

Programme Specification for Undergraduate Programme
Leading to:
MMath Mathematics
MMath Mathematics with Professional Practice



Applicable for all undergraduate students **starting at Level 5** in 2018

Version No.	Date	Notes – Q&S USE ONLY	AO
2018/19 v1	4 July 2018	Changes to Level 5 blocks: MA5627_CB becomes MA5640_CN; and MA5619_CB becomes MA5619_CN and moves from being compulsory to optional, MA5611 is removed from the list of compulsory blocks and the programme. MA5614 is added as an option and the following options are removed: MA5625; MA5623; MA5641; MA5644; and MA5673.	JP

Undergraduate Programme	
1. Awarding institution	Brunel University London
2. Teaching institution(s)	Brunel University London
3. Home college/department/division	College of Engineering, Design and Physical Sciences/ Dept of Mathematics Science/Mathematics
4. Contributing college/department/division/ associated institution	None.
5. Programme accredited by	<u>Institute of Mathematics and its Applications</u> – this programme is accredited to meet the educational requirements of the Chartered Mathematician designation, awarded by the Institute of Mathematics and its Applications,
6. Final award(s) and FHEQ Level of Award	MMath Mathematics MMath Mathematics with Professional Practice (FHEQ Level 7)
7. Programme title	MMath Mathematics MMath Mathematics with Professional Practice
8. Programme type (Single honours/joint)	Single
9. Normal length of programme (in months) for each mode of study	48 months Full time; 60 months Thick Sandwich (with Professional Practice)
10. Maximum period of registration for each mode of study	84 months Full time; 96 months 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, titles and FHEQ Level of Award	CertHe in Mathematics (FHEQ Level 4) DipHe in Mathematics (FHEQ Level 5) DipHe in Mathematics with Professional Practice (FHEQ Level 5) BSc (Ord) Mathematics (FHEQ Level 6) BSc (Ord) Mathematics with Professional Practice BSc (Hons) Mathematics (FHEQ Level 6) BSc (Hons) Mathematics with Professional Practice (FHEQ Level 6)
15. UCAS Code	G100 (Full time), G101 (Thick Sandwich)
16. JACS Code	G100
17. Route Code	G100UMMATH
18. Relevant subject benchmark statements and other external and internal reference points used to inform programme design.	QAA 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 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 Brunel International'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.	Students not achieving a weighted grade point average of 11 (corresponding to the grade B-) at Levels 1, 2 or 3 will normally not be permitted to progress on the MMath programme. If they satisfy the progression requirement, students may progress at the next level on the BSc programme. Students satisfying the progression requirements of the MMath programme may be permitted to change from the BSc programme onto the MMath programme.
22. Further information about the programme is available from the College website.	Link to programme information on the College website http://www.brunel.ac.uk/courses/undergraduate/mathematics-mmath

23. EDUCATIONAL AIMS OF THE PROGRAMME

The programme aims to enhance students' mathematical thought processes and deeper knowledge beyond that of the BSc. Mathematics programme, better equipping MMath graduates for further study or for employment requiring a similar level of mathematical understanding. MMath students are exposed to a deeper and broader range of more advanced mathematical theories and techniques cognate to Level 3 by means of taught MSc modules and 'directed learning' modular blocks that develop independent learning skills.

The programme aims to produce graduates able to:

1. demonstrate, in theory and practice, a deep understanding of a range of mathematical theories and techniques of use in various domains of mathematics;
2. formulate, soundly and rigorously, solutions to mathematical problems by identifying and implementing relevant mathematical and computational tools and techniques;
3. execute a major project and report the findings in a well-articulated, well designed and timely fashion;
4. communicate their ability and knowledge, verbally and through written documentation, and have experienced working in a team;
5. progress to employment or postgraduate study in areas requiring numeracy, **in particular in applied mathematics, finance and statistics;**
6. enjoy a wide spectrum of mathematical activities, from tackling mathematical problems for their own sake to the exploration of its professional side;
7. appreciate that the enjoyment of mathematics and the need for rigour are not mutually exclusive;
8. demonstrate the skills required for independent research and for life-long learning of the highest kind.

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:

Level	Category (K = knowledge and understanding, C = cognitive (thinking) skills,	Learning Outcome	Associated Assessment Blocks Code(s)	Associated Study Blocks Code(s)	Associated Modular Blocks Code(s)

	S = other skills and attributes)				
1					
1	K 1x5	Demonstrate knowledge and understanding of basic mathematical techniques in calculus, linear algebra, probability theory, geometry, descriptive statistics and numerical methods;	MA1812_CB MA1813_CA MA1819_CA MA1826_CN MA1870_CN	MA1710_SB MA1711_SB MA1712_SB MA1720_SB MA1726_SB MA1770_SB MA1795_SB	
1	K 1x2	Demonstrate knowledge and understanding of the formal language and elementary tools of formal mathematics (including set theory, counting and logic);	MA1813_CA MA1826_CN	MA1710_SB MA1712_SB MA1726_SB	
1	C 1x3	Construct elementary proofs within formal mathematical systems;	MA1813_CA MA1826_CN MA1870_CN	MA1710_SB MA1711_SB MA1712_SB MA1720_SB MA1726_SB MA1770_SB	
1	C 1x4	Formulate and solve elementary mathematical problems associated with the application of mathematics to the real world;	MA1826_CN MA1849_CN MA1870_CN MA1819_CA	MA1720_SB MA1726_SB MA1749_SB MA1770_SB	
1	S 1x5	Produce documents with appropriate mathematical content;	MA1819_CA MA1826_CN MA1849_CN	MA1726_SB MA1749_SB MA1770_SB	
1	S 1x6	Use a range of appropriate mathematical software;	MA1819_CA MA1849_CN	MA1749_SB MA1770_SB MA1795_SB	
1	K 1o1	Demonstrate knowledge and understanding of simple examples of application of mathematics to real world problems, including mechanics;	MA1826_CN MA1849_CN MA1870_CN	MA1720_SB MA1726_SB MA1749_SB MA1770_SB	

2					
2	K 2x1	Demonstrate knowledge and understanding of techniques and theories of use in linear mathematics, including ordinary and partial differential equations, and multivariable calculus.	MA2812_CB MA2815_CN MA2832_CN MA2841_CN	MA2712_SB MA2715_SB MA2722_SB MA2730_SB MA2731_SB	
2	K 2x2	Demonstrate knowledge and understanding of techniques and theories of elementary stochastic models and statistical inference;	MA2870_CB MA2887_CN	MA2771_SB MA2786_SB	
2	C 2x3	Model, formulate and analyse classical problems in various areas of applications of mathematics;	MA2812_CB MA2815_CN MA2841_CN MA2887_CN	MA2712_SB MA2715_SB MA2726_SB MA2741_SB MA2786_SB	
2	S 2x4	Communicate mathematics in a clear and concise manner appropriate to the context;	MA2832_CN MA2897_CB	MA2722_SB MA2730_SB MA2731_SB MA2771_SB	
2	S 2x5	Operate in teams in order to plan, execute, report and present mathematics and computer based projects;	MA2895_CB MA2897_CB	MA2715_SB MA2771_SB	
2	K 2o1	Demonstrate knowledge and understanding of mathematical tools leading to numerical algorithms in various areas of applications;	MA2815_CN MA2832_CN MA2887_CN	MA2715_SB MA2721_SB MA2726_SB MA2730_SB MA2786_SB	
2	C 2o2	Operate within mathematical structures with a broad range of abstract mathematical concepts;	MA2815_CN MA2832_CN	MA2715_SB MA2721_SB MA2722_SB MA2726_SB MA2730_SB MA2731_SB	
2	S 2o3	Able to document the conception and development of computer programs;	MA2895_CB	MA2715_SB	
2	K 2p1	Demonstrate knowledge and understanding of the structures, processes and business environment relevant to the work placement;		MA2554_SB	MA2555_CB
2	C 2p2	Demonstrate problem-solving skills, analytical and creative skills given real life situations;		MA2554_SB	MA2555_CB
2	C 2p3	Analyse and critically reflect on the work placement context;		MA2554_SB	MA2555_CB
2	S 2p4	Demonstrate numerical, technical, professional and communication skills;		MA2554_SB	MA2555_CB
2	S 2p5	Demonstrate planning and organisational skills with the ability to work in a team;		MA2554_SB	MA2555_CB
3					
3	K 3x1	Demonstrate knowledge and understanding of advanced mathematical tools and their use in a range of applications in areas comprising ordinary and partial differential equations, complex variable, combinatorics, numerical analysis, operational research, stochastic modelling and statistics (Ord.);			MA3610_CN MA3614_CN MA3626_CN MA3650_CN MA3667_CN MA3670_CN MA3676_CN MA3686_CN MA3990_CB
3	K 3x2	Demonstrate a sound understanding in a broad range of important areas of mathematics (Ord.);			MA3610_CN MA3614_CN MA3626_CN MA3650_CN MA3667_CN MA3670_CN MA3676_CN MA3686_CN MA3990_CB
3	K 3x3	Demonstrate knowledge and understanding of the mathematics and computing tools necessary to execute a major project (BSc.);			MA3990_CB

3	S 3x4	Plan and evaluate a major project (BSc.);			MA3990_CB
3	S 3x5	Report (in writing and orally), document and package a major project (BSc.)			MA3990_CB
3	C 3o1	Formulate and solve advanced problems in a broad range of application of mathematics (BSc.);			MA3610_CN MA3614_CN MA3626_CN MA3650_CN MA3667_CN MA3670_CN MA3676_CN MA3686_CN MA3990_CB
3	C 3o2	Critically evaluate important types of algorithms in mathematics (BSc.);			MA3626_CN MA3650_CN MA3667_CN MA3676_CN MA3686_CN MA3990_CB

5

5	K 5x1	Demonstrate knowledge and understanding of state of the art mathematical tools and their use in a wide range of applications in areas of use to applied and financial mathematics and statistics;			All level 5 blocks
5	C 5x2	Construct proofs within formal mathematical systems;			All level 5 blocks
5	K 5x3	Demonstrate a deep understanding in a range of important areas of mathematics;			All level 5 blocks
5	S 5x4	Identify, define, and review appropriate literature prior to conducting systematic investigations and interpreting results/theories;			MA5640_CN MA5691_CB
5	S 5x5	Communicate effectively in written, visual, and verbal modes and use communications and information technology effectively;			MA5691_CB MA5640_CN
5	S 5x6	Plan and manage learning and appraise outcomes of learning.			All level 5 blocks
5	K 5o1	Demonstrate knowledge and understanding of the mathematics and computing tools necessary to execute the advanced project.			MA5691_CB

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

At Level 1, great care is taken to give time to students to adapt to university style of learning and studying. Starting with an environment of frequent meetings in small groups, as they progress in Term 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. At Level 1, the study block Fundamentals of Mathematics will set the key concepts used in other modules to develop abstract ideas. From Level 2, students should be able to study from plenary lectures, exercises classes and computer labs.

To be able to pursue their interests, students can choose most of their third and fourth year mathematical modules and modular blocks in areas covering 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 BSc Final Year Project MA3990_CB and the Advanced Project at Level 5 MA5690_CB, students will be allocated from their list of preferences. Students will choose their preferred project list for MA3990_CB from a sub-list of the BSc programmes list that emphasise the delivery of mathematical, and/or computational, tasks, with their analysis. The sub-list will be created by the programme co-ordinator. In the final fourth year, students will have five options to choose from a list drawn from the MSc. courses and 'directed learning' modules. The 'directed learning' modules are in the broad research areas of members of staff. There will be weekly contact hours, including presentation by students, and supported by textbooks or equivalent. Students will polish and deepen their skills for independent learning and reflection.

Acquiring soft skills is also an important part of undergraduate studies. Although the teaching of soft skills is imbedded in the context of study blocks, they are also assessed `independently` (MA1819_CA at Level 1, MA2895_CB, MA2897_CB at Level 2) to highlight that their acquisition is indispensable for progression in the programme. At Level 1, students will have learned how to write and type mathematics and use a range of appropriate mathematical software. This is achieved with documents for self-paced learning, surgeries and feedback from short pieces of coursework (1x5-6). Directing the students to particular reporting for a variety of tasks followed by careful feedback, students will progress at Level 2 The learning outcome 2o3 is addressed in the numerical analysis project (MA2895_CB) and the learning outcomes 2x4-5 are addressed in the statistics project (MA2897_CB). The final learning outcomes 3x3-5 follow the successful completion of the Final Year project. Finally, the Advanced Project MA5690_CB, Research Methods and Case Studies MA564027_CN and the `directed learning` modular blocks are the main scene for achieving the learning outcomes 5x4-6 and 5o1.

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, short written exercises, in addition to exercises and their solutions done in the classroom and at home. At Level 1, we help students to be able to use the opportunities for formative assessment to generate feedback student can use to assess their progress. At Levels 1 and 2, some subjects are grouped together in final examinations, usually with limited choice of questions, to emphasize that some of the material learned during the year is part of a whole and should be continuously available in the student's mind in the subsequent parts of their studies. Some other examinations are testing material separately, in particular final examinations at Level 3, to allow for an evaluation of the depth of understanding of the students. In that case, choices of questions are usually available.

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 is 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 Level 1, there are many opportunities for formative assessment with rapid feedback, usually class tests, weekly written coursework or computer based tests. Coursework is also being used at Level 2 and 3 for students to work on complicated examples that need computing power or cannot be addressed in a timed examination. The learning outcome 3x3 will be mainly tested in the third year project MA3990_CB. At Level 5, the assessment for the modules common with the MSc. could have some summative coursework (depending on the modular block) and a final examination. The Advanced Project will be assessed via a final report, an oral presentation from the student followed by an oral examination of the report. The assessment for the `directed learning` modules will use a portfolio of work done during the term. This portfolio will be presented and discussed with the examiners to assess ownership and the extent of knowledge, understanding and critical appraisal of the material compared with the learning outcomes of the module.

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 (2p1-5). 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.

Level 1	
<p>Compulsory assessment block codes, titles and credit</p> <p>MA1812_CB Essential Mathematics (20 credits) Core: Block MA1813_CA Advanced Mathematics I (20 credits) Core: All, Block MA1819_CA Mathematical and Computational Skills (20 credits) Core: All, Block MA1826_CN Geometry and Applications (20 credits) MA1849_CN Computing Projects and Mechanics (20 credits) MA1870_CN Probability and Statistics (20 credits)</p>	<p>Optional assessment block codes, titles and credits</p>
<p>Compulsory study block codes, titles and credit volume</p> <p>MA1710_SB Transition to Independent Learning of Mathematics (10 credits) MA1711_SB Calculus (15 credits) MA1712_SB Fundamentals (10 credits) MA1720_SB Linear Algebra (15 credits) MA1726_SB Geometry and Applications (20 credits) MA1749_SB Computing Projects and Mechanics (20 credits) MA1770_SB Probability and Statistics (20 credits) MA1795_SB Algorithms and Numerical Methods (10 credits)</p>	<p>Optional Study block codes, titles and credit volume</p>
<p>Compulsory modular block codes, titles and credits</p>	<p>Optional modular block codes, titles and credits</p>
<p>Level 1 Progression and Award Requirements</p> <p>As per Senate Regulation 2</p>	

Level 2	
<p>Compulsory assessment block codes, titles and credits</p> <p>MA2812_CB Multivariable Mathematics (10 credits) Core: Block MA2815_CN Advanced Mathematics II and Numerical Methods (20 credits) MA2832_CN Algebra and Analysis (20 credits) MA2841_CN Vector Calculus and Applications (20 credits) MA2870_CB Probability and Statistics II (10 credits) Core: Block MA2887_CN Operational Research, Probability and Statistics (20 credits) MA2895_CB Numerical Analysis Project (10 credits) Core: Block MA2897_CB Statistics Project (10 credits) Core: Block</p>	<p>Optional assessment block codes, titles and credits</p>

Compulsory study block codes, titles and credit volume MA2712_SB Multivariable Calculus (10 credits) MA2715_SB Advanced Calculus and Numerical Methods (10 credits) MA2721_SB Linear Methods (10 credits) MA2722_SB Algebra (10 credits) MA2726_SB Elements of Combinatorics (10 credits) MA2730_SB Analysis 1 (10 credits) MA2731_SB Analysis 2 (10 credits) MA2741_SB Vector Calculus and Applications (20 credits) MA2771_SB Probability and Statistics II (20 credits) MA2786_SB Operational Research (10 credits) MA2554_SB Employability Skills (5 credits)	Optional Study block codes, titles and credit volume
Compulsory modular block codes, titles and credits	Optional modular block codes, titles and credits
Level 2 Progression and Award Requirements As per Senate Regulation 2	

Level 2 – 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 Professional Practice” MA2555_CB Work Placement (120 placement credits) Core: Block	Optional modular block codes, titles and credits
Level 2 Placement Progression and Award Requirements As per Senate Regulation 2 For MMath Mathematics with Professional Practice, MA2555_CB will contribute 25% of the Level 2 profile and 5% of the overall degree calculation	

Level 3	
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_CB Project (40 credits) Core: Block MA3614_CN Complex Variable Methods and Applications (20 credits)	Optional modular block codes, titles and credits Students must choose 60 credits of options from the following list: MA3610_CN Ordinary and Partial Differential Equations (20 credits) MA3626_CN Encryption and Data Compression (20 credits) MA3650_CN Numerical Methods for Differential Equations (20 credits) MA3667_CN Financial Mathematics (20 credits) MA3670_CN Statistics III (20 credits) MA3676_CN Stochastic Models (20 credits) MA3686_CN Risk and Optimisation for Financial Planning (20 credits)
Level 3 Progression and Award Requirements As per Senate Regulation 2 For BSc Mathematics with Professional Practice, MA2555_CB will contribute 8.33% of the overall degree calculation	

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

<p>Compulsory modular block codes, titles and credits</p> <p>MA5691_CB Advanced Project (30 credits) Core: Block</p> <p>MA5640_CN Research Methods and Case Studies (15 credits)</p>	<p>Optional modular block codes, titles and credits</p> <p><u>Students must choose 75 credits of options from the following list:</u></p> <p>MA5614_CN Probability and Stochastics (15 credits)</p> <p>MA5619_CN Advanced Mathematical Methods (15 credits)</p> <p>MA5624_CN Option Pricing Theory (15 credits)</p> <p>MA5616_CN Financial Computing I (15 credits)</p> <p>MA5618_CN Financial Computing II (15 credits)</p> <p>MA5676_CN Time Series Modelling (15 credits)</p> <p>MA5620_CN Topics in Combinatorics (15 credits)</p> <p>MA5661_CN Dynamical Systems and ODEs (15 credits)</p> <p>MA5664_CN Mathematical Biology (15 credits)</p> <p>MA5672_CN Random Matrix Theory (15 credits)</p> <p>MA5674_CN Modern Regression and Classification (15 credits)</p> <p>MA5675_CN Network Models (15 credits)</p>
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Level 5 Progression and Award Requirements

[As per Senate Regulation 2](#)

For MMath Mathematics with Professional Practice, MA2555_CB will contribute 5% 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.