Postgraduate Programme Specification
MSc Applied Data Science in Engineering

This specification provides a summary of the main features of the programme and learning outcomes that a student might reasonably be expected to achieve and demonstrate where full advantage is taken of all learning opportunities offered. Further details on the learning, teaching and assessment approach for the programme and modules can be accessed on the University website and Virtual Learning Environment, GCU Learn. All programmes of the University are subject to the University's Quality Assurance processes.

GENERAL INFORMATION				
Programme Title	MSc Applied Data Science in Engineering			
Final Award	MSc Applied Data Science in Engineering			
Awarding Body	Glasgow Caledonian University			
School	SCEBE			
Department	Applied Science			
Mode of Study	Full-time Online Distance Learning			
Location of Delivery	Glasgow Campus			
UCAS Code				
Accreditations (PSRB)				
Period of Approval	From:	September 2022	To:	-

EDUCATIONAL AIMS OF PROGRAMME

Aims

The proposed MSc programme is targeted at a significant and growing skills and capability gap for engineers with a knowledge of industrial digitisation and data analysis. Industry needs graduates with the multi-disciplinary knowledge to make a significant contribution by integrating digital technologies, data science and physical assets to enable realisation of SMART industrial systems and factories.

This MSc course aims to contextualize data science and data engineering to equip mechanical, electrical, control & instrumentation engineers with expert knowledge and practical skills to enable the use of data for provision of through life engineering intelligent support solutions, while engaging data analysts to understand systems and systems of systems. SCEBE is well placed to deliver such a programme having the expertise in instrumentation, electrical/mechanical and reliability engineering as well as data scientists and cyber security experts who will all feed into the programme to give a truly rounded programme giving graduates an in-depth knowledge in the engineering with a solid appreciation of data analytics. The programme combines the latest academic advances and provides practice in utilising the tools, techniques and design patterns used by industry professionals, to produce graduates that are intellectually and practically equipped for high quality relevant employment or capable of moving onwards to undertake related research.

LEARNING OUTCOMES

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, skills, qualities and other attributes in the following areas:

A: Knowledge and understanding;
The students should be able to:
A1 Apply a comprehensive knowledge of facts, concepts and theory of new technologies supporting the digital transformation of Asset Design and Asset Support (Operations and Maintenance) using systems engineering approaches.
A2 Select and apply concepts, principles, theory, and application of data science in the engineering context.
A3 Demonstrate the facts, concepts, and application of mathematics, statistics and engineering principles relevant to system characterisation using instrumentation and their impact on digital engineering tools and integrated processes.
A4 Apply comprehensive knowledge related to the concepts, and principles of design and utilisation of industrial internet of things (IIoT) solutions.
A5 Apply knowledge of engineering management principles, commercial management and intellectual property relevant to digital transformation of assets.
A6 Demonstrate critical awareness of new developments and quality assurance principles (including awareness of cyber security landscapes) relevant to data engineering.

B: Practice: Applied knowledge, skills and understanding;
The students should:
B1 Be able to formulate, analyse and solve complex problems specific to data plugged to sense-acquire-transmit-analyse-act processes.
B2 Demonstrate skills in data gathering, selection and application of appropriate computational techniques to convert system data into information capable of supporting design, operational and maintenance decisions.
B3 Critically evaluate the reliability, availability and maintainability of complex systems and processes using statistical modelling and predictive analytics.
B4 Be able to develop and critically evaluate software for data science.
B5 Be able to identify and optimise instrumentation capable of supporting system health management capabilities as an enabler for predictive maintenance strategies.
B6 Be able to design IIOT solutions for engineering applications; demonstrate awareness of cyber security landscapes.

C: Generic cognitive skills;
The students should:
C1 Demonstrate critical thinking and problem solving for data-enabled engineering assets.
C2 Take account of technological, ethical and commercial constraints in achieving engineering solutions for data enabled assets and operations.
C3 Be able to contribute positively as part of a group to plan, organise and carry out work efficiently in a timely manner.
C4 Concurrently handle data from several engineering functions involved in the design of smart systems.
C5 Critically evaluate work undertaken by themselves and others.

D: Communication, numeracy and ICT skills

The students should:
D1 Understand the theory related to digital transformation in the context of different engineering applications.
D2 Select and utilise appropriate standards and relevant recommended practices.
D3 Communicate effectively on complex engineering matters.
D4 Demonstrate numeracy and mathematical skills related to data handling.
D5 Select and critically evaluate technical literature and other sources of information to solve complex problems.
D6 Select and apply appropriate computational and analytical techniques to model systems.

E: Autonomy, accountability and working with others.
The students should demonstrate:
E1 Application time management and task prioritisation skills
E2 Independent working
E3 Ability to debate the role of quality management systems in the context of complex problems in the digital transformation space.
E4 Planning, monitoring, reviewing, and evaluating own learning and development.
E5 Interpersonal skills relating to the ability to interact with other people as evidenced by effective team performance/ Ability to prepare and deliver group presentations.

The focus of the programme is on the understanding, gathering and utilisation of data in the context of engineering assets. This involves the integration of an extremely complex and sophisticated skill set, which have been identified under the four headings; knowledge and understanding; practice of applied knowledge, skills and understanding and communication, numeracy, and ICT skills (3A, 3B and 3D). To make a real contribution to engineering environments, the programme also includes tasks and assessment techniques meant to enable the development of cognitive skills as well as the ability to demonstrate the autonomy, accountability, and the ability of working with other functions within engineering organisations (3C and 3E).

Many of the proposed learning outcomes are embedded in a high number of the eight taught modules and the assessment (e. g. the cognitive skills set (C1 (8/8), C5 (7/8)), communication, numeracy, and ICT skills (D3 (5/8), D4(4/8) and D6 (4/8)) and the autonomy, accountability skills set (E1 (6/8) and E2 (6/8)).

The group working key engineering life skills captured under C3 and E5 are developed in several modules and specifically assessed for full time students in the System Health Management and Digital Twin modules. Distance learning students are working in industry and it is envisaged that they will have experience of group working in their workplace. The ability to communicate effectively on engineering matters (D3) will again be assessed in a high number of the taught modules (5/8).

LEARNING AND TEACHING METHODS

The programme admits students at both September and January intakes. All the taught modules of the programme are devised and delivered in a relatively self-contained format and there are no formal prerequisites between any taught modules; students are ensured to have uniform experiences of learning whether they start the study in September or January intake.

For full time students the eight taught modules will be presented as a 12-week cycle. Full and comprehensive course material will be provided to support the intensive tuition. Lectures may be presented both by lecturers from the University and experts from industry. Class contact will be lectures, tutorials, seminars and laboratory sessions as appropriate. Each module has an appropriate handbook detailing the module descriptor, learning outcomes, and assessment strategies adopted.

The distance learning students will be provided with a comprehensive study pack supported by communication with module tutors. The study pack will include a study guide as detailed in the distance learning delivery section. Distance learning students who will be employed in industry will gain group working skills in the course of their work.

In addition, for FT and DL delivery mode, each module will be supported through the managed learning environment, GCULearn®, which provides on-line support such as: general staff and student announcements and information; course documents (in a wide range of formats); discussion board; and the used of Collaborate Ultra/MS Teams tools which enable the realisation of a virtual classroom (real-time student support, including an electronic white board, screen sharing, recording/downloading of virtual sessions, remote control of student's computers and a mechanism for real-time Q & A between module tutors and students).

The modules to some extent split into two groups, depending on the emphasis – although this is not a rigid distinction. Data Capture, IoT Framework Informatics, Predictive Maintenance, and the Project are primarily integrative with new knowledge being introduced where appropriate, whereas the other modules (Software Development for Data Science, System Health Management, Data Visualisation, Digital Twins) focus on new knowledge and illustrate the concepts through examples and applied activities.

Subjects which are of general importance to the professional engineer operating in the digital engineering space are covered in the Professional Practice module.

A range of assessment instruments is applied within the programme, depending on the nature of the subject area. Assessments may involve a range of activities, including research, report-writing, designing and developing technical solutions (for example: undertaking data-analytics, developing software, identification & optimisation of sensor set solutions), delivering individual and group presentations.

Most of the coursework assignments involve undertaking a significant element of independent study and implementing associated practical tasks within a given deadline. Students are thus required to develop independent responsibility, plan their learning, prioritise tasks and manage their time appropriately to successfully complete the assignment (E1, E2, E5).

Many assignments require students to retrieve and utilise and evaluate information from a variety of sources both research and commercially based (A5, D5).

Tutorial/Seminar work requires students to present their work (and consider the work of others), in both written and oral form (A1, A3, A4, E4).

Group working is also set within the programme and it is used to develop effective communication on a technical subject while enhancing team working skills (D2, C4, D3, E3).

ASSESSMENT METHODS

The programme provides a variety of formative and summative assessment methods. Programme and Module specific guidance will provide detail of the assessment methods specific to each module.

Across the programme the assessment methods may include the following:

- Written coursework (essays, reports, case studies, dissertation, literature review)
- Oral coursework (presentations, structured conversations)
- Practical Assessment (Placement, VIVA, Laboratory work)
- Group work
- Blogs and Wikis
- Portfolio Presentations
- Formal Examinations and Class Tests

The above assessments may be delivered either in person and online as appropriate and determined at module level by the Module Leader.

The Masters dissertation module is a notional 600 hours effort on the part of the student and is supervised by an appropriate academic member of staff. The underlying philosophy of the Masters dissertation is to allow each student to develop and mature educationally by identifying, studying, analysing and evaluating a substantial problem or challenging issue within the broad discipline scope of the programme. The Masters dissertation offers a further and critical alternative to learning within the traditional lecture/tutorial environment and consequently an alternative method for the student to demonstrate their capabilities and to achieve the key learning objectives required from the module. Masters dissertations are normally research, industrially related, or consultancy based. The Masters dissertation is assessed as per the module descriptor:

- Oral Presentation of final dissertation (20%)
- Practical Operations (20%)
- Overall Performance of final Dissertation (60%)

The learning outcomes met by all students enrolled on the project module are A1, B2, C2, C2, C5, D1, D2, D3, D4, D5, D6, E1, E2, and E4. Several other LOs could be met depending on the topic of project.

ENTRY REQUIREMENTS

Specific entry requirements for this programme can be found on the prospectus and study pages on the GCU website at this location: www.gcu.ac.uk/study

All students entering the programme are required to adhere to the GCU Code of Student Conduct.

PROGRAMME STRUCTURE AND AVAILABLE AND FINAL EXIT AWARDS[1]							
The following modules are delivered as part of this programme:							
Module Code	**Module Title**	**Core or Optional**	**SCQF Level**	**Credit Size**	**Coursework %**	**Examination %**	**Practical %**
MMI226822	Software Development for Data Science	Core		15	100%		
MMH626812	System Health Management	Core		15	100%		
MMH126808	Data Capture	Core		15	50%	50%	
MMH626834	IoT Framework Informatics	Core		15	100%		
MMH323674	Professional Practice (Engineering)	Core		15	100%		
MMI226820	Data Visualisation	Core		15	100%		
MMH126833	Digital Twins	Core		15	100%		
MMH326845	Predictive Maintenance	Core		15	50%	50%	
MMH621937	Project	Core		60	100%		

[1] Periodically, programmes and modules may be subject to change or cancellation. Further information on this can be found on the GCU website here: www.gcu.ac.uk/currentstudents/essentials/policiesandprocedures/changesandcancellationtoprogrammes

Students undertaking the programme on a full-time basis commencing in September of each year will undertake the modules in the order presented above. This may be subject to variation for students commencing the programme at other times of year (e.g. January) and/or undertaking the programme on a part-time or distance learning mode of delivery.

The following final and early Exit Awards are available from this programme[2]:

Postgraduate Certificate (un-named) - *achieved upon successful completion of xxx credits (excluding the Dissertation / Project Module)*

Postgraduate Certificate in Applied Data Science in Engineering - *achieved upon successful completion of xxx credits which must include the modules asterisked above*

Postgraduate Diploma in Applied Data Science in Engineering - *achieved upon successful completion of xxx credits which must include the modules asterisked above*

Master of Science in Applied Data Science in Engineering - *achieved upon successful completion of xxx credits which must include the modules asterisked above*

ASSESSMENT REGULATIONS

Students should expect to complete their programme of study under the GCU Assessment Regulations that were in place at the commencement of their studies on that programme, unless proposed changes to University Regulations are advantageous to students. These can be found at: www.gcu.ac.uk/aboutgcu/supportservices/qualityassuranceandenhancement/regulationsandpolicies

[2] Please refer to the GCU Qualifications Framework for the minimum credits required for each level of award and the Programme Handbook for requirements on any specified or prohibited module combinations for each award.

VERSION CONTROL (to be completed in line with AQPP processes) **Any changes to the PSP must be recorded below by the programme team to ensure accuracy of the programme of study being offered.**			
Version Number	*Changes/Updates*	*Date Changes/Updates made*	*Date Effective From*
1.0			