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Programme Specification

**Title of Course:

BSc (Hons) Data Science**

**Date Specification Produced: July 2017**

**Date Specification Last Revised: September 2019**

This Programme Specification is designed for prospective students, current students, academic staff and potential employers. It provides a concise summary of the main features of the programme and the intended 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. More detailed information on the teaching, learning and assessment methods, learning outcomes and content of each module can be found in the Course Handbook and Module Descriptors.

**SECTION 1: GENERAL INFORMATION**

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| **Title:** | BSc (Hons) Data Science; |
| **Awarding Institution:** | Kingston University |
| **Teaching Institution:** | Kingston University  |
| **Location:** | Penrhyn Road |
| **Programme Accredited by:** |  |

# SECTION 2: THE PROGRAMME

## Programme Introduction

This course builds on the established strengths of the Mathematics and Computer Science programmes and develops a multidisciplinary approach to the computational analysis of data. Contemporary society faces new challenges in the analysis of data – predictive analytics in support of decision making processes which are both mathematical and computational – and as a result there is an increasing demand for data-savvy professionals both in industry and in research who are able make sense of large amounts of data and solve major problems. Data science is a multidisciplinary domain and in this BSc programme students follow a carefully-designed path through a curriculum that includes mathematics, statistics and computer science.

Data Science is one of the most rapidly expanding areas of employment globally, due to rapid and ongoing developments in computer systems and data gathering. Large data sets are now widespread in business, science and government. In some areas they manifest as “big data” but irrespective of this, the manipulation of large datasets has applications in the sciences, finance, retail, and particularly the digital economy, “internet of things” and social media.

For example Google is continually updating the data models and algorithms that its search engine uses to identify and rank millions of webpage hits in a fraction of a second. These algorithms use artificial intelligence techniques and although Google does not reveal precise details of the methods that it employs – the algorithms are far too valuable for that – they are based on the same underlying principles as are taught in this programme.

This course is an applications-focussed programme that targets a wide range of roles, such as Data Scientist, Data Analyst and Data Engineer, across a broad spectrum of employers, including the creative arts, telecommunication and management consultancy. It constitutes a coherent, academically sound programme of study covering the modern methods required to solve problems in the evolving field of data science, together with the development of broader computing and analytical skills. A successful student will, by the very nature of the course, have acquired specialist knowledge useful for the investigation and solution of quantitative problems in commerce and industry and have developed highly valued logical and analytical thought processes. In addition there is a strong focus on setting the application of the mathematics and statistics applied to data science in context – providing students with relevant commercial and social awareness and appropriate professional skills for their future career development. Data scientists tend to work within, or head-up, multidisciplinary teams and so throughout the course opportunities for the development of a range of key skills are embedded (in areas such as communication, teamwork, time and task management, and research). This broad range of skills is essential for employment and also prepares students for further study leading to a postgraduate taught or research-based qualification.

Fundamentally the course curriculum develops computational, mathematical and statistical skills that are related to the analysis, manipulation and modelling of data, which are the key technical skills of a data scientist. The theme developing professional skills culminates in students undertaking a substantial piece of independent study requiring research skills and drawing together strands from earlier study, taking their communication skills to new levels and allowing them to design and create solution implementations or other appropriate artefacts. A distinctive feature of this theme from Level 4 to Level 6 is that students from this course will work in groups together with students from other (mathematics and IT-based) disciplines on real-world case-studies developing their own professional skills and awareness of their place in the wider professional world.

The course is delivered by highly experienced and qualified expert staff, all with doctorates in their fields of expertise. Our research strengths most relevant to data science are in the fields of digital imaging, computer vision, wireless and mobile communications technologies and information systems. Research expertise and knowledge feeds directly into the taught courses and the School of Computer Science and Mathematics (CSM) has a long-standing reputation for providing a supportive learning environment for students.

The School’s overarching teaching ethos is discussed further in section F below but it is based on the principle that students should be engaged in active learning wherever possible. A largely problem-centred learning approach is adopted, whereby students begin with the problems of interest and learn the necessary theory and techniques required to solve them. Within this environment, traditional lectures are rare and the majority of class sessions are in workshop or large and small group tutorial format. Many of the problems considered, particularly those which are assessed, come from real-world applications. In order to facilitate the investigation of such problems, as well as mirror the situation in employment, extensive use is made of computational support. Students gain broad computing skills as well as experience of a variety of up to date professional, industry-standard software packages deployed on the university’s modern computing facilities which also makes them available to students off-site. The format of assessments is varied, although there are some traditional tests and examinations there is also an emphasis on more authentic assessments, which could be from business or research contacts in local SMEs like JPY Ltd or colleagues working with “big data” in the NHS. For example students investigate case-studies, individually and in groups, writing reports and giving oral presentations, typically they produce applications, simulations, posters, videos, schedules/quotations for customers, write articles etc. In some cases the topics or target audience for these will be defined by the student in consultation with the teaching staff which allows students to express their individuality and appreciate the diversity within course. In this way, as they progress through the course, students are able to assemble a portfolio of tangible outputs which evidence, explicitly, the knowledge and skills they have gained and which may be used to demonstrate their capabilities to future employers in a format that can be influenced by the students’ own preferences.

We continuously update our module content and themes to reflect the latest advances in the industry – for example while providing the essential knowledge about computer programming, databases and project management techniques, we also expose our students to the latest data visualisation approaches and data mining techniques. To support this we invest heavily in providing the latest equipment in the specialist computing laboratories of the School. These provide facilities such as multimedia equipment, games consoles, cameras and robotic units, and work in labs equipped with the latest networking hardware, high-spec PCs, Apple Macs and gaming consoles.

The Data Science degree course is interdisciplinary in nature and therefore (partially) satisfies the requirements of the computing, mathematics and statistics professions, allowing students to play to their strengths as their career preferences solidify. Students can choose to join the British Computer Society (BCS), Institute of Mathematics and its Applications (IMA) and/or the Royal Statistics Society (RSS) as student members. After graduation a period of relevant employment can lead to membership of one or more professional bodies and may lead to Chartered status.

The programme is informed by both the QAA subject benchmarks for mathematics and computer science, as well as the accreditation guidelines of the British Computer Society, and will aim to achieve recognition by the British Computer Society, which recently was awarded to all of the School’s Computer Science and Games programmes

## Aims of the Field/Course

The Data Science undergraduate programme introduces students to the developing area of data science, which is at the exciting intersection of mathematics and computer science. The programme addresses the issues raised by data analysis and “big data” (large-scale data analysis) through a broad, modern curriculum, that develops graduates with skills needed to analyse large data sets and to present information and findings in an appropriate form and format for a range of possible stakeholders in industry through the application of a core of mathematical, statistical and computer science knowledge. Specifically the aims are to produce graduates who:

* have the required knowledge, skills and attitudes to practice as professionals in both industry and commerce
* are equipped to meet the academic, professional and practical requirements for membership of appropriate professional bodies such as the British Computer Society
* possess the appropriate ability and inclination, and are equipped, to undertake advanced studies and/or research and development in the computing and information systems disciplines
* understand the legal, ethical, social, cultural and public aspects of problems and solutions
* are able to seek, use and communicate relevant information effectively in oral, visual and written forms
* are able to work in groups and individually, and to work for and with non-specialists

The course is ideal for students who are interested in developing and applying problem-solving skills to real world problems, would like to develop their understanding of mathematics and statistical techniques, and methods to interpret data. With a balance of solid theory and practical application, this course builds on knowledge in relevant areas of statistics, data analysis, probability and programming.

The course is designed to not require a mathematics or statistics A-level or equivalent and does not assume significant prior knowledge of programming. However an interest and enthusiasm for both data analysis and computing would be a valuable pre-requisite.

## Intended Learning Outcomes

The course provides opportunities for students to develop and demonstrate knowledge and understanding specific to the subject, key skills and graduate attributes in the following areas. The programme outcomes are referenced to the QAA subject benchmarks for mathematics and computer science, and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008), and relate to the typical student.

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| **Programme Learning Outcomes** |
|  | **Knowledge and Understanding**On completion of the course students will be able to: |  | **Intellectual Skills**On completion of the course students will be able to: |  | **Subject Practical Skills**On completion of the course students will be able to: |
| A1 | apply mathematical and statistical; techniques to a variety of problems demonstrating an appropriate mastery of the underpinning theory. | B1 | analyse, abstract and decompose problems to design effective models and solutions. | C1 | use appropriate software effectively to assist with large-scale data analysis, interpretation and prediction. |
| A2 | demonstrate awareness and understanding of key issues (ethical, legal, social, professional) relating to employment in the modern world. | B2 | synthesise information from disparate and potentially incomplete sources to model systems and create, documents and other related artefacts. | C2 | collaborate and communicate effectively with other professionals/stakeholders to plan, design, manage, implement and deliver data science projects. |
| A3 | select and apply knowledge appropriate to specific situations, particularly unfamiliar situations. | B3 | identify appropriate mathematical methods and any relevant computer applications, to assist in the solution of problems. | C3 | implement data science solutions using a variety of software environments. |
| A4 | explain the different ways in which data and information may be represented, stored and transmitted. | B4 | build upon the experience and responsibility gained as a result of the practical application of the skills acquired during the course to make a significant contribution as a data professional within an organization. |  |  |

In addition to the programme learning outcomes identified overleaf, the programme of study defined in this programme specification will allow

students to develop a range of Key Skills as follows:

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| **Key Skills** |
| **Self-Awareness Skills** | **Communication Skills** | **Interpersonal Skills** | **Research and information Literacy Skills** | **Numeracy Skills** | **Management & Leadership Skills** | **Creativity and Problem Solving Skills** |
| Take responsibility for own learning and plan for and record own personal development | Express ideas clearly and unambiguously in writing and the spoken work | Work well with others in a group or team | Search for and select relevant sources of information | Collect data from primary and secondary sources and use appropriate methods to manipulate and analyse this data | Determine the scope of a task (or project) | Apply scientific and other knowledge to analyse and evaluate information and data and to find solutions to problems |
| Recognise own academic strengths and weaknesses, reflect on performance and progress and respond to feedback | Present, challenge and defend ideas and results effectively orally and in writing | Work flexibly and respond to change | Critically evaluate information and use it appropriately | Present and record data in appropriate formats | Identify resources needed to undertake the task (or project) and to schedule and manage the resources | Work with complex ideas and justify judgements made through effective use of evidence |
| Organise self effectively, agreeing and setting realistic targets, accessing support where appropriate and managing time to achieve targets | Actively listen and respond appropriately to ideas of others | Discuss and debate with others and make concession to reach agreement | Apply the ethical and legal requirements in both the access and use of information | Interpret and evaluate data to inform and justify arguments | Evidence ability to successfully complete and evaluate a task (or project), revising the plan where necessary | Work independently with patience and persistence, pursuing the solution of a problem to its conclusion |
| Work effectively with limited supervision in unfamiliar contexts |  | Give, accept and respond to constructive feedback | Accurately cite and reference information sources | Be aware of issues of selection, accuracy and uncertainty in the collection and analysis of data | Motivate and direct others to enable an effective contribution from all participants |  |
|  |  | Show sensitivity and respect for diverse values and beliefs | Use software and IT technology as appropriate |  |  |  |

## Entry Requirements

The minimum entry qualifications for the programme are:

From A levels: 112 points (“BBC”), General Studies not accepted.

To include at least one full A-level equivalent with a strong computing and/or numeracy component such as A-Level Computing or Computer Science or ICT, AS/A-Level Mathematics or Statistics or Further Mathematics, BTEC Level 3 Qualification in ICT, Applied Science or Engineering, A-Level Physics or Chemistry.

BTEC National: 112 points: Distinction, Merit, Merit.

Access Diploma: 60 credits overall 45 at level 3 the remainder from level 3 or level 2.

Computing or Mathematics Foundation Year.

Plus: GCSE (A\*–C): five subjects, including English Language and Mathematics.

A minimum overall IELTS score of 6.0 with a minimum of 5.5 each element, iBT TOEFL 80 with R at 20, L at 19, S at 21 and W at 20 or equivalent is required for those for whom English is not their first language.

We will consider a range of alternative qualifications or experience that is equivalent to the typical offer. Applications from international students with equivalent qualifications are welcome.

## Field/Course Structure

This programme is offered in full-time and part-time mode, and leads to the award of BSc (Hons). Entry is normally at Level 4 with A-level or equivalent qualifications (See section D). Transfer from a similar course is possible at Level 5 with passes in comparable Level 4 modules but is at the discretion of the Course Director. Intake is normally in September.

### E1. Professional and Statutory Regulatory Bodies

### E2. Work-based learning, including sandwich courses

KU Talent; the University’s career service, has a specific team for the faculty that helps source industrial placements. Placement specialists within the KU Talent team help students throughout the application process, with support interviews and throughout the transition to work, for example, with mock interview sessions, CV workshops, careers fairs and industry speakers on employers’ needs. The team monitors the student whilst in industry. Placement students are visited whilst in industry by a network of academics who act as individual placement tutors.

Work placements are actively encouraged – although it is the responsibility of individual students to source and secure such placements. This allows students to reflect upon their own personal experience of working in an applied setting, to focus on aspects of this experience that they can clearly relate to theoretical concepts and to evaluate the relationship between theory and practice.

### E3. Outline Programme Structure

*BSc (Hons) Data Science*

 **LEVEL 4 LEVEL 5 LEVEL 6**

**INDUSTRIAL PLACEMENT**

MA6550 Practical Applications of Advanced Statistics

MA5550 Modelling Real-World Data with Statistics

MA4550 Practical Data Analyst Skills

CI4105 Programming 1: -Thinking like a Programmer

MA6610 Data Mining and Data Visualisation

CI5320 Database-Driven Application Development

MA6600 Artificial Intelligence and Machine Learning

MA5600 Mathematical and Software Skills for the Data Science Industry

MA4600 Introductory Mathematics for Data Science

CI6600 Individual Project

CI5450 Professional Environments 2

CI4450 Professional Environments 1

Each level is made up of four modules each worth 30 credit points. Typically a student must complete 120 credits at each level. All students will be provided with the University regulations and specific additions that are sometimes required for accreditation by outside bodies (e.g. professional or statutory bodies that confer professional accreditation). Full details of each module will be provided in module descriptors and student module guides.

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| **Level 4** (all core) |
| **Compulsory modules** | **Module code** | **Credit** **Value** | **Level**  | **Teaching Block** |
| Practical Data Analyst Skills | MA4550 | 30 | 4 | 1 & 2 |
| Introductory Mathematics for Data Science | MA4600 | 30 | 4 | 1 & 2 |
| Programming 1 - Thinking like a Programmer | CI4105 | 30 | 4 | 1 & 2 |
| Professional Environments 1 | CI4450 | 30 | 4 | 1 & 2 |

Progression to Level 5 requires 120 credits at Level 4.

Students exiting the course at this point who have successfully completed 120 credits are eligible for the award of Certificate of Higher Education in Data Science.

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| **Level 5** (at least 60 credits = core) |
| **Compulsory modules** | **Module code** | **Credit** **Value** | **Level**  | **Teaching Block** |  |
| Modelling Real-World Data with Statistics | MA5550 | 30 | 5 | 1 & 2 |  |
| Mathematical and Software Skills for the Data Science Industry | MA5600 | 30 | 5 | 1 & 2 |  |
| Database-Driven Application Development | CI5320 | 30 | 5 | 1 & 2 |  |
| Professional Environments 2 | CI5450 | 30 | 5 | 1 & 2 |  |

Progression to level 6 requires 120 credits at level 5.

Students exiting the programme at this point who have successfully completed 240 credits are eligible for the award of Diploma of Higher Education in Data Science.

Students who are on the sandwich course take the placement module CI5999 Industrial Placement

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| **Industrial Placement** (60 credit) for students on sandwich course |
| **Compulsory modules** | **Module code** | **Credit** **Value** | **Level**  | **Teaching Block** |  |
| Industrial Placement | CI5999 | 60 | 5 | 1 and 2 |  |

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| **Level 6** (at least 60 credits = core) |
| **Compulsory modules** | **Module code** | **Credit** **Value** | **Level**  | **Teaching Block** |  |
| Practical Applications of Advanced Statistics | MA6550 | 30 | 6 | 1 & 2 |  |
| Artificial Intelligence and Machine Learning | MA6600 | 30 | 6 | 1 & 2 |  |
| Data Mining and Data Visualisation | MA6610 | 30 | 6 | 1 & 2 |  |
| Individual Project | CI6600 | 30 | 6 | 1 & 2 |  |

At Level 6 the mark for the compulsory project module (CI6600 Individual project) cannot be compensated.

### Student “learning journey” – the development of knowledge and skills

The core knowledge and skills required for Data Scientists in employment, together with those skills that contribute to their ability to develop as undergraduates as well as post-graduation are developed in this course as follows.

(Bold arrows 🡺 indicate growth or development; thin arrows 🡪 suggest a link or supporting activity and colours represent intensity or significance.)

#### Mathematical and statistical knowledge and data analysis skills (Data Science theory and practice)

The applied use of industry-standard software starts in MA4550 and MA4600 where assessed outputs include presentations of outcomes from a survey and a mathematical modelling exercise, guided at Level 4 by module teams and Personal Tutors. The software knowledge base expands (in parallel with CI5450) with coursework using statistical software to collect and interpret (visualize) data in MA5550 and in MA5600 R and Python are used to present analyses of authentic datasets (real-world, research-based or synthetic from a simulated problem) in report and poster form. In the final year the use of software to visualize (MA6610) and model (MA6550), mine and make predictions from data (MA6600) are taught and assessed through the production of business client-oriented reports and visualizations. The capstone project (CI6600) draws these threads together in a project that is driven by the student’s aspirations and preferences, guided by their Personal Tutor and supervisor, selecting some of the tools and techniques to illustrate professional skills.

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| **Mathematics and Statistics** | MA4450, MA4600(small datasets & models) | 🡺 | MA5550, MA5600(sophisticated data) | 🡺 | MA6550, MA6600, MA6610(increased scale and sophistication) |
| 🡩 |  | 🡹 |  | 🡻 |
| CI4105(programming support) |  | CI5450(programming development) |  | CI6600(capstone dissertation) |

#### Programming knowledge and skills (information literacy for Data Science)

The development of experience using subject- and employment-specific software together with the ability to manipulate data through software and scripting (programming) starts with CI4105, which uses a state-of-the-art programming environment and pedagogy to introduce all students, regardless of prior experience, to programming, which is extended in CI5450 to the data science context through Python (the “glue language” widely-used in industry) in preparation for a capstone application in CI6600, where, guided by a member of staff, students choose a project showcasing the gamut of skills and knowledge acquired in a “product” suited for publication in the student’s portfolio (which in itself was introduced and curated through CI4450 and CI5450).

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| **Programming knowledge and skills** |
| CI4105(introduce) | 🡺 | CI5450(extend) | 🡺 | CI6600(apply) |

#### Communication skills (presenting work; giving, receiving and acting on feedback)

Presentations, reports, data models, mathematical models, visualizations and posters feature across the programme. The use of presentation and document-writing software to create these artefacts is guided through workshops in CI4450 and CI5450, whilst the information being presented increases in sophistication from MA4450 and MA4600 (small datasets and summary statistics with interpretation) through MA5550 and MA5600 (larger datasets, modelled and interpreted) to CI5320 (databases and information modelling), MA6550 (poster presentations in a mini conference format based on a predictive statistics application), MA6600 (interpretation of datamining) and MA6610 (impact and user experience of the visualization of large datasets).

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| **Communication** | MA4450, MA4600(small scale) | 🡺 | MA5550, MA5600, CI5320(sophisticated models) | 🡺 | MA6550, MA6600, MA6610(increased scale) |
| 🡩 |  | 🡩 |  | 🡻 |
| CI4450(support *via* portfolio) | 🡺 | CI5450(support *via* portfolio) |  | CI6600(capstone dissertation) |

#### Group work and the ability to work in teams

The course strategy is to carefully introduce and teach the practice of group work in Level 4 and use it quite intensively whilst the assessment stakes are low to establish good habits and models of group working, use it within summative assessments at Level 5 where the assessment stakes are higher but the contribution to the final degree classification is still relatively low and to develop it at Level 6 with typically one summative activity. As such, group assessments are used in 2 out of 4 modules at Level 4, summatively in 2 out of 4 modules at Level 5 and with two cohort-level activities rather than small group assessment at Level 6:

* CI4450 introduces the practice and process of group work; group working skills are demonstrated, taught and assessed in collaboration with colleagues from the Directorate for Student Achievement (KU Talent *etc.*) with assessed coursework in cross-disciplinary groups, timetabled group workshops (simulating a workplace environment) where attendance is expected and absence must be accounted for, and, typically, using project topics related to industry or research
* MA4550 summatively assesses group work (and thereby embeds the practice from CI4450) as part of a survey design and data collection coursework, which leads to a group presentation where students give and receive formative peer feedback
* CI4105 simulates professional software development practices, reinforcing the employability message without overburdening students
* CI5450 continues the professional emphasis with cross-discipline, industry-driven projects, with summatively assessed project management skills being developed to build on the group experience in CI4450
* CI5320 further develops the industry simulation with assessed group work built-in to workshops, close monitoring and feedback from the teaching staff as simulated “employers” in the second half of the module
* MA6550 and CI6600 (the capstone project) give opportunities to celebrate student’s work and to receive feedback from peers (MA6550), University staff (both) and employers (CI6600) in poster or conference settings.

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| **Group work** | CI4105(development in groups) |  |  |  |  |
| 🡻 |  |  |  |  |
| MA4450(uses & assesses by model) | 🡺 | CI5320(uses & assesses by model) | 🡺 | MA6550(receive/give peer feedback) |
| 🡹 |  | 🡩 |  | 🡻 |
| CI4450(teaches, supports & establishes model)  | 🡪 | CI5450(revisits model) |  | CI6600(receive peer & other feedback) |

## Principles of Teaching, Learning and Assessment

### Introduction

Data Science draws upon research and teaching activities across the School: There is current extensive teaching expertise in mathematics, statistics, programming and algorithms throughout the School, as well as research in aspects of Data Science, ranging from the security domain to medical applications and the *Internet of Things*. Research-informed teaching and projects utilising business and research datasets will enable Data Science students to benefit from the proximity of this research whilst studying within the School.

The overall ethos of teaching on this course is one of *active learning* – all teaching sessions will involve students as active participants and not passive listeners. Moreover, where possible classes will be structured around the investigation, analysis and/or solution of *problems* (so-called “problem-centred learning”) where students take an active role in discovering and building their own knowledge, and the lecturer supports this process with a hands-on approach in the classroom; any lecturing that’s necessary in this mode of teaching will always be short and active, for example making use of a classroom response system.

The School’s underpinning assessment strategy is “learning through making”, that is to support students’ learning through the tackling of problems leading to the construction of various artefacts intended to form part of a professional portfolio.

In Data Science these will support students in applying for placements and future work by evidencing skills, knowledge and experience. Typical examples include

* software scripting (production of code and datasets through level 4 and 5 modules, including with Python),
* mathematics for data science (developing models using Maple or MATLAB in level 4),
* data cleaning and interpretation (with a survey-based assignment in level 4 and a student-contributed dataset in level 5),
* data modelling (building and testing models with SAS and R in level 5, and creating a poster in level 6),
* data visualisation (starting with simple datasets in level 5 and multidimensional, “big” data in level 6), and
* predictive modelling & machine learning (with the application of AI to a contemporary data-driven problem in level 6).

Students will be guided by their Project Supervisor, Personal Tutor or Course Director to develop a final year (Level 6) project that showcases these skills and application of knowledge, as a capstone entry in the Personal Portfolio that was introduced and curated throughout the level 4 and level 5 *Professional Environments* modules.

In Data Science industry-relevant software is particularly important and will be used to support the development of technical skills in computing, mathematics and statistics. Alongside this the course will take advantage of the subject and School’s resources to use real-world data in an environment that reflects how Data Scientists work: encouraging group work within the Data Science cohort and with students from other courses, where individual strengths and differences are utilised.

In common with modern educational principles, authentic assessment that promotes learning will be the norm. The development of mathematical and statistical knowledge and expertise will be aligned with software-based skills, since Data Scientists rarely work unsupported by technology, and this is assured through the use of coursework developing outputs suitable for inclusion in the student’s professional portfolio and, where necessary, exams that are supported by software, utilise case studies or open book. (These linkages to a subset of the course outcomes and skills are represented in the learning journeys above.)

### Further details

The Data Science BSc course takes advantage of the inclusive curriculum, current curriculum framework and course evolution in CSM by sharing modules with both Computer Science and Mathematics, drawing Personal Tutors and project/assessment topics from across the School and adopting a contemporary teaching style. Emphasis is on workshop & real-life problem solving, with the creation of “products” at the heart of assessed work which will be demonstrated through the production of artefacts utilising industry-standard software and authentic datasets.

The learning and teaching strategies reflect the field aims and learning outcomes, student background, potential employer requirements and the need to develop a broad range of technical and professional skills, with the ability to apply them appropriately. The strategies ensure that students have a sound understanding of some areas in mathematics and statistics which are important in applications and have acquired the transferable skills expected of modern-day graduates.

Learning a subject like data science is often most readily undertaken in the context of the search for solutions to real-life problems. This is reflected in the approach adopted throughout this programme which is problem-centred wherever appropriate. The strategy is to start with a relevant problem then to move forward from there to explore the theory and techniques necessary to investigate that problem. The ‘top down’ approach provides more motivation for students to engage with material/concepts and opportunities for relatable (concrete), inclusive example problems to be used. Students frequently work in groups to tackle these problems both in timetabled sessions and outside, thereby creating a learning community in which the students collaborate with each other and staff. As the students work together in groups, both formatively and summatively, this community supports them automatically allowing for different learning styles and varied backgrounds.

Teaching and learning sessions adopt a hybrid approach based on modern pedagogical principles, with use of appropriate Technology Enhanced Learning (TEL) such as clickers. For any topics where a more formal didactic approach is deemed the most appropriate, the ‘lecture’ delivery will still involve active participation by students, for example, working through exercises and/or using classroom response systems throughout the session. Subject material and corresponding techniques are typically introduced via problem-centred learning often with a tutorial/seminar flipped or ‘partially flipped’ classroom approach to replace traditional lectures.

Canvas, the university’s virtual learning environment, is used extensively in all modules as a communication tool and means of dissemination of learning and reference materials, formative worksheets, assignments, links, videos and lecturer-annotated slides. In this way it acts as a dynamic study guide in each module and going further it provides a structured learning space to support students for independent study, facilitate discussion, and in addition in some modules, for formative and summative tests and surveys. Canvas is also used to facilitate group work, both formatively and summatively. For example in the Professional Environment modules students are introduced to the group collaboration features of Canvas and are encouraged to use the Canvas app to mediate discussion and to collaborate on coursework “artefacts” which can be formatively assessed in the group workshops while the record of collaboration contributes, summatively, to the module’s assessment outcomes.

Study materials, including examples and exercises, are published on Canvas in advance of the time-tabled sessions, to allow students to prepare and fully benefit from classroom time – further, many sessions adopt a flipped or partially flipped approach for which the pre-published materials are essential. The availability of this material assists students from various backgrounds to achieve a common level at the start of the session or to highlight any deficiencies which they can then address with the lecturer.

Students are encouraged to develop as independent learners as they progress through their degree course, this is supported explicitly through, for example, the strand of professional skills modules culminating in the individual project in the final year, and in individual modules through weekly exercises or reading that is given to students on Canvas and the module guide. In some modules (such as CI4450, CI4105 and MA4600) the weekly guided study involves Mentors or Personal Tutors at strategic points in the term, as well as being regularly monitored in class by module teams.

The assessment is regarded as an integral part of our learning and teaching strategy, and incorporates assessment both of and for learning. Ample opportunities are given to students for formative assessment with rapid feedback.

A wide range of assessment mechanisms is used to ensure that students with diverse backgrounds and different strengths and abilities are not disadvantaged and to ensure that our students are capable of tackling many different types of problems. The methods of assessment have been selected so as to be most appropriate for the nature of the subject material, teaching style and learning outcomes in each module and the balance between the various assessment methods for each module reflects the specified learning outcomes. Emphasis is given to authentic assessments based on real-world problems. This allows the students to produce “artefacts” as outcomes of the assessment process, forming a portfolio which provides tangible evidence of their developing skills and knowledge thus enhancing their employment prospects.

The teaching practice is guided by the Higher Education Academy (HEA) considerations for effective practice across subject areas together with Kingston University’s “Excellence in Inclusive Curriculum” initiative. In particular, a collaborative approach is taken which creates a partnership between staff, students, employers and other stakeholders (through the Industrial Advisory Board and by taking advantage of the networks of staff involved in research and enterprise activities, including KTPs). Opportunities to insure that the curriculum is inclusive occur in such forums as the Staff Student Consultative Committees and Boards of Study together with discussions at module and course level. Meetings take place between subject teams to consider subject specific issues. The variety of teaching activities also takes account of the students’ different learning preferences and experiences and there is a careful balance of individual and group based activities, which is assured at the programme level by Boards of Study. The assessment schemes in some modules permit an element of student choice, including a review topic in MA6550 and the dissertation topic in CI6600, allowing the students to customise the assessment to suit their own interests and background, enhancing inclusivity and giving the students a greater sense of ownership of their study.

Marking criteria are provided for all assessments as part of the assessment booklet at the beginning of the year for each module and care is taken to ensure that the language used in the assessment is jargon free, which is checked by the moderator. The case studies used are designed to be inclusive. Examples from the past include “Diversity in Gaming” which is available as a resource on the KU Equality Diversity and inclusion (EDI) website, and the ice-breaker “history of mathematics” poster assignment where the topics set by Personal Tutors reflect the diversity of the cohort.

Feedback, in a variety of formats provides students with guidance in developing skills which are both beneficial for future assessments and highly valued by employers. Feedback in the Professional Environment modules involves the Personal Tutors as a conduit through which feedback is given.

In the final year every student undertakes a 30 credit capstone Individual Project, which draws on and enhances the skills and knowledge developed throughout the programme. This consolidates independent learning skills and typically provides an opportunity for practical application of their academic knowledge to the implementation of a solution or construction of a suitable artefact.

In the programme as a whole, the following components are used in the assessment of the various modules:

* Practical exercises: to assess students’ understanding and technical competence
* Individual and group-based case studies: to assess ability to understand requirements, to provide solutions to realistic problems and to interact and work effectively with others as a contributing member of a team. The outcomes can be:
	+ Written report, where the ability to communicate the relevant concepts, methods, results and conclusions effectively will be assessed.
	+ Oral presentation, where the ability to summarise accurately and communicate clearly the key points from the work in a brief presentation will be assessed.
	+ Poster presentation where information and results must be succinct and eye-catching.
	+ Video, which may replicate features of oral presentations but allows advance preparation away from the audience (which may suit some students better).
	+ Article emphasising the ability to communicate with different audiences.
	+ Simulated client interactions: letters, quotations, etc.
* Multiple choice or short answer questions: to assess competence in basic techniques and understanding of concepts.
* Long answer structured questions in coursework assignments: to assess ability to apply learned techniques to solve simple to medium difficulty problems and which may include a limited investigative component
* Long answer structured questions in end-of-module examinations: to assess overall breadth of knowledge and technical competence to provide concise and accurate solutions within restricted time
* Project: The individual project module represents an opportunity for students to draw together different aspects of their learning on the course and to apply the techniques learned in an extended study. As such the assessment here will place a greater emphasis on ability to plan work, manage time effectively, and research background information, culminating in a written report and demonstration.

At the beginning of each academic year there is a course team meeting at which the delivery of material and assessments is planned with a full calendar being constructed. This ensures:

* that care is taken to avoid summative assessment bunching and thus student workloads are managed;
* synchronized and coherent delivery of material across the programme in a way that is visible both to staff and students, thus enabling assessments to draw on skills and knowledge from an appropriate variety of modules.

Students are expected to develop their skills, knowledge, confidence and understanding through independent and group learning, in the form of guided and self-directed study, and the exploration of the application of data science in the real world, throughout their course. For example basic team-working, investigative, researching and (informal) communication skills are introduced, developed and facilitated through the Professional Practice modules. Students are also introduced to the professional environment surrounding their area of study alongside considerations of ethical behaviour and responsibility. These themes are reinforced with professional development opportunities tailored for each programme level and delivered by colleagues from Student Achievement and KU Talent. Furthermore, all students explore group case studies for data science applications, requiring the collaborative investigation/solution of some real world problems as well as the production of written reports and oral or poster presentations. These foster the development of team-working, research and (formal) communication skills. In the final year all students will carry out research and present the background to and findings of their projects as indicated above. This will enhance their research and investigative skills to explore and master complex new ideas, learn and apply advanced techniques and further develop their independent working and communication skills.

The course team is research active within the Digital Information Research Centre (DIRC), which is dedicated to the advancement of the theory and applicability of computer science to enable internationally-leading work in the field of informatics, addressing the needs of society in the thematic areas of health, communications, security and data. The centre provides an inclusive and outward looking environment for research development, fostering interdisciplinary and multidisciplinary research to achieve maximum impact in real-world applications.

The following areas within the centre are incorporated into the course design:

* *NoobLab* is an online programming environment that has emerged as an artefact from research by the Technology Enhanced Learning Group. Targeted at those students who are new to programming, it provides an immersive learning experience in which practical exercises can be delivered in a stimulating, engaging fashion, with real-time feedback provided to the student as they work and progress at their own pace. The School has internationally recognised research groups that feed into and support student learning through its teaching programme.
* The computer vision activity within the centre has internationally recognised expertise in visual surveillance, medical imaging and intelligent environments. Recently, the centre coordinated a special session of the Computer Vision and Pattern Recognition conference on “Computer Vision for Computer Games”. The Human Body Motion Group within DIRC works on the extraction, analysis and synthesis of human motion using video footage and motion capture data for graphics and games applications. Thus there is good linkage between research and teaching and the teaching team for computer science draws from DIRC members.
* The Wireless Multimedia and Networking Research Group carries out fundamental and applied research on wireless communications and networking, media streaming and closely related fields. It investigates adaptive delivery of media information with an adequate quality of service. Research activity relies on the different fields of information theory, signal processing and applied mathematics, communication theory, wireless networking and security.

Students are also able to develop their research skills which form a fundamental part of Levels 4 to 6’s curriculum. These skills enable students to distinguish and present appropriate evidentiary information in an argument. These skills are greatly valued by employers.

Across the School staff members also engage with research into teaching and learning in Higher Education which feeds through to support learning in lectures and other forms of student engagement during contact time. These activities regularly develop investigative partnerships with students, formally within University projects like “SADRAS” or Faculty “Internships” and also informally, which lead to publications at pedagogical research conferences.

## Support for Students and their Learning

Students are supported by a highly qualified team of academic staff that includes individuals in the following roles:

* A Course Director to help students understand the programme structure
* A Module Leader for each module
* A Personal Tutor to provide academic and personal support

In Level 4 students are supported by a Level 5 student as an Academic Mentor.

Additional support is provided by the following specialist staff:

* Placement specialists within the KU Talent team to give general advice on placements (and a placement tutor to support students during the placement)
* Technical Support to advise students on IT and the use of software
* Library (Learning Resource Centres are available on each campus)
* A designated programme administrator
* English language support for international students

Matters outside the academic arena are supported by:

* Student support facilities that provide advice on issues such as finance, regulations, legal matters, accommodation, international student support etc.
* Disability and dyslexia student support
* A substantial Study Skills Centre that provides academic skills support
* KU Talent (Careers and Employability Service)
* The Union of Kingston Students
* An induction week at the beginning of each new academic session
* Staff Student Consultative Committee
* A virtual learning environment (VLE) available on the university’s intranet
* And the University provides a facility whereby students can email, or phone a designated number to get instant help on a variety of issues.

Support for students begins before enrolment through the Welcome environment on the Kingston University website and in particular Head Start events for Compact students to aid their orientation before the start of the academic year. The students are introduced to all these mechanisms during induction sessions at the beginning of each new academic year. It is here that the level 4 students first encounter the university’s computer network, which includes their personal access to the VLE and how to use it as a learning environment. They are also encouraged to make use of the substantial SEC Academic Study Skills Centre (SASC), an important resource that provides additional help across a range of academic skills and incorporates the MathsAid support facility.

Students are expected to be involved in the development of their programme. On an individual level through meetings with their personal tutors at which they can discuss their academic progress, personal development and can seek advice on course and module choices in the light of their career aspirations. As a cohort, students can contribute to many aspects of programme evolution, for example by student representation on committees including Staff Student Consultative Committees, as well as by their formal and informal feedback such as the mid-module and end-of-module reviews.

In addition, at Level 4, the School works with the Mentoring Team in the Directorate for Student Achievement to run weekly, timetabled Academic Mentor sessions. Here trained Level 5 student Mentors provide academic advice and support to Level 4 students, easing their transition into Higher Education and disseminating the Level 5 students’ experience from their Level 4 studies, as well as enhancing the skills of the Mentors themselves.

### The Personal Tutoring Scheme (PTS)

Students are assigned a member of the academic staff as their Personal Tutor (PT) which they retain for the full three or four-year duration of their time at university. The first contact between student and PT is during Induction Week for an introductory meeting and thereafter the following procedure is followed.

#### Level 4 [settling in and building confidence]

In the first year (Level 4) PTs follow-up the Induction Week contact with a 1-to-1 meeting between weeks 1 and 3 in order to discuss any academic or pastoral issues that might have arisen during this important settling-in period. Employability topics such as the value of industrial placements and internships are introduced; they are encouraged to think about compiling a CV in preparation for their future applications (this is followed up in the professional environments module).

Throughout the first teaching block, some academic sessions based around problem centred learning encourage the students to work together in their tutor groups in formative assessments to facilitate the bonding of these individuals into self-supporting study teams which are intended to endure. In addition selected second year students are recruited as mentors in the Level 4 programme to encourage the community spirit of their course and foster engagement.

Student attendance is closely monitored from the first teaching week. In the Professional Practice module this includes monitoring attendance and participation in group (team-based) workshops where students are developing their group working skills. Those absent from classes are contacted by their tutor to determine whether they need additional support. This is to address the danger of poor attendance at the beginning of the course which can be associated with poor academic outcomes.

Subsequent PT meetings are motivated by continued monitoring of formative assessment in core modules and helping students to begin preparing for summative assessments by providing support and signposting appropriate sessions in study skills centres. Where problems exist, both PTs and the module team(s) will direct students to MathsAid and/or SASC as appropriate.

#### Level 5 [‘stepping it up’ and broadening horizons]

In the second year the focus of the PT system is to encourage students to begin looking forwards, toward some form of academically-relevant placement activity, perhaps as a full-scale Industrial Placement in year 3, or as some form of identifiable engagement with industry, such as a relevant short-term placement, summer work or a subject-relevant internship. All students receive information from the KU Talent team on the process and opportunities before the winter vacation.

The PT highlights the importance of students engaging with this in their “welcome back” induction meeting in week 1, together with an explanation of how Level 5 modules contribute to degree classification and any other differences in course structure and assessment procedures between Level 4 and Level 5.

#### Level 6 [maximising success and moving on]

In the final year the focus shifts to graduation and employability and the PT scheme uses the capstone project module to promote PT-style discussions alongside regular project meetings (the supervisor is appointed as a second tutor and typically takes on the bulk of the PT role).

In the first weeks of term the PT’s role is to welcome students back, encourage them to reflect on their progress and module feedback, and plan to make the most of their final year, exemplified by early deliverables in the project module. Throughout Level 6, the KU Talent team provides activities which the PT signposts for students, some of which are delivered within and linked explicitly to sessions and assignments in core modules.

After the winter vacation the PT meets with their tutees to discuss the opportunities for graduate study and employment and provide contact details for employers’ reference requests. The final project (dissertation, presentation, and mathematical, statistical or data-based product) is a key employability “artefact”. As the PT is involved with the project from the start they are best placed to include details from the project (as well as other modules) in any reference and also, in collaboration with KU Talent, to encourage students how best to present their project on their *cv* and at interview.

## Ensuring and Enhancing the Quality of the Course

The University has several methods for evaluating and improving the quality and standards of its provision. These include:

* External examiners
* Boards of study with student representation
* Annual review and development
* Periodic review undertaken at subject level
* Student evaluation
* Moderation policies
* Periodic review for professional accreditation by the BCS: The Chartered Institute for IT

## Employability Statement

Computing and mathematical qualifications like Data Science are amongst the most versatile, and enable graduates to find employment in a wide spectrum of careers ranging from systems and business analysts, and software engineers, through to programmers and network specialists in a wide range of public and private sector industries. Recent graduates from the School found employment with large organisations such as IBM, Hewlett Packard, Capgemini, JDA Software, Thomson Reuters, GlaxoSmithKline, Axa, BAA, British Telecom, Ernst & Young, Marks & Spencer, Waitrose, Virgin Media, NHS Institute for Innovation and Improvement as well as a host of smaller companies and given the growth in Data Science-related roles we would expect graduates from this programme to broaden this. Graduates also pursue careers in academia, joining universities such as Kingston University’s PhD programmes in digital imaging, computer forensics, and user experience.

Our curriculum is largely applied in nature with many case studies chosen for their topicality and relevance to industry such as information systems design, programming, networking, and implementation issues. Working on case studies that are designed to simulate the working environment, typically in teams, gives students experience of applying their computing, statistical and mathematical methods, and key skills to open-ended problems with complex solutions, and presenting their findings, including any limitations, in a professional manner. This mirrors the experience of professionals working in commerce and industry. To further set the material in context as well as inspire our students, leading practitioners from industry, such as Google and IBM are invited to give guest lectures and workshops. Throughout the course students develop communication and interpersonal skills, learn time management and the value of prioritising and planning by involvement in the learning activities outlined in section F above.

In preparation for their future employment we make extensive use of industry standard software such as Oracle J Developer, Oracle SQL Developer, SAS, MATLAB, and R throughout the course and graduates regularly report back that it is their experience with these packages that differentiates them in the workplace.

### Personal Development Portfolio (PDP)

PDP is centred on student learning and development to encourage the student to become a more effective, independent and confident self-directed learner which appeals to employers. The student is responsible for engaging with the PDP process which is introduced in the core Professional Environments modules to support them and enable them to reflect upon their learning and achievements, formulate study action plans and to plan their career development needs. Students create a personal record of learning containing evidence of their qualities, key skills, achievements and products (artefacts of their learning and assessments) to support industrial placement applications and future job applications or applications for graduate studies. The development plans are reviewed regularly for feedback from their personal tutor.

### Industrial Placement (IP) and its Importance to Student Employability

All of our students are encouraged to make use of the opportunity to enhance their learning and personal development by undertaking a Summer Internship between years of study and/or an industrial placement in the third year of their programme. All placements are vetted to ensure that they provide a relevant experience in which students can apply their learning in a practical situation. All placement students on the course receive comprehensive support from the placement specialists (Talent Preparation Officers) within the KU Talent team in securing a position and while in the workplace, although ultimately the responsibility for the placement remains with the student. A small number of students take advantage of the opportunity for an overseas educational exchange visit, in which part of the course is studied at a university in another country, typically the USA or in Europe. This broadens their cultural experience and enhances their personal development in ways that are particularly valuable in today’s multinational employment market. Students also gain employability and transferrable skills through participation in the School’s annual monitoring process (*e.g.* as student representatives on the Staff Student Consultative Committee, Faculty Forum, and Board of Study); through volunteering, which the University and Union of Kingston Students facilitates, as Student Ambassadors, where mathematics students have been excellent ambassadors for our courses at Open Days, Enrolment and Induction events; and through the University’s Talent Academy programme which offers a range of different on-campus employment opportunities to students. Large numbers of suitable employers and alumni come to the University to take part in Careers Fairs, deliver talks and to recruit students for specific opportunities

### Professional Skills and Student Employability

Our programme is designed to embed employability skills within the curriculum at all levels and develop students’ ability to recognise their personal and academic achievements and career aspiration. This is fostered through the strand of professional environments modules built into the programme from the start. During these, students experience a transition from guided towards independent learning and career planning and development, through a series of sessions, offered under the auspices of KU Talent, including; Professional Communication, Time and Self-Management and Identifying and Articulating Skills. There are also opportunities to perfect skills required to gain employment such as; CV writing, Psychometric Test and Using LinkedIn. These modules are shared with other courses in the School and students study and work in a multidisciplinary environment, developing their ability to communicate with people outside their subject specialism. In this way students gain insight into the true nature of commercial teamwork, harnessing a range of different talents and skills to tackle complex problems, preparing them for the workplace. As they progress students enhance their planning, teamwork and communication skills, (in the professional environments modules and throughout the programme) and show evidence of these though oral and poster presentations and both individual and group written reports. Outputs from these (written reports, posters and records, e.g. as videos and/or slideshows), plus products such as computer programs or results from modelling exercises on real-world problems, can be collated into a portfolio which may be presented to potential employers. Furthermore, their personal development and career options and plans are discussed with their personal tutors at regular intervals throughout their studies, and guidance given as appropriate. This is in liaison with the KU Talent team, the University’s Careers Service.

This theme culminates in the Level 6 capstone project module, which draws together the academic strands of the course. It also enhances students’ employability skills in different ways, giving them an insight into what mathematicians do in graduate careers. Typically, the project involves the application of mathematics to explore some real-world problem, often stemming from the supervisor’s research interests; for example modelling of traffic flow, renewable energy generation, weather prediction, impact of comets on the Earth, or sport strategies and technologies. Undertaking this type of activity gives students a taste of independent research, albeit supported by the supervisor, as they familiarise themselves with the real world situation and the mathematical techniques required to investigate it. In the project, students are encouraged to develop their critical thinking, creative and analytical skills, and gain experience and proficiency in technical writing. When choosing their Level 6 option choices and project topic, students are guided by their Personal Tutor regarding what possible choices best suit their career aspirations.

The experiences gained during, and their reports and presentations on, students’ projects can provide a valuable case study to be cited in job applications and, if shortlisted, a focus for discussion and demonstration of professional skills in interviews. This has proved to be vitally important for several recent graduates, for whom giving an account of their project and the skills developed therein was crucial in securing a position of graduate employment during their interviews.

The course is vocational and curriculum developments are discussed by the School’s Industrial Advisory Panel. The School has strong links with both industry and professional bodies, including the BCS the Chartered Institute for IT. It hosts a local BCS chapter and several members of the School are involved with the Institute at corporate level. The Destinations and Leavers survey indicates that graduates from the established Computer Science and Mathematics programmes go onto the following careers (among others):

|  |  |  |  |
| --- | --- | --- | --- |
| Technical Analyst | Technical manager / Information Systems Manager | System support manager / Information Manager | Software developer / Software Engineer |
| Software administrator | IT Consultant / Systems Architect | IT developer | Database administrator / IT systems administrator |
| Network support / Network Engineer/executive | Analyst / Application Analyst / Business Analyst | Internet developer | Project manager |
| Web master | Analyst programmer | Web designer / Web Developer | Network analyst |
| Data Analyst / Information Analyst | Multimedia Programmer | UX Analyst | Communication Manager / Network Consultant |

## Approved Variants from the Undergraduate or Postgraduate Regulations

Compensation of the project module

Compensation is not permitted for the following module:

* CI6600 Individual Project

Reassessment following failure of the first attempt will normally be:

* by retake to improve the dissertation for marginal failure (Grade F5 or marks of 35-39) and the mark will be capped
* by repeat only with a new project brief and the mark will be capped.

## Other sources of information that you may wish to consult

QAA Benchmark statement website: <http://www.qaa.ac.uk/en/Publications/Documents/SBS-Computing-16.pdf>

Professional or statutory body information:

The British Computer Society <http://www.bcs.org/>

The Institute of Mathematics and its Applications <https://ima.org.uk/>

The Royal Statistical Society <https://www.rss.org.uk/>

Module guides

Student handbook

Guidance on Enterprise and Entrepreneurship (Draft)

<http://www.qaa.ac.uk/Publications/InformationAndGuidance/Documents/EE_Draft_Guidance.pdf>

### Development of Field/Course Learning Outcomes in Modules

This map identifies where the field/course learning outcomes are summatively assessed across the modules for this field/course. It provides an aid to academic staff in understanding how individual modules contribute to the field/course aims, a means to help students monitor their own learning, personal and professional development as the field/course progresses and a checklist for quality assurance purposes

|  |  |  |  |
| --- | --- | --- | --- |
| **Module code** | **Level 4** | **Level 5** | **Level 6** |
| MA4550 Mathematical Methods and Modelling of Applications | MA4600 Introductory Mathematics for Data Science | CI4105 Programming I - Thinking like a programmer | CI4450 Professional environments 1 | MA5550 Modelling Real-World Data with Statistics | MA5600 Mathematical and Software Skills for the Data Science Industry | CI5320 Database-Driven Application Development | CI5450 Professional environments 2 | MA6550 Practical Applications of Advanced Statistics | MA6600 Artificial Intelligence and Machine Learning | MA6610 Data Mining and Data Visualisation | CI6600 Individual Project |
| **Knowledge & Understanding** | A1 | ✓ | ✓ |  |  | ✓ | ✓ |  |  | ✓ | ✓ |  | ✓ |
| A2 | ✓ | ✓ |  | ✓ |  |  |  | ✓ | ✓ |  |  | ✓ |
| A3 |  | ✓ |  |  | ✓ | ✓ |  |  | ✓ | ✓ | ✓ | ✓ |
| A4 | ✓ |  | ✓ | ✓ |  |  | ✓ |  |  |  | ✓ | ✓ |
| **Intellectual Skills** | B1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  | ✓ |
| B2 | ✓ | ✓ | ✓ | ✓ | ✓ |  | ✓ | ✓ | ✓ |  | ✓ | ✓ |
| B3 | ✓ | ✓ | ✓ |  | ✓ | ✓ |  |  | ✓ | ✓ | ✓ | ✓ |
| B4 |  | ✓ |  | ✓ |  |  |  | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Practical Skills** | C1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  |  | ✓ | ✓ | ✓ | ✓ |
| C2 |  |  | ✓ |  |  |  | ✓ | ✓ |  |  | ✓ | ✓ |
| C3 |  | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  | ✓ | ✓ |  | ✓ |

**Students will be provided with formative assessment opportunities throughout the course to practise and develop their proficiency in the range of assessment methods utilised.**

### Technical Annex

|  |  |
| --- | --- |
| **Final Award(s):** | BSc (Hons) Data Science |
| **Intermediate Award(s):** | Cert HE, Dip HE |
| **Minimum period of registration:** | Full-time – 3 yearsSandwich – 4 yearsPart-time – 6 years |
| **Maximum period of registration:** | Full-time – 6 yearsSandwich – 8 yearsPart-time – 12 years |
| **FHEQ Level for the Final Award:** | 6 |
| **QAA Subject Benchmark:** | ComputingMathematics Statistics and Operational Research (2015) |
| **Modes of Delivery:** | Full-time, part-time |
| **Language of Delivery:** | English |
| **Faculty:** | Science Engineering and Computing |
| **School:** | Computer Science and Mathematics |
| **Department:** | Mathematics |
| **JACS code:** | G300 |
| **UCAS Code:** | G300 (3 year full time)G301 (4 year sandwich)G308 (4 year including foundation year) |
| **Course/Route Code:** | DSC |