

## Course Handbook

# MSc Applied Data Science

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School of Engineering



Please read this Handbook in conjunction with the University's Student Handbook.

All course materials, including lecture notes and other additional materials related to your course and provided to you, whether electronically or in hard copy, as part of your study, are the property of (or licensed to) UCLan and MUST not be distributed, sold, published, made available to others or copied other than for your personal study use unless you have gained written permission to do so from the Dean of School. This applies to the materials in their entirety and to any part of the materials.

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## 1. Welcome to the course

Welcome to the MSc/PGDip/PGCert course in Applied Data Science. With the increasing processing and learning capabilities of processors, together with more and more data collected by embedded devices such as smart meters, the golden time for data scientists and engineers has arrived for sure.

Since early 2017, a group of enthusiastic staff from the School of Engineering gathered together and worked really hard so that this course can be developed.

This course aims to provide master's level education on data science, with strong emphasis on the tools and applications of data science in research and real life.

Students who graduate will obtain the award of Master of Science (MSc) in Applied Data Science (ADS).

During the course, you will be working with experienced university staff who have specialized knowledge and skills within their own areas. You will receive guidance and support from them to help you succeed in this course.

This level of degree also requires you to demonstrate your competence and commitment through your study here to earn the award. The course team will be working together with you.

We wish you will enjoy your study through the course.

### 1.1 Rationale, aims and learning outcomes of the course



The MSc course in Applied Data Science is to prepare engineers for a new developing interdisciplinary field of engineering, computing and statistics. The programme will cover lots of important tools and skills emerging in this area, with a broad spectrum of applications.

#### Programme Aims

- |   |
|---|
| • To provide graduate level education targeting awards for MSc Applied Data Science, with alternative exit awards for PGDip and PGCert  |
| • To meet the Institution of Engineering and Technology's accreditation requirements  |
| • Produce graduates with the principles and knowledge to work on modern data science  |
| • Equip students with research and problem solving skills in relevant topics  |
| • To produce engineers with skills and experience appropriate for a career in data science and its applications across a range of areas |

Applicants with strong interests in data and the applications of data are all welcome. As per the inter-disciplinary nature of the programme, applicants could be from many different backgrounds in STEM (Science, technology, engineering and mathematics) domain. Refer to the Admission Criteria of the Programme Specification for more details.

## 1.2 Course Team

There are a number of staff working on this course. Contact details for the course team are as follows:

Roles	Names	Emails	Ext
Module tutor	Dr Carl Berry	<a href="mailto:CBerry1@uclan.ac.uk">CBerry1@uclan.ac.uk</a>	3245
Module tutor	Dr Aikaterini Fragaki	<a href="mailto:AFragaki@uclan.ac.uk">AFragaki@uclan.ac.uk</a>	3826
Module tutor	Dr Geoffrey Hall	<a href="mailto:GHall5@uclan.ac.uk">GHall5@uclan.ac.uk</a>	5164
Module tutor	Dr Stephen Kirkup	<a href="mailto:SMKirkup@uclan.ac.uk">SMKirkup@uclan.ac.uk</a>	3246
Module tutor	Prof Bogdan Matuszewski	<a href="mailto:BMatuszewski1@uclan.ac.uk">BMatuszewski1@uclan.ac.uk</a>	3250
Module tutor	Dr Ahmed Onsy	<a href="mailto:AOnsy@uclan.ac.uk">AOnsy@uclan.ac.uk</a>	3266
Module tutor	Prof Lik-Kwan Shark	<a href="mailto:LShark@uclan.ac.uk">LShark@uclan.ac.uk</a>	3253
Module tutor	Dr Philip Tranter	<a href="mailto:PTRanter@uclan.ac.uk">PTRanter@uclan.ac.uk</a>	3260
Academic lead	Dr Martin Varley	<a href="mailto:MRVarley@uclan.ac.uk">MRVarley@uclan.ac.uk</a>	3272
Module tutor	Dr Zheng Xie	<a href="mailto:ZXie2@uclan.ac.uk">ZXie2@uclan.ac.uk</a>	3226
Module tutor	Dr Javad Yazdani	<a href="mailto:JYazdani@uclan.ac.uk">JYazdani@uclan.ac.uk</a>	2685
Course leader	Dr Yu Zhou	<a href="mailto:yzhou11@uclan.ac.uk">yzhou11@uclan.ac.uk</a>	2890

## 1.3 Expertise of staff

Many tutors of the course team have research interests and experiences in the broad field of data science and the applications. A number of staff are also research active. More information about the details of expertise of an individual staff can be found from online staff profile pages.

## 1.4 Academic Advisor

You will have an Academic Advisor who will provide additional academic support during your study. They will be the first point of contact for many of the questions that you might have. Your Academic Advisor will be able to help you with personal development, including developing skills in self-awareness, reflection and action planning.



## 1.5 Administration details

Campus Admin Services provides academic administration support for students and staff and are located in the following hubs which open from 8.45am until 5.15pm

Monday to Thursday and until 4.00pm on Fridays. The hub can provide general assistance and advice regarding specific processes such as extenuating circumstances, extensions and appeals.

### **Computing and Technology Building**

Art, Design and Fashion

Computing

Journalism, Media and Performance

Engineering

Telephone: 01772 891994/891995

Email: [CandTHub@uclan.ac.uk](mailto:CandTHub@uclan.ac.uk)

### **1.6 Communication**



The University expects you to use your UCLan email address and check regularly for messages from staff. If you send us email messages from other addresses they risk being filtered out as potential spam and discarded unread.

The best way to contact your tutor is via email as we all check our emails on a regular basis. If you have sent an email and have been waiting for the reply for quite some time, you might resend the email or use the telephone number to give a phone call if necessary.

If you want to make an appointment with your AA, you can send an email to your AA first and then propose a few time slots options so that the tutor can find a mutually convenient time to meet you.

To make the communication effective, it is good practice to use the class time wisely and talk to the tutors in the class if possible.

The communication skills are not just important for your course here, it will be important for your career.

### **1.7 External Examiner**

The University will appoint an external examiner to the course. The external examiner will work together with the course team to ensure the standards of the course are comparable to those provided at other higher education institutions in the UK. The name of this person, their position and home institution can be found below. If you wish to make contact with your External Examiner, you should do this through your Course Leader and not directly. External Examiner reports will be made available to you electronically. The School will also send a sample of student coursework to the external examiner(s) for external moderation purposes, once it has been marked and internally moderated by the course tutors. The sample will include work awarded the highest and lowest marks and awarded marks in the middle range.

MSc / PGDip ADS External Examiner:



## 2. Structure of the course

### 2.1 Overall structure

All modules will be delivered on Preston Main Campus of the University of Central Lancashire (UCLan). See the table below for overall structure.

Code	Title	Credit	Semester 1	Semester 2	Semester 3
<b>EL4895</b>	<b>MSc Project (Core)</b>	<b>60</b>			
EL4166	Research Methods (Compulsory)	20			
EL4011	Artificial Intelligence and Machine Learning (Compulsory)	20			
EL4012	Internet of Things (Compulsory)	20			
EL4016	Big Data Analytics and Visualization (Compulsory)	20			
EL4013	Programming with Data (Compulsory)	20			
<i>EL4015</i>	<i>Object Oriented Software Development (Optional)</i>	<i>20</i>			
<i>EL4014</i>	<i>Visual Information Processing (Optional)</i>	<i>20</i>			
<i>EL4147</i>	<i>Digital Signal and Image Processing B (Optional)</i>	<i>20</i>			
<i>EL4007</i>	<i>Advanced Robotics and Intelligent System Design (Optional)</i>	<i>20</i>			
<i>ER4706</i>	<i>Applied Instrumentation (Optional)</i>	<i>20</i>			

There is one Core module (EL4895), five compulsory modules (EL4166, EL4011, EL4012, EL4016, EL4013) and five optional module (EL4015, EL4014, EL4147, EL4007, ER4706).

You are allowed to choose one optional module and this decision shall be made carefully and it is generally based on your own academic interests. For example, if you wish to

develop along software engineering direction, choose EL4015. If you wish to develop skills in robotics, choose EL4007. If you are interested in sensors and instruments, choose ER4706. If you are interested in computer vision and applications, choose EL4014. If you are interested in signal and image processing, choose EL4147.

Note for EL4147 and EL4007, there are pre-requisites to be satisfied. Specifically, for EL4147, students shall either have taken EL3147, or have equivalent experiences. For EL4007, students shall either have taken EL3007, or EL3102 or have equivalent experiences.

Choice of the optional module shall be made by the 2<sup>nd</sup> week of your study. You are advised to talk to the module team and the course team so that the module fits your study plan to the best. More information and 1-to-1 advice will be available during the induction week.

## **2.2 Modules available**

Each module is a self-contained block of learning with defined aims, learning outcomes and assessment. A standard module is worth 20 credits with the only exception of the MSc Project module (60-credit). A standard module equates to the learning activity expected from one sixth of a full-time undergraduate year. Modules may be developed as half or double modules with credit allocated up to a maximum of 120 credits per module.

### **EL4011 - Artificial Intelligence and Machine Learning – 20 Credits**

This module aims to provide students with the theoretical, analytical and practical skills that will enable them to design, integrate and use artificial intelligence and machine learning systems. It also develops students' research aptitude and equip them with the skills needed for independent study in different areas of artificial intelligence and machine learning research.

### **EL4012 - Internet of Things – 20 Credits**

This module aims to introduce the student to the hardware and software systems required to implement an 'Internet of Things' Data node and Cloud connection. Social and technological impact of widespread use of IoT will be investigated.

### **EL4016 - Big Data Analytics and Visualization – 20 Credits**

This module aims to enable students to gain experience and develop an understanding of the fundamental topics in the fields of Big Data analytics and data visualisation. This module will enhance the employability of students in data science.

### **EL4013 - Programming with Data – 20 Credits**

This module aims to develop the programming and problem solving skills of the students for data science with Python and R. The module will enhance students' capabilities in other modules such as Big Data and Visualization.

### **EL4015 - Object Oriented Software Development – 20 Credits**

This module aims to develop object-oriented software development skills of the students. While practical aspects of programming are important, this module also provides the methodology of software development in data science related applications.

#### EL4014 - Visual Information Processing – 20 Credits

This module aims to introduce students to fundamental concepts of visual data representation and processing, essential for understanding and development of modern vision based artificial intelligence systems. It provides students with the theoretical, analytical and practical skills that will enable them to design, build and use complex computer vision systems for image/video understanding, including: automatic object detection, categorisation and segmentation. It also develops students' skill to comprehend, and to use future developments in computational visual information processing.

#### EL4147 - Digital Signal and Image Processing B – 20 Credits

This module aims to enable students to acquire an understanding and hands-on experiences of advanced Digital Signal and Image Processing techniques including signal and image analysis, compression, enhancement and segmentation, and practical implementation considerations.

#### EL4007 - Advanced Robotics and Intelligent System Design - 20 Credits

This module aims to i) extend existing competencies in the design and development of autonomous robotic systems with a focus on the applications of artificial intelligence, advanced control, and safety critical operation; ii) integrate the knowledge and understanding acquired at earlier stages of the course in the implementation of autonomous robotic systems; iii) demonstrate understanding of the fundamental challenges and state of the art associated with the discipline of robotics.

#### ER 4706 Applied Instrumentation – 20 Credits

This module introduces methods of computer interfacing of industrial or scientific instruments and data processing for monitoring and control of engineering processes. It provides a comprehensive understanding of the use of advanced instrumentation and sensing methods. The module will also consider the application of signal processing methods and system design methods.

#### EL4166 Research Methods – 20 Credits

This module will introduce basics of conducting research, including how to use literature effectively, project specifying, planning and delivery of a substantial research project within a chosen technical area. This module will prepare the students for the MSc Project module.

#### EL4895 MSc Project – 60 Credits

This module aims to provide the students with the opportunity to develop a significant piece of research work. It will require the student to specify, plan, execute and report a programme of work leading to the development of new knowledge, methods or applications, as appropriate for the chosen topic. The module will enhance the students' employability skills such as written communication, project planning and management and dissemination of research outcomes.





## 2.3 Course requirements

The course is designed for the accreditation of Institution of Engineering and Technology on behalf of the Engineering Council as for the requirements of registering as a Chartered Engineer (CEng). Details about CEng can be found from:

<https://www.theiet.org/membership/profreg/ceng/>

## 2.4 Module Registration Options

Discussions about your progression through the course normally take place in February each year. It is an opportunity for you to make plans for your study over the next academic year. The course team will tell you about the various modules / combinations available and you will both agree on the most appropriate course of study for you.

## 2.5 Study Time

### 2.5.1 Weekly timetable

A timetable will be available once you have enrolled onto the programme, through the Student Portal.

### 2.5.2 Expected hours of study

20-credit is a standard module size and it is expected to cost 200 notional learning hours.

For a year-module with 20-credit, you are expected to spend about 6 hours on that module each week; For a semester-based 20-credit module, about 12 hours per week is therefore needed. We expect that you commit a minimum of 36 hours study per week (pro-rata for part-time students and/or semester-based modules), inclusive of your contact hours.

So for a typical year-based module you may have (for example) a 2-hour lecture, and a 1-hour tutorial or a 2-hour practical session per week, leaving you approximately 2 or 3 hours for self-directed study (further reading, tutorial questions, assignments, revision). This is thinking time – not coffee and biscuits time! Sometimes you may be working in groups for practical work and you should try and arrange to meet up outside the scheduled class times. You will also need to use equipment such as computer and laboratory facilities for practical work, again sometimes outside the scheduled class times.

### 2.5.3 Attendance Requirements



You are required to attend all timetabled learning activities for each module. To allow electronic recording of your attendances on classes, you should always bring your student card with you and scan it before you enter the room of every class. If you forget to bring your student card for some reason, you need to report this onsite to your tutor so that your attendance information can be manually checked.

Notification of illness or exceptional requests for leave of absence must be made to:

C&T Hub

Telephone: 01772 891994/891995

Email: [CandTHub@uclan.ac.uk](mailto:CandTHub@uclan.ac.uk)

If you are an international student, please be aware that UCLan is obliged to tell the Visas and Immigration (UKVI) if you withdraw from a course, defer or suspend your studies, or if you fail to attend the course regularly. Any international travel during your study must be authorized.

If there is any personal circumstances that make it difficult for you to meet your study obligations, you need to seek advice from your Academic Advisor and/or Course Leader.

### **3. Approaches to teaching and learning**

#### **3.1 Learning and teaching methods**

You are going to experience a number of learning and teaching methods throughout the course. This includes the traditional lectures with the assistance of slides, practical lab demonstrations followed by your hands-on exercises. You will be doing pre-reading before the class and you will be doing guided reading afterwards.

Teaching materials for each module will be available on Blackboard website.

For the 3-module level 7 project (EL4895), you will have an Academic Advisor from whom you can meet regularly and ask for individual guidance on your project.

#### **3.2 Study skills**

Students are expected to prepare for all the classes, to read materials on Blackboard. Students are encouraged to take active roles in discussion to develop skills including communication and presentation.

There are a variety of services to support your studies here and these include

WISER <http://www.uclan.ac.uk/students/study/wiser/index.php>

LIS [https://portal.uclan.ac.uk/webapps/portal/frameset.jsp?tab\\_group\\_id=25\\_1](https://portal.uclan.ac.uk/webapps/portal/frameset.jsp?tab_group_id=25_1)



#### **3.3 Learning resources**

##### **3.3.1 Learning Information Services (LIS)**

There are extensive collections of books (hardcopies and e-books) purchased by the University and you are entitled to use them all. There are also many training sessions offered by LIS to enable you to gain all the skills you need for your research and study here. Go to the LIS website to find out more. You might also contact the librarian (Mr R Frost) to get help on an individual basis.

##### **3.3.2 Electronic Resources**

Teaching materials will be available online via Blackboard website. For each module, there will be a dedicated homepage. To access Blackboard, you will need a username and password. You will receive this upon registration.

As a student here in UCLan, it is very important to check Blackboard regularly as this is the main repository of teaching materials.

There are also many other useful electronic resources from LIS, such as e-journals, databases, video clips (e.g., Lynda) etc.

#### **3.4 Personal development planning**

To make sure that you achieve your full potential whilst at university and beyond, the course has been designed with personal development planning. This is not extra to your degree, but an important part of it.

Personal development planning tutorials will be offered as part of this programme. Academic Advisors will support students' in personal development planning by offering advices on an individual basis.

Your personal development planning is not only important for you, it is also important for the University. You are encouraged to keep a record of your achievements in your study here and when you are asking your UCLan teacher for a reference for your application of jobs, your teacher can use this record information to provide more rounded details to help you to earn the best chances.

The School of Engineering encourages all our students to apply for the student membership of IET. It is not only useful to orient your study here in UCLan, it is also important for your future career development as an engineer. The school also offer financial support for the registration.



### 3.5 Preparing for your career

The University Career service offers a range of support for you, including:

- Career and employability advice and guidance appointments
- Support to find work placements, internships, voluntary opportunities, part-time employment and live projects
- Workshops, seminars, modules, certificates and events to develop your skills

Daily drop-in service available for CV checks and initial careers information. For more information come along and visit the career service team or access the careers and employability resources via the Student Portal.

## 4. Student Support



### 4.1 Academic Advisors

You will be assigned an Academic Advisor who will assist with Academic related problems. You will find out more about them and their role in induction week. They are responsible for providing you with support and advice in relation to your programme of studies, assistance in accessing other services available to students within the University, and to offer whatever help and assistance they can to make your time at the University a satisfying and stimulating experience. Their job is not to have all the answers but they will be able to direct you to the person or place where they can be found. Your Academic Adviser should be supportive, helpful and try to understand (but not necessarily share) your point of view when you need advice. At times it may be necessary for them to challenge you over your progress, performance or attendance, but it is not their role to constantly monitor you in these areas as may have happened at school or college.

You should meet your Academic Advisor during induction week and time will be allocated on the induction timetable to enable to you do this. During this meeting you should make arrangements about the process by which future regular contact will be maintained. You should take an active role to meet with your Academic Adviser regularly.

To make an appointment with your Academic Advisor, you can use an app called "Starfish" or you can see an appointment to your Academic Advisor via e-mail. You should check your UNIVERSITY e-mail account regularly.

Both you and your tutors should keep appropriate records of meetings and this may form part of your Personal Development Process.

If you need to get advice in an emergency or when your Academic Adviser is not available then you can go and see your retention tutor or course leader.

If you have good reason for wishing to change your Academic Adviser, then this can be arranged by contacting the Course Leader.

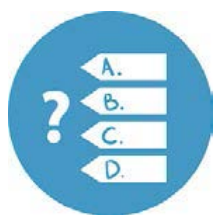
#### **4.2 Students with disabilities**

If you have a disability that may affect your studies, please either contact the Disability Advisory Service - [disability@uclan.ac.uk](mailto:disability@uclan.ac.uk) - or let one of the course team know as soon as possible. With your agreement information will be passed on to the Disability Advisory Service. The University will make reasonable adjustments to accommodate your needs and to provide appropriate support for you to complete your study successfully. Where necessary, you will be asked for evidence to help identify appropriate adjustments.

#### **4.3 Students' Union One Stop Shop**

The Students' Union offers thousands of volunteering opportunities ranging from representative to other leadership roles. The Union also advertises paid work and employs student staff on a variety of roles. You can find out more on the Students' Union website: <http://www.uclansu.co.uk>

### **5. Assessment**



#### **5.1 Assessment Strategy**

All modules will be assessed and you are expected to attempt all assessments for all the modules you are registered. You should attend the assessments at the scheduled times unless you are authorized with extensions or extenuating circumstances which justifies the deferral.

The assessments include both formative and summative and they might be presented in different formats.

The pass mark for all Level 7 modules is set as 50%.

More details can be found from the Assessment Handbook of the university.

#### **5.2 Notification of assignments and examination arrangements**

Notifications of assignments will be made by your module tutor typically via Emails and/or in classes. The course team will work together to spread the workload of assessments through the course.

It is important to plan your work carefully so that you do not miss any assessments.

Exams take place at the end of Semester 2. Details will be released in due course and you will be notified by the University email and/or by Starfish.

#### **5.3 Referencing**

When you are working on your coursework reports and your thesis, referencing is an important part of your work. The spirit behind the referencing is to acknowledge the contributions from many other people.

## The Harvard Referencing System

The Harvard referencing system is the default choice in this course.

For a given published work, in this referencing system, you give the author's surname and the year of publication when you wish to refer to this piece of work. You also need to present the full details of the publication at the end of your report, including names of the author, year of publication, title, etc, so that this publication can be retrieved if anyone wishes to.

## IEEE Referencing System

There is also another popular referencing system from IEEE (Institute of Electrical and Electronic Engineers). When you are using the IEEE reference style in your work to refer to a publication, you firstly need to assign that publication a numeric index number, then you use this selected number as a code to refer to the publication. At the end of your report, you should give the full details of that publication and also the index number. It is very important that the numbers are used consistently in the IEEE referencing system.

### 5.4 Confidential material

If you are working on data and projects of confidential nature, you should adhere to the principle of confidentiality requirements of the University, e.g., signing a Non-Disclosure Contract, as well as the General Data Protection Act (GDPR). It is your ethical and legal responsibilities to respect confidentiality and the anonymity of individuals and organizations.

More information can be found by contacting the Ethics Committee of the University.

### 5.5 Cheating, plagiarism, collusion or re-presentation

Please refer to the information included in section 6.6 of the University Student Handbook for full definitions. The University uses an online Assessment Tool called Turnitin. A pseudo-Turnitin assignment will be set up using the School space on Blackboard to allow students to check as many drafts as the system allows before their final submission to the 'official' Turnitin assignment. Students are required to self-submit their own assignment on Turnitin and will be given access to the Originality Reports arising from each submission. In operating Turnitin, Schools must take steps to ensure that the University's requirement for all summative assessment to be marked anonymously is not undermined and therefore Turnitin reports should either be anonymised or considered separately from marking. Turnitin may also be used to assist with plagiarism detection and collusion, where there is suspicion about individual piece(s) of work.

## 6. Classification of Awards

The University publishes the principles underpinning the way in which awards and results are decided in [Academic Regulations](#). Decisions about the overall classification of awards are made by Assessment Boards through the application of the academic and relevant course regulations.

To meet the requirements of MSc award, you must earn 180-credit, i.e., you pass 9 modules (20-credit for each) with 50% or above.

The award will be an MSc in Applied Data Science.

The classification of awards is as follows:

Distinction: 70%-100%

Merit:	60%-69%
Pass:	50%-59%
Fail:	0%-49%

## **Exit Awards**

See Programme Specification for details on other exit awards.



### **7. Student Feedback**

You can play an important part in the process of improving the quality of this course through the feedback you give.

There are a variety of mechanism for you to feedback about your experience of teaching and learning. This includes in-class feedback to your module tutor, leaving messages at on-line module forum, completing a module questionnaire etc. We aim to respond to your feedback and let you know our plans for improvement.

The Students' Union works closely with the University to ensure that your voices are heard in all aspects of student life. We encourage you to provide constructive feedback throughout your life here at UCLan so that we can have a better and better University to work together.

#### **7.1 Student Staff Liaison Committee meetings (SSLCs)**

Details of the Protocol for the operation of SSLCs is included in section 8.2 of the University Student Handbook. The purpose of a SSLC meeting is to provide the opportunity for course representatives to feedback to staff about the course, the overall student experience so that the future courses can be improved. These meetings are normally scheduled once per semester and it will be administered at the school level.

## **8. Appendices**

### **8.1 Programme Specification(s)**

**UNIVERSITY OF CENTRAL LANCASHIRE**

**Programme Specification**

This Programme Specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided.

***Sources of information on the programme can be found in Section 17***

<b>1. Awarding Institution / Body</b>	University of Central Lancashire
<b>2. Teaching Institution and Location of Delivery</b>	University of Central Lancashire (Preston Main Campus)
<b>3. University School/Centre</b>	School of Engineering
<b>4. External Accreditation</b>	Institution of Engineering and Technology (IET) (to be accredited after 1 <sup>st</sup> graduating cohort)
<b>5. Title of Final Award</b>	MSc Applied Data Science
<b>6. Modes of Attendance offered</b>	Full time / Part time
<b>7a) UCAS Code</b>	
<b>7b) JACS Code</b>	H100 / (100184 – HECoS code)
<b>8. Relevant Subject Benchmarking Group(s)</b>	<b>QAA Subject Benchmarking Statement: Engineering (2015)</b>
<b>9. Other external influences</b>	<b>Engineering Council UK-SPEC, Accreditation of Higher Education Programmes by IET (3<sup>rd</sup> Edition) QAA: The UK Quality Code for Higher Education</b>
<b>10. Date of production/revision of this form</b>	April 2018
<b>11. Aims of the Programme</b>	
<ul style="list-style-type: none"> <li>• <b>To provide graduate level education targeting awards for MSc Applied Data Science, with alternative exit awards for PGDip and PGCert</b></li> <li>• <b>To meet the Institution of Engineering and Technology's accreditation requirements</b></li> <li>• <b>Produce graduates with the principles and knowledge to work on modern data science</b></li> <li>• <b>Equip students with research and problem solving skills in relevant topics</b></li> <li>• <b>To produce engineers with skills and experience appropriate for a career in data science and its applications across a range of areas</b></li> </ul>	

<b>8. Learning Outcomes, Teaching, Learning and Assessment Methods</b>
<b>A. Knowledge and Understanding</b>
A1. Demonstrate knowledge and understanding of fundamental concepts in data science
A2. Demonstrate knowledge, understanding and skills in using methods and tools in data science
A3. Appraise current trends and developments in industrial applications of data science
<b>Teaching and Learning Methods</b>
Teaching and learning methods include lectures, tutorials, seminars, practical lab sessions, design and case studies, directed self-study and project work.
<b>Assessment methods</b>
Two different types of assessment methods will be used as specified in the module. Written assessment methods include exams, coursework reports and project thesis. Other assessment methods include interviews, presentations, lab based demonstration
<b>B. Subject-specific skills</b>
B1. Apply data science related theories and techniques to solve a significant problem
B2. Plan, manage and execute a data science project with uncertainties or in unfamiliar situations
B3. Critical evaluate results of project, using quantitative skills where appropriate
B4. The ability to generate an innovative design for products, system, components to fulfil new needs
<b>Teaching and Learning Methods</b>
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<b>Assessment methods</b>
Two different types of assessment methods will be used as specified in the module. Written assessment methods include exams, coursework reports and project thesis. Other assessment methods include interviews, presentations, lab based demonstration
<b>C. Thinking Skills</b>
C1. Evaluate customer needs and define the problem effectively
C2. Assess strengths and limitations of the techniques and future directions



C3. Evaluate the wider economic, environmental, legal and social context of the subject to promote sustainable development

**Teaching and Learning Methods**

Teaching and learning methods include lectures, tutorials, seminars, practical lab sessions, design and case studies, directed self-study and project work.

**Assessment methods**

Written assessment methods include exams, coursework reports and project thesis.

Other assessment methods include interviews, presentations, lab based demonstration.

**D. Other skills relevant to employability and personal development**

D1. Apply skills in effective use of literature and general IT facilities

D2. Work effectively both individually and as part of a team, communication skills

D3. Plan self-learning as the foundation for lifelong learning/CPD and reflection on Continuous Professional Development to improve performance

**Teaching and Learning Methods**

Teaching and learning methods include lectures, tutorials, seminars, practical lab sessions, design and case studies, directed self-study and project work.

**Assessment methods**

Written assessment methods include exams, coursework reports and project thesis.

Other assessment methods include interviews, presentations, lab based demonstration

13. Programme Structures*				14. Awards and Credits*
Level	Module Code	Module Title	Credit rating	
Level 7	EL4895 (Core)	MSc Project (Engineering)	60	<p><b>MSc Applied Data Science</b> Requires 180 credits at Level 7.</p> <p><b>PGDip Applied Data Science</b> Requires 120 credits at Level 7.</p> <p><b>PGCert Applied Data Science</b> Requires 60 credits at Level 7 Artificial Intelligence and Machine Learning and/or Big Data Analytics and Visualization</p> <p><b>PGCert Internet of Things</b> Requires 60 credits at Level 7 Internet of Things (Exclude above combination)</p> <p><b>PGCert Data Studies</b> Requires 60 credits at Level 7 (Exclude above combinations)</p>
	EL4166 (COMP)	Research methods	20	
	EL4011 (COMP)	Artificial Intelligence and Machine learning	20	
	EL4012 (COMP)	Internet of Things	20	
	EL4016 (COMP)	Big Data Analytics and Visualization	20	
	EL4013 (COMP)	Programming with Data	20	
	EL4015	Object-Oriented Software Development	20	
	EL4147	Digital Signal and Image Processing B	20	
	EL4014	Visual Information Processing	20	

	ER4706	Applied Instrumentation	20	
	EL4007	Advanced Robotics and Intelligent System Design	20	

### 15. Personal Development Planning

Each student will have an Academic Advisor who will meet with the students regularly to discuss the progresses of students' study here.

The University also has a Careers Service which offers guidance and support for the PDP of the students.

### 16. Admissions criteria \*

(including agreed tariffs for entry with advanced standing)

*\*Correct as at date of approval. For latest information, please consult the University's website.*

Students will be informed of their personal minimum entry criteria in their offer letter. Applicants will normally be required to have, one of:

Hons Degree in STEM areas. 2:2 degree or higher which includes programming module(s).

Applicants who do not meet the above requirements can be considered individually subject to interview.

Applicants might be interviewed if the course team deems it necessary.

Applicants whose 1<sup>st</sup> language is not English will be required to have a minimum level of proficiency required by the University for postgraduate studies. Please consult the UCLan admissions department for the most up to date requirements.

For optional modules EL4007 (Advanced Robotics and Intelligent System Design) and EL4147 (Digital Signal and Image Processing B), students should satisfy the pre-requisites defined in the module descriptors. Specifically,

EL4007 – EL3007, or equivalent

EL4147 – EL3147, or EL3102 or equivalent

### 17. Key sources of information about the programme

- University website: [www.uclan.ac.uk](http://www.uclan.ac.uk)
- School website: [www.uclan.ac.uk/schools/engineering](http://www.uclan.ac.uk/schools/engineering)
- Course leader: Y Zhou

## 18. Curriculum Skills Map

Please tick in the relevant boxes where individual Programme Learning Outcomes are being assessed

Level	Module Code	Module Title	Core (C), Compulsory (COMP) or Option (O)	Programme Learning Outcomes												
				Knowledge and understanding			Subject-specific Skills				Thinking Skills			Other skills relevant to employability and personal development		
				A1	A2	A3	B1	B2	B3	B4	C1	C2	C3	D1	D2	D3
LEVEL 7	EL4895	MSc Project	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	EL4166	Research Methods	COMP			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	EL4011	Artificial Intelligence and Machine learning	COMP	✓	✓		✓		✓			✓		✓		
	EL4012	Internet of Things	COMP		✓	✓	✓	✓		✓		✓	✓	✓		
	EL4016	Big Data Analytics and Visualization	COMP	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	
	EL4013	Programming with Data	COMP	✓	✓		✓	✓	✓			✓		✓	✓	
	EL4147	Digital Signal and Image Processing	O		✓		✓	✓	✓			✓		✓	✓	
	EL4014	Visual Information Processing	O		✓	✓	✓		✓	✓		✓		✓		
	EL4015	Object Oriented Software Development	O		✓		✓				✓	✓		✓	✓	
	ER4706	Applied Instrumentation	O		✓	✓	✓	✓			✓	✓	✓	✓	✓	
	EL4007	Advanced Robotics and Intelligent System Design	O		✓	✓	✓	✓		✓		✓	✓	✓		

**Note:** Mapping to other external frameworks, e.g. professional/statutory bodies, will be included within Student Course Handbooks

## 19. LEARNING OUTCOMES FOR EXIT AWARDS:

For **each exit award available**, list learning outcomes relating to the knowledge and understanding, subject specific skills, thinking, other skills relevant to employability and personal development that a typical student might be expected to gain as a result of successfully completing each level of a course of study.

For example a student may be able to critically analyse something by the time that they complete the target award but at diploma level they might only be able to outline it and at certificate level list.

For a standard BA/BSc (Hons) award the exit award learning outcomes for CertHE (Level 4) and DipHE (Level 5), BA/BSc (Level 6) should be included; for a postgraduate Masters, this would normally be PGDip and PGCert.

### **Learning outcomes for the award of: \_\_\_ PGDip Applied Data Science \_\_\_**

- A1. Demonstrate knowledge and understanding of fundamental concepts in data science
- A2. Demonstrate knowledge, understanding and skills in using methods and tools in data science
- A3. Appraise current trends and developments in industrial applications of data science
  
- B1'. Apply data science related theories and techniques to solve problems
- B2'. Plan, manage and execute a data science project
- B3. Critically evaluate results of project
- B4. The ability to generate an innovative design for products, system, components to fulfil new needs
  
- C1. Evaluate customer needs and define the problem effectively
- C2. Assess strengths and limitations of the techniques and future directions
- C3. Evaluate the wider economic, environmental, legal and social context of the subject
  
- D1. Apply skills in effective use of literature and general IT facilities
- D2. Work effectively both individually and as part of a team, communication skills
- D3. Plan self-learning as the foundation for lifelong learning/CPD and reflection on Continuous Professional Development to improve performance

### **Learning outcomes for the award of: \_\_\_\_\_ PGCert Applied Data Science \_\_\_\_\_**

- A1'. Demonstrate knowledge and understanding of fundamental concepts in applied data science
- B1'. Apply data science related theories and techniques to solve problems
- C1. Evaluate customer needs and define the problem effectively
- C3. Evaluate the wider economic, environmental, legal and social context of the subject
- D1. Apply skills in effective use of literature and general IT facilities

### **Learning outcomes for the award of: \_\_\_\_\_ PGCert Internet of Things \_\_\_\_\_**

- A1. Demonstrate knowledge and understanding of fundamental concepts in Internet of Things
- B1". Apply related theories and techniques to solve problems
- C1. Evaluate customer needs and define the problem effectively
- C3. Evaluate the wider economic, environmental, legal and social context of the subject
- D1. Apply skills in effective use of literature and general IT facilities

**Learning outcomes for the award of: \_\_\_\_\_ PGCert Data Science \_\_\_\_\_**

A2. Demonstrate knowledge, understanding and skills in using methods and tools in data science

B1'. Apply data science related theories and techniques to solve problems

C1. Evaluate customer needs and define the problem effectively

C3. Evaluate the wider economic, environmental, legal and social context of the subject

D1. Apply skills in effective use of literature and general IT facilities