University of the
West of England
BRISTOL

PROGRAMME SPECIFICATION

Part 1: Information	
Awarding Institution	University of the West of England, Bristol
Teaching Institution	University of the West of England, Bristol
Delivery Location	Frenchay Campus
Study abroad / Exchange / Credit recognition	Study abroad option available at Virginia Commonwealth University, USA. This study abroad option is suspended from 2018/19.
Faculty responsible for programme	Environment and Technology
Department responsible for programme	Engineering Design and Mathematics
Professional Statutory or Regulatory Body Links	Institute of Mathematics and its Applications (IMA)
Highest Award Title	MMath Mathematics
Default Award Title	
Interim Award Titles	BSc(Hons) Mathematics BSc Mathematics Diploma of Higher Education Mathematics Certificate of Higher Education Mathematics
UWE Progression Route	
Mode of Delivery	SW, Full-time (attendance)
ISIS code/s	
For implementation from	September 2017

Part 2: Description

This programme is designed to provide a broad experience of the mathematical sciences discipline as well as a deeper understanding of some areas of the discipline with a particular focus on applications relevant to the world of modern employment. Graduates of this integrated undergraduate masters programme will be equipped to access employment that has high earnings potential in a wide variety of professional contexts, and/or to commence doctoral level study. Mathematics graduates are employed across the economy, for example in business and financial modelling, in engineering, in research organisations modelling problems in biology, physics, computer science and social science, in big data and statistical analysis roles. The extra value provided by this MMath programme over a BSc (Hons) programme is a greater depth and experience of applications in the real world, particularly applications in data science.   Students will be provided with the opportunity to develop their skills and employability through interaction with industry and through developing high-level skills in analysis, report-writing and communication.

The innovative approach of this programme over other MMath programmes offered in the UK is the focus on preparing graduates for employment through our links with employers in sectors such as data science and finance. Whilst the programme will also equip graduates with the skills and knowledge should they wish to enter doctoral training programmes in a number of application areas, the principle aim is to prepare graduates to enter employment at a higher level than standard graduate entry.

The MMath Mathematics programme has the following educational aims:

1. To produce graduates who are familiar with concepts and skills of disciplines within mathematical sciences that will enable them to gain employment in a number of sectors including science, technology, government and business;
2. To develop deep understanding of the underlying and unifying mathematical concepts that underpin the different branches of the discipline;
3. To prepare students for progression to study doctoral degrees in Mathematics, Statistics and Operational research;
4. To develop analytical, problem-solving transferable skills that will be valuable to graduates in any career;
5. To develop the ability to select and apply mathematical statistical and operational research concepts in a range of contexts;
6. To develop, interpret and critique models applied to a range of problems in different contexts;
7. To effectively use specialised computer software to solve problems in the mathematical science and to understand their strengths and limitations;
8. To understand and implement basic programming concepts and develop algorithms for the solution of mathematical problems.
8. To ensure that graduates can communicate effectively to both expert and non-expert audiences through presentations and through written reports;
9. To continue the development of those general study skills that will enable students to become independent lifelong learners;
10. To develop research skills and the ability to read critically a range of material from a variety of sources;
11. To be able to translate real-world problems into mathematical terms;
12. The ability to plan and conduct a substantial project in the mathematical sciences.

Programme requirements for the purposes of the Higher Education Achievement Record (HEAR)

The aim of this programme is to produce applied mathematical science M-level graduates able to apply their knowledge and skills in a professional context.

A successful graduate will be highly numerate and analytical and able to communicate their knowledge to a specialist or non-specialist audience. On completion, graduates will have successfully completed individual and group investigations, demonstrating an ability to work independently and as part of a team. Graduates will be critical thinkers who understand the strengths and limitation of mathematical and statistical models and engage with academic and professional literature.

Regulations

Part 2: Description

A: Approved to [University Regulations and Procedures](#)

Learning Outcomes

A Knowledge and understanding of:

1. Analytical techniques used to solve problems involving linear or nonlinear systems;

2. Analytical techniques used to solve problems involving discrete mathematical objects;

3. Computational techniques for solving mathematical and statistical problems;

4. The application of computer software to analyse and solve mathematical and statistical problems;

5. Programming concepts and structures for implementing numerical algorithms;

6. The theoretical underpinning and application of a wide range of methods for statistical analysis, design of experiments and data modelling;

7. The modelling process, applied to a variety of problems, using techniques from mathematics, statistics and operational research

8. The application of mathematical and statistical techniques to solve realistic problems drawn from a variety of application areas; e.g. biology, physics, finance, health, business, transport, social science;

B Intellectual Skills

Graduates will have the ability to:

1. think logically and use symbolic language to describe the relationships between real and abstract quantities in the context of mathematical, statistical and operational research problems;

2. communicate mathematical and statistical arguments, using appropriate notation, in a clear and precise manner

3. construct rigorous logical arguments and mathematical proofs;

4. critically interpret solutions obtained using mathematical, statistical and operational research techniques and report conclusions in a clear and appropriate manner;

5. design, implement and test algorithms;

6. To translate real-world problems into mathematical terms.

C Subject, Professional and Practical Skills

Graduates will be able to:

1. adopt different problem solving approaches from mathematical, statistical and operational research to problems that arise in a variety of contexts;

2. use mathematical language, notation and methods in the description and analysis of problems in appropriate areas of application;

3. communicate the results from mathematical or statistical investigations in a manner that is appropriate for a non technical audience;

4. apply mathematical theory in a variety of contexts such as financial mathematics, fluid dynamics, computational mathematics, coding, mathematical biology, transport and decision modelling.

5. apply statistical methods in a variety of contexts relevant to government, science and industry.

6. develop and implement mathematical and statistical models in a variety of contexts.

D Transferable Skills and other attributes

Graduates will be able to

1. communicate using professional standards of English, both orally and through written technical reports;

2. demonstrate the ability to manage their own time and meet deadlines;

3. plan and conduct a substantial individual project;

4. work in teams and take responsibility for individual and shared objectives;

5. use IT skills in context and to learn how to use new software tools to develop and to implement solutions;

6. take a logical and systematic approach to problem formulation, solution and decision making;

7. demonstrate the ability to learn independently;

8. to be able to critically review available literature that is relevant to the subject discipline;

ESD: Important attributes of a graduate of this programme will be to understand the potential impact of mathematical sciences on society and the environment and to develop the modelling skills and tools that can support change.

Throughout the programme students develop the necessary mathematical and statistical skills that underpin the application of mathematical sciences to real world scenarios. It is important that students become confident with developing software solutions and basic concepts of coding as this is how the methods of mathematics and statistics are implemented in the work-place and research environments.

Applications of the subject are covered in a number of the modules, but here we concentrate on those modules that are present in the core of the programme structure. Modules that make a direct contribution to this theme are marked in **green**.

Learning Outcomes:	UFMFL2-30-1 Sets, functions and linear algebra	UFMFK3-30-1 Calculus and numerical methods	UFMFPA-30-1 Statistical reasoning	UFMFM3-30-1 Modelling and Optimisation	UFMFF9-30-2 Mathematical Methods	UFMFNA-30-2 Statistical Modelling	UFMFC7-30-2 Algebra, Combinatorics and graphs	UFMFK8-30-3 Dynamical Systems	UFMFX9-30-3 Numerical Analysis	UFMF89-15-3 Industrial Placement	UFMFV9-15-3 Mathematics, Statistics & OR Project B	UFMFU9-30-3 Maths, Statistics & OR Project A	UFMFLH-15-M Stochastic Processes	UFMFHH-30-M Data Science	UFMFJH-15-M Mathematical Biology	UFMFGH-30-M Computational Mathematics	UFMFKH-15-M Networks and graphs	UFMFMH-15-M Mathematical Sciences Case Studies
A) Knowledge and understanding of:																		
1 Analytical techniques used to solve problems involving linear or nonlinear systems	✓	✓		✓				✓			✓	✓	✓		✓			✓
2 Analytical techniques used to solve problems involving discrete mathematical objects	✓						✓				✓	✓					✓	✓

Learning Outcome	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
3 Computational techniques for solving mathematical and statistical problems	✓	✓	✓		✓			✓								✓		
4 The application of computer software to analyse and solve mathematical and statistical problems					✓									✓		✓		
5 Programming concepts and structures for implementing numerical algorithms																✓		
6 The theoretical underpinning and application of a wide range of methods for statistical analysis, design of experiments and data modelling		✓			✓								✓	✓				
7 The modelling process, applied to a variety of problems, using techniques from mathematics, statistics and operational research			✓		✓		✓							✓				✓
8 The application of mathematical and statistical techniques to solve realistic problems drawn from a variety of application areas; e.g. biology, physics, finance, health, business, transport, social science;				✓										✓	✓			✓
(B) Intellectual Skills																		
1 Think logically and use symbolic language to describe the relationships between real and abstract quantities in the context of mathematical, statistical and operational research problems	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
2 Communicate mathematical and statistical arguments, using appropriate notation, in a clear and precise manner	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
3 Construct rigorous logical arguments and mathematical proofs	✓					✓											✓	
4 Critically interpret solutions obtained using mathematical, statistical and operational research techniques and report conclusions in a clear and appropriate manner						✓					✓	✓						✓
5 Design, implement and test algorithms									✓							✓		
6 To translate real-world problems into mathematical terms													✓	✓	✓	✓	✓	✓
(C) Subject/Professional/Practical Skills																		
1 Adopt different problem solving approaches from mathematical, statistical and operational research to problems that arise in a variety of contexts	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓
2 Use mathematical language, notation and methods in the description and analysis of problems in appropriate areas of application													✓	✓	✓	✓	✓	✓
3 Communicate the results from mathematical or statistical investigations in a manner that is appropriate for a non technical audience											✓	✓						✓
4 Apply mathematical theory in a variety of contexts such as financial mathematics, fluid dynamics, computational mathematics, coding, mathematical				✓		✓	✓	✓						✓	✓	✓		✓

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
biology, transport and decision modelling																	
5 Apply statistical methods in a variety of contexts relevant to government, science and industry						✓							✓				✓
6 Develop and implement mathematical and statistical models in a variety of contexts						✓		✓	✓				✓	✓		✓	✓
(D) Transferable skills and other attributes																	
1 Communicate using professional standards of English, both orally and through written technical reports						✓				✓	✓	✓					✓
2 Demonstrate the ability to manage their own time and meet deadlines										✓	✓	✓					✓
3 Plan and conduct a substantial individual project										✓	✓						✓
4 Work in teams and take responsibility for individual and shared objectives				✓													
5 Use IT skills in context and to learn how to use new software tools to develop and to implement solutions		✓	✓			✓		✓							✓		
6 Take a logical and systematic approach to problem formulation, solution and decision making	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
7 Demonstrate the ability to learn independently										✓	✓						✓
8 To be able to critically to review available literature that is relevant to the subject discipline										✓	✓	✓	✓	✓	✓	✓	✓

Part 4: Programme Structure:				
This structure diagram demonstrates the student journey from Entry through to Graduation for a **full time student**, including: level and credit requirements; interim award requirements; module diet, including compulsory and optional modules.				

ENTRY		**Compulsory Modules**	**Optional Modules**	**Interim Awards**
	Level 1	UFMFL3-30-1 Sets, Functions and Linear Algebra UFMFK3-30-1 Calculus and Numerical Methods UFMFPA-30-1 Statistical Reasoning UFMFM3-30-1 Modelling and Optimisation	None	Certificate of Higher Education Mathematics 120 credits of which not less than 100 are at level 1 or above.
		Compulsory Modules	**Optional Modules**	**Interim Awards**
	Level 2	UFMFF9-30-2 Mathematical Methods UFMFNA-30-2 Statistical Modelling UFMFC7-30-2 Algebra, Combinatorics and Graphs	*Select 30 credits from* UFMFG9-15-2 Mathematical Statistics UFMFT7-15-2 Complex Variables UFMF7A-15-2 Operational Research UFMFQ7-15-2 Coding Theory and Applications UTXN8M-30-2 Professional Development in Secondary Education 1 [Students transferring in from BSc Maths with QTS only] UFMFSK-30-2 Reflection on Practice in Secondary Education [Students transferring in from BSc Maths with QTS only]	Diploma of Higher Education Mathematics 240 credits at which not less than 100 are at level 2 or above and 120 are at level 1 or above.
	Level 2 MMath Mathematics International Variant – Mathematical Sciences and Statistical Sciences and Operations Research undergraduate programmes, College of Humanities and Sciences. Virginia Commonwealth University **NOTE: STUDENTS MUST TAKE A TOTAL OF 8 (US three credit – Level 300-500) MODULES** In accordance with UWE Academic Regulations and Procedures, the modules studied at VCU will be recognised by UWE as contributing to the credit requirements of the award as accredited				

learning (AL), subject to the student achieving a pass in each of the VCU modules. No marks will be transferred from VCU to UWE. The assessment outcomes against the equivalent UWE modules will be pass or fail only.

VCU has suspended outward mobility to Virginia Commonwealth University from 2018/19.

Compulsory modules	Optional modules	Interim Awards:
Students must take all of the following modules MATH307 Multivariate Calculus • MATH432 Ordinary Differential Equations • MATH433 Partial Differential Equations • STAT310 Introduction to Statistical Inference • STAT544 Statistical Methods II	**Students must take three modules from the following modules**: • MATH415 Numerical Methods • OPER427 Deterministic Operations Research • MATH380 Introduction to Mathematical Biology • MATH401 Introduction to Abstract Algebra • MATH350 Introductory Combinatorics • MATH351 Applied Abstract Algebra • MATH191 Topics in Mathematics	Credit requirements: 240 (EQUIVALENT) – Diploma in Higher Education Other requirements None

Year Out: *Students may elect to spend a minimum of 40 weeks working for an organisation, in a role where mathematical and statistical methods are used in the workplace. _Placement Option:_* **Industrial Placement** UFMF89-15-3

		Compulsory Modules	Optional Modules	Interim Awards
Level 3		UFMFK8-30-3 Dynamical Systems UFMFX9-30-3 Numerical Analysis **Select one of the following project modules** UFMFU9-30-3 Mathematics, Statistics and Operational Research Project A UFMFV9-15-3 Mathematics, Statistics and Operational Research Project B	***Select at most 45 credits from Mathematics Options*** UFMFUG-15-3 Financial Mathematics UFMFVG-15-3 Fluid Dynamics UFMFWG-15-3 Applied Algebra and Geometry UFMFY7-30-3 Decision Modelling ***Select at most 30 credits from: Statistics Options.*** UFMFK7-30-3 Statistical Research Methods UFMFW9-30-3 Multivariate Statistical Modelling	BSc Mathematics 300 credits of which at least 60 must be at level 3, a further 100 at level 2 or above and a further 140 at level 1 or above BSc(Hons) Mathematics 360 credits, of which at least 100 must be at level 3, a further 100 at level 2 or above and a further 140 at level 1 or above

	Compulsory Modules	Optional Modules	Interim Awards
Level M	UFMFHH-30-M Data Science UFMFJH-15-M Mathematical Biology UFMFGH-30-M Computational Mathematics UFMFLH-15-M Stochastic Processes UFMFKH-15-M Networks and Graphs UFMFMH-15-M Mathematical Sciences Case Studies		BSc(Hons) Mathematics 360 credits, of which at least 100 must be at level 3, a further 100 at level 2 or above and a further 140 at level 1 or above **Highest Award:** MMath Mathematics 480 credits at appropriate level

Part 5: Entry Requirements

The University's Standard Entry Requirements apply*: The UCAS points tariff will be reviewed on a regular basis and published for new applicants. However, an applicant to this programme will typically have an A-level in mathematics at grade A or at grade A*.

Applicants without A-level mathematics at the appropriate grade, or an equivalent qualification, will be considered on a case-by-case basis.

Students on BSc (Hons) Mathematics and BSc (Hons) Mathematics & Statistics may transfer internally to the MMath programme provided they have attained an average of at least 60% in their level 2 modules or 60% in their level 3 modules, provided that the core programme for MMath has been followed.

Part 6: Reference Points and Benchmarks

The following reference points and benchmarks have been used in the design of the programme:

QAA UK Quality Code for HE
      -Framework for higher education qualifications (FHEQ)
      -Subject benchmark statements
      -Qualification characteristics for Foundation degrees and Master's degrees

Strategy 2020
University policies
Staff research projects
Any relevant PSRB requirements

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First CAP Approval Date	31 January 2017			
Revision CAP Approval Date *Update this row each time a change goes to CAP*	6 Nov 2017	Version	1 2	Link to MIA (ID 2586) Link to RIA 12480 (ID 4550)
Next Periodic Curriculum Review due date	2023			
Date of last Periodic Curriculum Review				