

Programme Specification for Undergraduate Programme

Leading to:

BSc (Hons) Mathematics for Data Science

(Delivered at North China University of Technology)

Applicable for all undergraduate students starting in 2021

Version No.	Date	Notes – QUALITY ASSURANCE USE ONLY	QA
2021.22 V1.0	19 August 2021	Programme content confirmed for a September 2021 start.	JP

Undergraduate Programme	
1. Awarding institution	Brunel University London
2. Teaching institution	Brunel University London, North China University of Technology
3. Home college/Department	College of Engineering, Design and Physical Sciences/ Department of Mathematics
4. Contributing College/Department/Division/ Associated Institution	North China University of Technology (NCUT)
5. Programme accredited by	Not Accredited.
6. Final award(s) and FHEQ Level of Award	BSc (Hons) Mathematics for Data Science (FHEQ level 6)
7. Programme title	BSc Mathematics for Data Science
8. Programme type (single honours/joint)	Single Honours, Double degree programme (BUL and NCUT)
9. Normal length of programme (in months) for each mode of study	48 months (Full time);
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
13. Modes of delivery	Standard, block mode (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) BSc (Ord) Mathematics for Data Science (FHEQ level 6)
15. UCAS Code	Not applicable
16. HECoS Code	100406
17. Route Code	3G4CUMDSNCUT
18. Relevant subject benchmark statements and other external and internal reference points used to inform programme design.	UK Quality Code for Higher Education which includes the English Framework for Higher Education Qualifications within Part A on Setting and Maintaining Academic Standards QAA Subject Benchmark Statement (Mathematics, Statistics and Operational research) Brunel University London 2030

19. Admission Requirements	<p>Details of entry requirements are provided on the University's and College website and on the NCUT website.</p> <p>Levels of English for non-native speakers are defined in terms of the English language component of the Chinese national College entrance examinations.</p> <p>Although there is no English requirement on admission, students whose mark for English language component of the entrance examinations is below 115 out of 150 should be advised that it will be difficult to successfully complete the BUL degree.</p>
20. Other relevant information (e.g. study abroad, additional information on placements)	None
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.	<p>1. For the BSc. Honours degree, the student must have achieved an IELTS score of 5.5 (on each component) or above or a Brunel English language test score of 55 or above to progress from FHEQ Level 5 to Level 6.</p> <p>2. Degree award rule for the BSc. Honours degree:</p> <p>2.1 The student must have achieved an IELTS score of 6.0 (on each component) or above or a Brunel English language test score of 60 or above.</p> <p>2.2. A student cannot get a Brunel Honours degree if the student fails to meet NCUT's degree requirements.</p> <p>3. Degree award rule for the BSc. Ordinary degree:</p> <p>3.1 300 credits in total, including at least 100 credits in FHEQ Level 4, 100 in FHEQ Level 5 and 80 credits at FHEQ Level 6.</p> <p>3.2 The student must have achieved an IELTS score of 6.0 (on each component) or above or a Brunel English language test score of 60 or above.</p> <p>3.3 To get a BSc. Ordinary degree, a student needs to take all modules specified in the NCUT Chinese degree program specification.</p>
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)
Year 1 and Year 2 FHEQ Level 4					
	K	1P1. Understand and implement appropriate basic techniques across a range of mathematical topics.			MA1603 MA1604 MA1605 MA1606
	K,C	1P2. Demonstrate knowledge and understanding of the precise language, notation and elementary tools of formal mathematics (including set theory, counting and logic).			MA1604 MA1606
	K,C	1P3. Formulate and solve accurately elementary mathematical problems associated with the application of mathematics to industry and the commercial world.			MA1607 MA1608
	S	1P4. Communicate accurately and reliably scientific material in a cogent and structured fashion.			MA1607 MA1608
	C,S	1P5. Use mathematical techniques and related software to model problems, generate solutions, interpret these and perform comparative analysis where appropriate.			MA1607 MA1608
	C,S	1P6. Manipulate, visualise and interpret data correctly and report findings coherently.			MA1606 MA1607
	K,S	1P7. Demonstrate knowledge, technical and personal ability to engage in a search for a professional activity.			MA1604

Year 3 and 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

Year 4 and 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 (Ord.).			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

This joint programme aims to bring together the strengths of NCUT and BUL in the fields of Data Science to produce mathematicians with the skills and knowledge to go into careers in these fields.

All teaching on the programme is in English, and to enable students to develop the English language skills required, the programme is delivered over four years. This allows time to include teaching focussed exclusively on developing students' command of English to a professional level, practising the four core skills of listening, speaking, reading and writing. The English language blocks do not carry credits towards the BUL degree award, but are essential for students to successfully complete assessments in English. The way in which English is used in a real world context is introduced early in the programme with the 40 credits of project and professional skills blocks at FHEQ Level 4. Those are followed by a similar amount of credits at FHEQ Levels 5 and 6.

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 Years 1 and 2 (FHEQ Level 4), great care is taken to give time to students adapt to the university style of learning and studying. 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, 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.

From FHEQ Level 5, students will continue to be able to study from plenary lectures, exercises classes and computer labs. 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 University 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 the FHEQ Level 4, the block MA1607 will be dedicated to the development of programming skills and their use in small projects. The block MA1608 will start the development of professional skills, including writing and presentation, in modelling contexts appropriate to FHEQ Level 4. In FHEQ Level 5, the block MA 2690 will continue the development of professional skills linked to the 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 at FHEQ Level 5 (MA2690, MA2679), and then built upon as part of the Final Year Project training.

50% of the contact time will be carried out by BUL academic staff (including some remote teaching using appropriate technology, particularly for supervision of Final Year Projects), and 50% by NCUT academic staff.

All students will be assigned a Personal Tutor, based at NCUT, to provide more individual support where necessary.

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 at FHEQ Level 4, 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 at FHEQ Level 5 and 6 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 FHEQ Levels 4 and 5. At FHEQ Level 6, to allow for an evaluation of the depth of understanding of the students, choices of questions are usually available.

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.

Teaching on the blocks stated below will be delivered 50% by BUL and 50% by NCUT.

Year 1 and 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
<p>Compulsory modular block codes, titles and credits</p> <p>All blocks are 0 credits unless otherwise stated</p> <p><u>Year 1 -Term 1</u></p> <p>MA1601 English for Academic Purposes (FHEQ Level 4)</p> <p><u>Year 1 -Term 2</u></p> <p>MA1602 English for Communication Scientific Purposes (FHEQ Level 4)</p>	

Year 2 and 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. The Language blocks are at FHEQ Level 5. <u>Year 2-Term 3</u> MA2601 Intensive English Training I (0 credits, FHEQ Level 5) MA1603 Calculus MA1604 Fundamentals Core: Element 1 MA1605 Linear Algebra <u>Year 2-Term 4</u> MA2602 Intensive English Training II (0 credits, FHEQ Level 5) MA1606 Probability and Statistics I MA1607 Programming and Mathematical Projects MA1608 Elements of Applied Mathematics	Optional modular block codes, titles and credits
Year 2 and FHEQ Level 4 Progression and Award Requirements	
As per Senate Regulation 2	

Year 3 and 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 <u>Year 3-Term 5</u> MA2612 Multivariable Calculus MA2670 Probability and Statistics II MA2682 Discrete Mathematics and OR <u>Year 3-Term 6</u> 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

Year 3 and FHEQ Level 5 Progression and Award Requirements

As per [Senate Regulation 2](#)

except for the following variations to Senate Regulation 2:

The following English language requirement must be met for a student progress to FHEQ Level 6 Honours degree: the student must have achieved an IETLS score of 5.5 (on each component) or above or a Brunel English language test score of 55 or above (on each component).

If students fail to meet the requirements for progression to FHEQ Level 6 Honours degree, they may progress to FHEQ Level 6 Ordinary if they have at least 100 credits at FHEQ Level 5. They must be aware that there will be a minimum level of English to be achieved for an Ordinary degree (see FHEQ Level 6 Award requirements).

Year 4 and 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 <u>Year 4-Term 7</u> MA3671 Experimental Design and Regression (20 credits) MA3674 Statistical Analysis for Big Data (20 credits) MA3676 Stochastic Models (20 credits) MA3687 Decision Making in the Face of Risk (20 credits) <u>Year 4-Term 8</u> MA3697 Data Science Project (40 credits) Core: Block	Optional modular block codes, titles and credits
Year 4 and FHEQ Level 6 Progression and Award Requirements As per Senate Regulation 2 except for the following variations to Senate Regulation 2: The following English language requirement must be met for a student progress to graduate (both Honours and Ordinary), the student must have achieved an IETLS score of 6.0 (on each component) or above or a Brunel English language test score of 60 or above (on each component). A student cannot get a Brunel BSc. Honours degree if the student fails to meet NCUT's degree requirements. To get a BSc. Ordinary degree, a student needs to take all modules specified in NCUT Chinese degree program specification.	

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.