Programme Specification for Undergraduate Programme
Leading to:
BSc (Hons) Mathematics with Computer Science
BSc (Hons) Mathematics with Computer Science and Professional Practice

*Applicable for all undergraduate students **starting at FHEQ Level 4** in 2019*

Version No.	Date	Notes – QUALITY ASSURANCE USE ONLY	QA
1.0	*19 June 2019*	*Major modifications to programme ready for a September 2019 start.*	*JP*
2.0	*17 September 2019*	*Minor modification to programme. Element 1 of MA1612 is now Core and must be passed at D-.*	*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/ Dept of Mathematics/Mathematics
4. Contributing College/Department/Division/ Associated Institution	None
5. Programme accredited by	Institute of Mathematics and its Applications - this programme will meet the educational requirements of the Chartered Mathematician designation, awarded by the Institute of Mathematics and its Applications, when it is followed by subsequent training and experience in employment to obtain equivalent competencies to those specified by the Quality Assurance Agency (QAA) for taught masters degrees.
6. Final award(s) and FHEQ Level of Award	BSc (Hons) Mathematics with Computer Science (FHEQ level 6) BSc (Hons) Mathematics with Computer Science and Professional Practice (FHEQ level 6)
7. Programme title	BSc Mathematics with Computer Science BSc Mathematics with Computer Science and Professional Practice
8. Programme type (single honours/joint)	N/A
9. Normal length of programme (in months) for each mode of study	36 months Full time; 48 months Thick Sandwich (with Professional Practice)
10. Maximum period of registration for each mode of study	6 years Full time; 7 years Thick Sandwich (with Professional Practice)
11. Variation(s) to September start	None
12. Modes of study	Full time; Thick Sandwich
13. Modes of delivery	Standard
14. Intermediate awards and titles with FHEQ Level of Award	CertHe in Mathematics with Computer Science (FHEQ level 4) DipHe in Mathematics with Computer Science (FHEQ level 5)

	DipHe in Mathematics with Computer Science and Professional Practice (FHEQ level 5) BSc (Ord) Mathematics with Computer Science (FHEQ level 6) BSc (Ord) Mathematics with Computer Science and Professional Practice (FHEQ level 6)
15. UCAS Code	G1GL (Full time), G1GK (Thick Sandwich
16. HECoS Code	100403, 100366
17. Route Code	G1G4USMTHCP2
18. Relevant subject benchmark statements and other external and internal reference points used to inform programme design.	UK Quality Code for Higher Education QAA Subject Benchmark Statement (Mathematics, Statistics and Operational research) Brunel 2030 Brunel Placement Learning Policy, as published under the 'Placements' section of the 'Managing Higher Education Provision with Others' page.
19. Admission Requirements	Details of entry requirements are provided on the University's and College website. Levels of English for non-native speakers are outlined on the University's language requirements pages.
20. Other relevant information (e.g. study abroad, additional information on placements)	Information about work placement (Thick Sandwich mode of study) can be found on the University web page http://www.brunel.ac.uk/services/pcc or on our web page http://www.brunel.ac.uk/cedps/mathematics/undergraduate
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:

1.Use a range of mathematical tools to solve practical problems arising in industry, commerce and the life sciences;

2. Demonstrate advanced modelling skills relevant to mathematics applied to relevant areas;

3. Use industry standard software and techniques for modelling and solving mathematical problems;

4. Communicate their results, ability and knowledge clearly to user communities using various appropriate media;

5. Execute a major individual 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 one or more branches of mathematics;

8. Enjoy a wide spectrum of mathematical activities, from tackling mathematical problems for their own sake to the exploration of its professional side;

9d. Critically appraise computational solutions to problems arising in applied mathematics and have experience of the whole cycle of software development;

10. Design, implement and appraise software solutions to modern day problems, eg. modern approaches to algorithms, data storage and analysis etc.

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 FHEQ Level 4					
	K	1P1. Understand and implement appropriate basic techniques across a range of mathematical topics.			All blocks
	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
	K,C	1P3. Formulate and solve accurately elementary mathematical problems associated with the application of mathematics to industry and the commercial world.			MA1691
	S	1P4. Communicate accurately and reliably scientific material in a cogent and structured fashion.			MA1691
	C,S	1P5. Use mathematical techniques and related software to model problems, generate solutions, interpret these and perform comparative analysis where appropriate.			MA1691
	C,S	1P6. Manipulate, visualise and interpret data correctly and report findings coherently. (C,S)			MA1670
	K,S	1P7. Demonstrate knowledge, technical and personal ability to engage in a search for a professional activity.			MA1691
	K,C	1C1 Demonstrate knowledge and understanding of the concepts and technical tools necessary to program successfully in advanced programming languages;	CS1811	CS1702	

Year 2 and FHEQ Level 5					
	K,C	2P1. Demonstrate knowledge and critical understanding of techniques and theories of use in mathematics, including ordinary differential equations, multivariable calculus, discrete mathematics and OR.			All blocks
	K,C	2P2. Demonstrate knowledge and critical understanding of techniques and theories of elementary stochastic models and statistical inference.			MA2670
	S	2P3. Communicate effectively mathematics in a clear and concise manner appropriate to the context and audience.			MA2690
	S	2P4. Operate in teams in order to plan, execute, report and present mathematics and computer based projects in familiar and less familiar areas .			MA2690 MA2646
	K,C	2P5. Demonstrate knowledge and critical understanding of mathematical tools leading to numerical algorithms in various areas of applications.			MA2690 MA2646
	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 mathematical environment.			MA2690 MA2646
	K	2C1. Demonstrate knowledge and understanding of object oriented software design, implementation, maintenance and documentation;			CS2002
	K	2C2. Demonstrate knowledge and understanding of classic and meta-heuristic algorithms;			CS2004
	C	2C3. Plan, implement, test and modify a piece of software and evaluate its life-cycle;			CS2002
	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

Year 3 and FHEQ Level 6					
	K,C	3P1. (Ord) Demonstrate knowledge, sound and systematic understanding of advanced mathematical tools and their use in a range of applications.			All blocks
	C,S	3P2. Formulate, solve and report on advanced problems in a broad range of application of mathematics.			All blocks
	K,C,S	3P3. Plan, execute, evaluate and report a major project.			MA3990
	C	3P4. Critically evaluate important methods and types of algorithms in applied mathematics.			All blocks
	C,S	3P5. Able to manage their own learning and critically evaluate primary sources of mathematical theories and modelling			MA3990
	C,S	3P6. Able to communicate problems and solutions in mathematical terms appropriate to the audience as well as their own critical evaluation.			All blocks
	K,C	3O1. Demonstrate knowledge and understanding of means and methods to estimate the efficiency of discrete algorithms in deterministic and random contexts.			All blocks
	C	3C1. Take real-world problems and identify relevant characteristics to guide the selection of an appropriate algorithm.			All blocks
	K,S	3C2. (Ord) Use software development methods covering an object-oriented approach.			CS3003

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. The Department is using dedicated small rooms and centrally controlled larger rooms, with tables for group work, both with extensive computer access and boards, 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 to adapt to 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 of 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, to be able to pursue their interests, students will have as many optional modular blocks as possible in their named degrees to choose from. Such list of optional blocks can be amended over the year as minor modifications to take into account students choices and staff expertise and interest. Currently blocks cover mathematical methods, including complex variable theory, differential equations, discrete mathematics, combinatorics, applications to the physical and non physical worlds, numerical methods, operational research, probability and risk modelling, and statistics. For the Final Year 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 Maths@Brunel. 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 classical modelling context 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 MA2646. In the Final Year, the FYP is one important vector to show how much has been achieved in professional skills, we also offer a taught option Mathematics in Context MA3660 where we will be able to use more innovative teaching and assessment methods with experienced students.

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
The one year Foundation Level structure available to eligible students is specified in the document "Mathematics and Computing with an Integrated Foundation".This document also specifies the admission and progression requirements.

Year 1 and FHEQ Level 4	
Compulsory assessment block codes, titles and credit CS1811 Fundamental Programming Assessment (20 credits)	**Optional assessment block codes, titles and credits**
Compulsory study block codes, titles and credit volume CS1702 Introductory Programming (20 credits)	**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 MA1670 Probability and Statistics I MA1691 Programming and Mathematical Projects	Optional modular block codes, titles and credits
Year 1 and FHEQ Level 4 Progression and Award Requirements **As per Senate Regulation 2**	

Year 2 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** MA2612 Multivariable Calculus MA2670 Probability and Statistics II MA2682 Discrete Mathematics and OR MA2690 Professional Development and Project Work CS2002 Software Development and Management CS2004 Algorithms and their Applications	**Optional modular block codes, titles and credits** **All blocks are 20 credits unless otherwise stated**
Year 2 and FHEQ Level 5 Progression and Award Requirements **As per Senate Regulation 2**	

Year 2 and 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	Optional modular block codes, titles and credits
This modular block is a requirement only for the awards "with Professional Practice" MA2555 Work Placement (120 placement credits) Core: Block	
Year 2 and FHEQ Level 5 Placement Progression and Award Requirements **As per Senate Regulation 2** For BSc (Hons) Mathematics with Computer Science and Professional Practice, MA2555 will contribute 25% of the Year 2 and FHEQ Level 5 profile and 8.33% of the overall degree calculation	

Year 3 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 MA3990 Final Year Project (40 credits) Core: Block CS3002 Artificial Intelligence (20 credits) CS3003 Software Engineering (20 credits)	**Optional modular block codes, titles and credits** **All the modular blocks are 20 credits unless stated otherwise.** Students must choose 40 credits of options from the following list: MA3610 Ordinary and Partial Differential Equations MA3614 Complex Variable Methods and Applications MA3626 Encryption and Data Compression MA3650 Numerical Methods for Differential Equations MA3660 Mathematics in Context MA3670 Statistics III MA3676 Stochastic Models MA3686 Risk and Optimisation for Financial Planning
Year 3 and FHEQ Level 6 Progression and Award Requirements **As per Senate Regulation 2** For BSc (Hons) Mathematics with Computer Science and Professional Practice, 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.