

Programme Specification for Undergraduate Programme

Leading to:

BSc (Hons) Mathematics for Data Science

BSc (Hons) Mathematics for Data Science with Placement

Applicable for all undergraduate students **starting at FHEQ Level 4 in 2021**

Version No.	Date	Notes – QUALITY ASSURANCE USE ONLY	QA
2021-22 v0.5	21 May 2020	New programme due to commence in September 2021 and subject to change in content and delivery..	JP
2021-22 v0.6	30 June 2020	Route code added.	JP
2021-22 v1.0	6 January 2021	Block code MA3671 allocated to Experimental Design and Regression.	JP
2021-22 V1.1	11 March 2021	UCAS codes added.	JP
2020-21 v2.0	7 April 2021	Minor modification to programme. Minor changes to wording of the programme level learning outcomes and Educational Aims. Module title for MA3667 corrected to state it is Mathematical Finance and MA3674 corrected to Statistical Data Science and Machine Learning.	JP

Undergraduate Programme	
1. Awarding institution	Brunel University London
2. Teaching institution	Brunel University London
3. Home college/Department	College of Engineering, Design and Physical Sciences/ Department of Mathematics
4. Contributing College/Department/Division/ Associated Institution	None
5. Programme accredited by	IMA accreditation will be sought in 2020
6. Final award(s) and FHEQ Level of Award	BSc (Hons) Mathematics for Data Science (FHEQ level 6) BSc (Hons) Mathematics for Data Science with Placement (FHEQ level 6)
7. Programme title	BSc Mathematics for Data Science BSc Mathematics for Data Science with Placement
8. Programme type (single honours/joint)	Single honours
9. Normal length of programme (in months) for each mode of study	36 months Full Time; 48 months Thick Sandwich (with Placement)
10. Maximum period of registration for each mode of study	Normal or standard duration plus 3 years
11. Variation(s) to September start	None
12. Modes of study	Full time; Thick Sandwich
13. Modes of delivery	Standard (on campus)
14. Intermediate awards and titles with FHEQ Level of Award	CertHe in Mathematics for Data Science (FHEQ level 4) DipHe in Mathematics for Data Science (FHEQ level 5) DipHe in Mathematics for Data Science with Placement (FHEQ level 5) BSc (Ord) Mathematics for Data Science (FHEQ level 6) BSc (Ord) Mathematics for Data Science with Placement (FHEQ level 6)

15. UCAS Code	G1ND (Full time), G1NK (Thick Sandwich)
16. HECoS Code	100406
17. Route Code	J2JAUMADASCI
18. Relevant subject benchmark statements and other external and internal reference points used to inform programme design.	<p>UK Quality Code for Higher Education which includes the English Framework for Higher Education Qualifications within Part A on Setting and Maintaining Academic Standards</p> <p>QAA Subject Benchmark Statement (Mathematics, Statistics and Operational research)</p> <p>Brunel University London 2030</p> <p>Brunel Placement Learning Policy, as published under the 'Placements' section of the 'Managing Higher Education Provision with Others' page.</p>
19. Admission Requirements	<p>Details of entry requirements are provided on the University's and College website.</p> <p>Levels of English for non-native speakers are outlined on the University's language requirements pages.</p>
20. Other relevant information (e.g. study abroad, additional information on placements)	<p>Information about work placement (Thick Sandwich mode of study) can be found on the University web page</p> <p>http://www.brunel.ac.uk/services/pcc</p> <p>or on our web page</p> <p>http://www.brunel.ac.uk/cedps/mathematics/undergraduate</p>
21. Programme regulations not specified in Senate Regulation 2. Any departure from regulations specified in Senate Regulation 2 must be stated here and approved by Senate.	None
22. Further information about the programme is available from the College website.	Course web page

23. EDUCATIONAL AIMS OF THE PROGRAMME

The programme aims to produce graduates able to use mathematics creatively to address, interpret and process data science problems from a variety of sources. In particular, graduates will be able to:

1. Demonstrate knowledge of a range of mathematical and statistical methods and techniques and critically evaluate their appropriateness for the analysis of data arising in applied fields such as industry, commerce and the life sciences;
2. Demonstrate advanced modelling and programming skills relevant to scenarios and algorithms that arise in modern data science applications;
3. Critically evaluate the appropriateness of software and techniques for modelling and solving modern data analytics problems;
4. Communicate their results, ability and knowledge clearly to user communities using various appropriate media;
5. Execute a major project and report their findings in a coherent, structured and timely fashion;
6. Work constructively and cooperatively as part of a team;
7. Progress to employment or postgraduate study in areas requiring knowledge of data science.

24. PROGRAMME AND INTERMEDIATE LEARNING OUTCOMES

The programme provides opportunities for students to develop and demonstrate knowledge and understanding (K) cognitive (thinking) skills (C) and other skills and attributes (S) in the following areas:

Year and FHEQ level	Category (K = knowledge and understanding, C = cognitive (thinking) skills, S = other skills and attributes)	Learning Outcome	Associated Assessment Blocks Code(s)	Associated Study Blocks Code(s)	Associated Modular Blocks Code(s)
FHEQ Level 4					
	K	1P1. Understand and implement appropriate basic techniques across a range of mathematical topics.			MA1611, MA1612, MA1620, MA1670
	K,C	1P2. Demonstrate knowledge and understanding of the precise language, notation and elementary tools of formal mathematics (including set theory, counting and logic).			MA1612 MA1670
	K,C	1P3. Formulate and solve accurately elementary mathematical problems associated with the application of mathematics to industry and the commercial world.			MA1691 MA1664
	S	1P4. Communicate accurately and reliably scientific material in a cogent and structured fashion.			MA1691 MA1664
	C,S	1P5. Use mathematical techniques and related software to model problems, generate solutions, interpret these and perform comparative analysis where appropriate.			MA1691 MA1664
	C,S	1P6. Manipulate, visualise and interpret data correctly and report findings coherently.			MA1670 MA1691
	K,S	1P7. Demonstrate knowledge, technical and personal ability to engage in a search for a professional activity.			MA1612
FHEQ Level 5					
	K,C	2P1/2. Demonstrate knowledge and critical understanding of techniques and theories of use in mathematics, including multivariable calculus, discrete mathematics and OR, and theories of elementary stochastic models and statistical inference.			MA2612 MA2670 MA2682
	S	2P3. Effectively communicate mathematics in a clear and concise manner appropriate to the context and audience.			MA2690 MA2679
	S	2P4. Operate in teams in order to plan, execute, report and present mathematics and computer based projects in familiar and less familiar areas of machine learning and other areas of mathematics.			MA2690 MA2647

	K,C	2P5. Demonstrate knowledge and critical understanding of mathematical tools leading to numerical algorithms in deep learning and other areas of mathematics.			MA2690 MA2647
	S	2P6. Demonstrate an awareness of the requirement for continuous professional development.			MA2690
	K,S	2P7. Demonstrate knowledge and technical ability in the skills required in a professional data science and mathematical environment.			MA2690 MA2647
	K,S	2P8. Demonstrate a sound understanding of research ethics, specifically ethical use of data, and be able to determine appropriate actions regarding ethical collection and use of data.			MA2690 MA2679
	K,C	2O1. Model, formulate and analyse classical problems in various areas of applications of deep learning, statistics and mathematics.			MA2647 MA2670 MA2682 MA2690
	C	2O2. Operate within mathematical structures with a broad range of abstract mathematical concepts.			MA2612 MA2670 MA2682
	K	2W1. Demonstrate knowledge and understanding of the structures, processes and business environment relevant to the work placement.			MA2555
	C	2W2. Demonstrate problem-solving skills, analytical and creative skills given real life situations.			MA2555
	C	2W3. Analyse and critically reflect on the work placement context.			MA2555
	K,S	2W4. Demonstrate numerical, technical, professional and communication skills.			MA2555
	S	2W5. Demonstrate planning and organisational skills with the ability to work in a team.			MA2555
FHEQ Level 6					
	K,C	3P1. Demonstrate both knowledge, and a sound and systematic understanding of advanced data analytics tools and their use in a range of applications.			MA3671 MA3674 MA3697
	C,S	3P2. Formulate, solve and report on data science problems in a broad range of application of mathematics, statistics and computing.			MA3674 MA3697
	K,C,S	3P3. Plan, execute, evaluate and report a major project in data science.			MA3697
	C	3P4. Critically evaluate important methods and types of algorithms of use in data analytics.			MA3674 MA3697
	C,S	3P5. Able to manage their own learning and critically evaluate primary sources of data analytics theories and modelling			MA3697
	C,S	3P6. Able to communicate problems and solutions in mathematical and computing terms appropriate to the audience as well as their own critical evaluation.			MA3674 MA3697

Learning/teaching strategies and methods to enable learning outcomes to be achieved, including formative assessments

Teaching and learning activities consist of a mix of lectures, exercise/example classes, computer workshops and more innovative teaching methods. Small rooms and centrally controlled larger rooms, with tables for group work, both with computer access and boards, are used to enhance the students' learning experience. In lectures concepts are introduced, definitions are stated, results (theorems in mathematics modules) and techniques are explained (often proved in mathematics modules). Practice and formative feedback are continuously provided in regular exercise/example classes and computer workshops.

In Year 1, great care is taken to give time to students to adapt to university style of learning and studying. The teaching will occur in small classes at an intensive contact hour rate for 4 weeks, followed by whole cohort lectures. The small classes are intended to foster closer contact and monitoring from group leaders so as to help students individually adapt to the university style of learning and teaching. A variety of teaching styles will be introduced during those weeks. There will be regular homework and formative class tests. This will enable students to achieve the transition from the controlled, personalised environment they might have experienced at school to an environment where they are able to work more independently, with confidence, on material they have learned about during the contact hours, including lectures and seminars. Personal contact with staff is less frequent than at school, and so it is aimed at improving the capacity and will of students to develop alone, or in groups, work learned or done in class, with a view to eventually feeling comfortable with their own capacities of being responsible and in charge of their learning.

As they progress in Term 1 of Year 1, students will take charge of their learning. In particular they will have developed learning strategies needing shorter and less frequent contact time with teaching staff, both in their mathematics and computing activities. Practice and formative feedback will also occur during lectures and surgery sessions when appropriate. Cognitive skills are based on knowledge and understanding of mathematical and computing concepts and tools.

In the block MA1612 Fundamentals of Mathematics in Year 1, key manipulative skills will be improved as well as study skills, in conjunction with tutor contact following the Tutorial@Brunel scheme. In this block, concepts used in other blocks to develop abstract ideas will be fostered.

From Year 2, students will continue to be able to study from plenary lectures, exercises classes and computer labs. In the Final Year, in addition to the two compulsory taught blocks in Statistics (Statistical Data Science and Machine Learning, Experimental Design and Regression), students will have some optional modular blocks to be able to pursue their interests. This list of optional blocks can be amended over the years as minor modifications to take into account students' choices and staff expertise and interest. Currently blocks cover Financial Mathematics, Stochastic Models, Decision Making in the Face of Risk. For the Final Year Project (Data Science Project), students will be allocated from their list of preferences. Students at all levels will be encouraged to participate to a showcase of their best work in an annual event along the lines of the current "Brunel Engineers" model. Students and staff will be expected to attend. Employers, colleagues from the College and the University, as well as the External Examiners, will be invited.

In our degrees we intend to develop seriously and explicitly professional and modelling skills across the levels. Acquiring such skills is an important part of undergraduate studies and needs space in our curriculum for students to receive feedback and improve. Although some of those skills are also imbedded in the context of all blocks, they need space and independent assessment to highlight that their acquisition is indispensable for progression in the programme.

Starting in Year 1, the block MA1691 will be dedicated to the development of programming skills and their use in small projects. The block MA1664 will start the development of professional skills, including writing and presentation, in modelling contexts appropriate to Year 1. In Year 2, the block MA 2690 will continue the development of professional skills linked to the placement and job market, via employability conferences and other sessions during the year. There will also be an improvement of general and computing skills, as well as more advanced modelling in the block MA2647 that will introduce the mathematics and models of Deep

Learning. In the Final Year, the FYP is one important vector to show how much has been achieved in professional skills.

Attention will be given to the ethical challenges in relation to the collection and use of data. Students will be taught about ethical use of data, with topics such as information retrieval, research ethics, Data Protection Law, the Freedom of Information Act, data collection and curation embedded in the appropriate blocks. These principles will be introduced in Year 2 (MA2690, MA2679), and then built upon as part of the Final Year Project training.

Summative assessment strategies and methods to enable learning outcomes to be demonstrated

The programme uses elements of formative and summative assessment. Although both forms of assessment will be marked/graded, only the summative assessment will count for progression or the final award. Formative assessment is fundamental in the learning process. It includes class tests (both in paper and electronic format), electronic quizzes, short written exercises, in addition to exercises and their solutions done in the classroom and at home.

During the programme a variety of assessment methods are used, although a final examination and class tests feature heavily in 'theoretical' aspects of mathematics. Different types of coursework are important in more 'applied' assessment blocks. In fact, a mix of assignment types are used for important aspects of the curriculum in order to strengthen specific connections between theory and practice. At each level there is a component of continuous assessment to provide summative feedback before the final examinations. In particular in Year 1, there are many opportunities for formative assessment with rapid feedback, usually class tests, weekly written coursework or computer-based tests. Coursework can also be used in Years 2 and 3 for students to work on more complicated examples that need computing power or cannot be addressed in a timed examination. Usually there are no options in the questions to answer in the examinations for Years 1 and 2. In Year 3, to allow for an evaluation of the depth of understanding of the students, choices of questions are usually available.

Due to the variability of work placement, its assessment will involve the following procedure: in collaboration with an assigned placement tutor and their work-place manager or supervisor, students are expected to define a set of concrete work placement objectives which map onto the placement learning outcomes (2W1-5). They should aim to achieve their objectives by performing the role in which they are employed, and, while doing so, write a portfolio documenting their achievements towards achieving their objectives. The grading of the portfolio will be the main contributor to the mark for the placement.

25. Programme Structure, progression and award requirements

Programme structures and features: levels, assessment blocks, credit and progression and award requirements

- **Compulsory block:** one which all students registered for the award are required to take as part of their programme of study. These will be listed in the left hand column;
- **Optional block:** one which students choose from an 'option range'. These will be listed in the right hand column;
- A **core assessment** is an assessment identified within an assessment block or modular block (either compulsory or optional) which must be passed (at grade D- or better) in order to be eligible to progress and to be eligible for the final award. All core assessments must be specified on the programme specification next to the appropriate assessment or modular block:

Where students are expected to pass the block at D- or better, but not necessarily all elements, then the block itself is core.

e.g. AB3000 Project (40)
Core: Block

Where only some elements of assessments are required to be passed at D- or better, these

will be identified by listing each element that is core
 e.g. ABXXX1 Title (XX credits)
 Core: 1 & 4

Where students are expected to pass all assessments in a block then this will be identified.
 By setting the assessment this way, students are also required to pass the block by default.
 This will be identified thus:
 e.g. ABXXXX Title (XX credits)
 Core: All, Block

- A **non-core assessment** does not have to be passed at grade D- or better, but must be better than a grade F, in order to progress and to be eligible for the final award.

Foundation Level

There is a Foundation Level structure available to all students as G504 'Mathematics and Computing with an Integrated Foundation Year'. The admission and progression requirements are stated on its Programme Specification.

FHEQ Level 4

Compulsory assessment block codes, titles and credit	Optional assessment block codes, titles and credits
Compulsory study block codes, titles and credit volume	Optional Study block codes, titles and credit volume
Compulsory modular block codes, titles and credits All blocks are 20 credits unless otherwise stated MA1611 Calculus MA1612 Fundamentals Core: Element 1 MA1620 Linear Algebra MA1664 Elements of Applied Mathematics MA1670 Probability and Statistics I MA1691 Programming and Mathematical Projects	Optional modular block codes, titles and credits

FHEQ Level 4 Progression and Award Requirements

As per [Senate Regulation 2](#)

FHEQ Level 5	
Compulsory assessment block codes, titles and credits	Optional assessment block codes, titles and credits
Compulsory study block codes, titles and credit volume	Optional Study block codes, titles and credit volume
Compulsory modular block codes, titles and credits All blocks are 20 credits unless otherwise stated MA2612 Multivariable Calculus MA2670 Probability and Statistics II MA2682 Discrete Mathematics and OR MA2690 Professional Development and Project Work Core: Element 1 MA2679 Statistical Programming for Data Analytics MA2647 Mathematics of Deep Learning	Optional modular block codes, titles and credits All blocks are 20 credits unless otherwise stated
FHEQ Level 5 Progression and Award Requirements	
As per Senate Regulation 2	

FHEQ Level 5 – Sandwich Placement	
Compulsory assessment block codes, titles and credits	Optional assessment block codes, titles and credits
Compulsory study block codes, titles and credit volume	Optional study block codes, titles and credit volume
Compulsory modular block codes, titles and credits This modular block is a requirement only for the awards “with Placement” MA2555_CB Work Placement (120 placement credits) Core: Block	Optional modular block codes, titles and credits
FHEQ Level 5 Placement Progression and Award Requirements	
As per Senate Regulation 2	
For BSc (Hons) Mathematics for Data Science, MA2555 will contribute 25% to the FHEQ Level 5 profile and 8.33% of the overall degree calculation	

FHEQ Level 6	
Compulsory assessment block codes, titles and credits	Optional assessment block codes, titles and credits
Compulsory study block codes, titles and credit volume	Optional study block codes, titles and credit volume
Compulsory modular block codes, titles and credits MA3697 Data Science Project (40 credits) Core: Block MA3671 Experimental Design and Regression (20 credits) MA3674 Statistical Data Science and Machine Learning (20 credits)	Optional modular block codes, titles and credits All the modular blocks are 20 credits unless stated otherwise. <u>Students must choose 40 credits of options from the following list:</u> MA3667 Mathematical Finance MA3676 Stochastic Models MA3687 Decision Making in the Face of Risk
FHEQ Level 6 Progression and Award Requirements As per Senate Regulation 2 For BSc (Hons) Mathematics for Data Science with Placement, MA2555 will contribute 8.33% of the overall degree calculation	

Please note: this specification provides a concise summary of the main features of the programme and the learning outcomes that a 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 learning outcomes, content and teaching, learning and assessment methods can be found in the modular block, assessment and study block outlines and other programme and block information. The accuracy of the information contained in this document is reviewed by the University from time to time and whenever a modification occurs.