Explain the principles involved in different control systems and their differences in performance and applications 2. Select the appropriate control strategy for a given application in process and motion control 3. Specify the components for open loop and closed loop control for industrial use cases 4. Develop process and motion control systems for industrial use cases 9 learning outcomes for a 5 credit module was far too ambitious. Also the focus of the programme is

		6. Analyse closed-loop control systems in terms of stability performance. 7. Specify system performance in terms of time-domain and frequency-domain response. 8. Analyse control systems in terms of steady-state error. 9. Design, set up, operate and analyse complex control systems. Set up and operate robotic systems. Model control system behaviour using suitable metho	on Automation and the use of control systems in a manufacturing industry setting. Control systems concepts will be introduced in the context of their use in automation, specifically for temperature and motion control.
3	Industry module 3	1. Design an automated cell integrating a robotic arm, PLC control, vision systems and safety features This LO is covering Instrumentation, PLC, Robotics, Mechanical Systems and Control Systems strands. Other LOs relate to the Transferrable skills strand.	1. Design an automated cell integrating hardware such as robotic arm, PLC controller, drive or vision systems as well as safety features. Drive was added to reflect the content of the Control System module. The Description of the project was expanded on to give more structure to the delivery and increase consistency. See details in Instrumentation strand.

Programming strand

Programming is covered in the PLC and Robotics strands as students learn to programme hardware. This strand relates to more generic programming languages.

Stage	Module name	Current Learning Outcomes mapping to this strand	Proposed Changes
2	Programming with Python (this module was originally in year 3 and now moved to year 2. Python is a higher level language so easier to introduce first. Also, this allows for the programming of robotic arms.	1. Develop Python code, incorporating fundamental programming principles and techniques. 2. Select, use and test a range of standard Python language features and common libraries, using professional development tools. 3. Apply software engineering principles in Python. 4. Design and debug code to address unforeseen tasks. 5. Select and use Python modules in data analysis applications. 6. Display an appreciation of good programming practice, style and ethics.	1. Develop Python code, incorporating fundamental programming principles and techniques, for robotic technology. 2. Select, use and test a range of standard Python language features and common libraries, using professional development tools. 3. Apply software engineering principles in Python. 4. Design and debug code to address unforeseen tasks. 5. Display an appreciation of good programming practice, style and ethics. LO 5 was removed as too ambitious for a level 6. The topic is covered in year 3 in the IoT Project module The assessment strategy was removed to better scaffold students' learning.
3	Programming with C&C++ (originally in year 2, moved to year 3) Some of the LOs are better suited to a Level	1. Develop and debug basic programs incorporating fundamental programming principles and techniques. 2. Select, use and test modern C & C++ core language and standard library features, using professional software and hardware development tools.	No change to the LO as they were too ambitious for a level6. The assessment strategy was modified to better scaffold students' learning.

	7, in particular if students have already experience of programming.	3. Apply basic algorithm design and documentation techniques. 4. Design & debug code to address unforeseen tasks. 5. Display an appreciation of good programming practice, style and ethics. 6. Describe applications and principles of C & C++.	

Data integration strand

Stage	Module name	Current Learning Outcomes mapping to this strand	Proposed Changes
2	Networking Technology	1. Discuss current network technologies, applications and emerging trends for industrial and business applications. 2. Describe the Internet protocol suite (TCP/IP). 3. Recognise and analyse Ethernet, Industrial Ethernet and wireless network architectures, devices and data. 4. Select, configure and problem-solve networking elements in a practical application. 5. Design, build and test a basic network in a practical application. 6. Appreciate network management principles and challenges.	No change
3	Internet of Things project	1. Research an IoT based application area and create a project proposal, following general requirements. 2. Discuss a selected IoT application area, including industry, trends, technologies, ethics. 3. Investigate & select suitable hardware and/or software elements to use in a project, following general guidelines. 4. Develop, integrate, build and test hardware and/or software elements of a project, on a specified Internet of Things development platform. 5. Apply problem solving techniques to technical and other issues that arise in the context of a project. 6. Manage project deliverables throughout the project timeline in an agile environment.	LO8 was changed to include data capture, data storage and a data analytics which was removed from the Python programming module. 8. Demonstrate project technical functionality, including data capture, data storage and data analytics. Two assessments have been combined to reduce the workload.

		7. Contribute towards a collaborative working environment, as well as work independently towards project goals. 8. Demonstrate project technical functionality, and understanding of technical and mathematical concepts and implementations incorporated. 9. Communicate project ideas, design and deliverables, using professional tools and guidelines.	

Transversal skills

Stage	Module name	Current Learning Outcomes mapping to this strand	Proposed Changes
1	Learning Innovation Skills	1. Apply the basic principles of critical thinking/problem solving to engineering systems 2. Demonstrate an enhanced capacity to communicate verbally in contexts relevant to an engineering environment 3. Explain the ethical standards required of the professional engineer 4. Demonstrate an ability to communicate via electronic media to the standards of the engineering industry 5. Appraise, select, and apply appropriate learning strategies	No change
	Industry module 1	1. Comply with company's procedures and policies, and describe the company's ethical guidelines relating to the workplace, customers and the environment. 4. Describe and explain manufacturing processes available in the work place. 6. Integrate in the company work place, communicating and contributing as an individual and team member, and describe the company's organisational structure. 7. Reflect on their experiential learning. LOs 2,3 and 5 relates to the PLC and Robotics strands	No change to these LOS
2	Project Management	1. Apply the principles and methodologies of project management to their specialist discipline.	No change to this module.

		2. Apply project management techniques and systems in their specialist discipline. 3. Recognise the complexities of team based management. 4. Structure project or job tasks, schedule and manage. 5. Apply engineering and project management techniques to real problems in industry or laboratory settings 6. Combine various aspects of the course in a practical context through preparing and delivering presentations / reports on the specification / scope, planning and implementing of a project	
	Industry module 2	1. Select the appropriate tools, methodologies and techniques to solve manufacturing problems, and design and implement solutions. 3. Communicate findings to teams and management, and work effectively as a team member. 4. Describe and communicate how the regulatory constraints affect the operations of the company, and how ethical considerations affect their conduct as a technician. 6. Reflect on their experiential learning, and their ability to solve problems using a structured technical approach, and identify gaps.	No change to these LO. Two other Los relate to the technical project, specifically the Instrumentation and PLC .
	Six sigma Grenn Belt Quality Name changed to Six Sigma Quality as the Green Belt certification is not included.	1. Explain the Define, Measure, Analyse, Improve and Control steps in Six Sigma. Describe lean engineering and the origins of Six sigma. 2. Use 'Define' phase tools to decide on the process improvement of a Six Sigma project 3. Determine the current performance using a variety of 'Measure' tools	The module learning outcomes were changed to align with Professional Accreditation requirements, and the syllabus of the module has been stream-lined to adapt to the requirements of the programme. The TLA and Assessment strategy were reviewed to reflect the way the module is delivered.

		4. Use the 'Analyse' tools, including inferential statistics to determine the issues to be addressed. 5. Use the 'Improve' tools, to experiment and assess the process optimisation. 6. 'Control' the process to verify the variances are corrected, select appropriate statistical process control (SPC) techniques.	