Programme Information		
Programme Title	Programme Code	HECoS Code
Applied Mathematics	G1U2 (1YFT) G1U224 (2YPT)	For Registry Use Only

Award	Length of Study	Mode of Study	Entry Point(s)	Total Credits	
				ECTS	CATS
MSc - G1U2	1 Calendar Year (12 months)	Full-Time	Annually in October	90	180
MSc - G1U224	2 Calendar Years (24 months)	Part-Time	Annually in October	90	180
PG Diploma	1 Calendar Year (12 months)	Full-Time	*	60	120
PG Diploma	2 Calendar Years (24 months)	Part-Time	*	60	120
PG Certificate	1 Calendar Year (12 months)	Full-Time	*	30	60
PG Certificate	2 Calendar Years (24 months)	Part-Time	*	30	60
*The PG Certificate and PG Diploma are exit awards and are not available for entry. All students must apply to and join MSc.					

Ownership			
Awarding Institution	Imperial College London	Faculty	Faculty of Natural Sciences
Teaching Institution	Imperial College London	Department	Mathematics
Associateship	N/A	Main Location(s) of Study	South Kensington Campus
External Reference			
Relevant QAA Benchmark Statement(s) and/or other external reference points		Mathematics, Statistics and Operational Research	
FHEQ Level		Level 7	
EHEA Level		2nd Cycle	
External Accreditor(s) (if applicable)			
External Accreditor 1:	N/A		
Accreditation received:	N/A	Accreditation renewal:	N/A

Collaborative Provision			
Collaborative partner	Collaboration type	Agreement effective date	Agreement expiry date
N/A	N/A	N/A	N/A

Specification Details	
Programme Lead	Dr Ory Schnitzer
Student cohorts covered by specification	2022-23 entry
Date of introduction of programme	October 21
Date of programme specification/revision	October 22

Programme Overview

This course will provide you with outstanding training in many different aspects of Applied Mathematics.

We offer a great variety of modules with depth of instruction, small classes and a substantial research project. The very broad choice of modules and research projects available covers all areas of applied mathematics and mathematical physics, reflecting the very broad research interests of members of the Applied Mathematics and Mathematical Physics section of the Department of Mathematics. Particular strengths include fluid dynamics, mathematical modelling, numerical analysis and scientific computation, mathematical physics, mathematical biology, applied analysis of PDEs and stochastic differential equations, asymptotic and perturbation methods, data, networks and complexity science.

You will be able to choose 8 modules from the list of Applied Mathematics modules (typically 20-25 modules), 4 in the autumn term and 4 in the spring term; there are no other restrictions and there are no mandatory core modules (except the research project). This will allow you to design your own learning plan in line with your unique background, interests and the field in which your wish to do your research project.

A list of projects is published early on in the year. With this list as a starting point for further discussion, and with guidance from your personal tutor, you will engage with potential supervisors to agree on a topic for your individual research project. You will begin to work on your project during the spring term, alongside your course work, and then full-time over the summer.

The skill set obtained during the Applied Mathematics MSc programme is well suited for continuing to PhD level research in applied mathematics. It is also highly transferable, which opens opportunities for a career in industry or for further advanced study and research in diverse areas including engineering, physics and finance.

Learning Outcomes

Students who have fulfilled all the requirements of the programme will be awarded a MSc. On successful completion of the programme, our aim is that you will have achieved the following Learning Outcomes (divided into three groups):

1) <u>Outcomes from modules element</u>
   a) Explore the role of logical mathematical argument and deductive reasoning, and apply them through formal processes of mathematical proof and development of mathematical theories.
   b) Operate symbolic and numerical software as apart of practical computation
   c) Manipulate precise and intricate ideas and construct logical arguments using appropriate terminology.
   d) Communicate effectively using a variety of modes and media including written, oral and digital forms.

2) <u>Advanced outcomes from modules element</u>
   a) Exercise deep conceptual understanding of one or more branches of applied mathematics
   b) Use mathematics as a language in a wide range of situations relevant to research and industry
   c) Demonstrate independent learning of mathematical constructions and methods

d) Solve problems using appropriate mathematical and research toolboxes, including modelling, analytical and computational skills.
e) Assimilate a large body of complex concepts and their inter-relationships.
f) Solve open-ended problems and problems with well-defined solutions by formulating problems in precise terms, identifying key issues and trying different approaches in order to make progress.

3) Outcomes from research-project element
a) Demonstrate critical thinking and creativity and innovatively apply mathematical skills to tackle complex research problems
b) Design a research project with set hypotheses and objectives within the context of a wide body of scientific literature that you have reviewed.
c) Communicate your expertise in relation to a particular research topic, both orally and in writing.

Students not eligible for a MSc degree, may be awarded exit awards (see "Progression and Classification"). Our aim is that a student awarded a (i) PG Certificate based on 4 modules would achieve the outcomes in group 1; (ii) PG Certificate based on the project element would achieve the outcomes in groups 3; (iii) PG Diploma based on 8 modules would achieve the outcomes in groups 1 and 2; (iv) PG Diploma based on 4 modules and the project element would achieve the outcomes in groups 1 and 3.

The Imperial Graduate Attributes are a set of core competencies which we expect students to achieve through completion of any Imperial College degree programme. The Graduate Attributes are available at: www.imperial.ac.uk/students/academic-support/graduate-attributes

Entry Requirements	
Academic Requirement	Normally a 2.1 Honours degree in mathematics, applied mathematics or a related subject, such as engineering or physics. For further information on entry requirements, please go to PG: www.imperial.ac.uk/study/pg/apply/requirements/pgacademic
Non-academic Requirements	N/A
English Language Requirement	Standard requirement (PG) Please check for other Accepted English Qualifications
Admissions Test/Interview	N/A

The programme's competency standards documents can be found at: **TBA**

Learning & Teaching Approach

Learning and Teaching Delivery Methods

Modules (autumn and spring terms) will be delivered by lectures, problem classes, office hours, problem sheets for independent work, and assessed coursework problem sets and mini-projects.

The project element (spring and summer terms) will involve independent research and literature review and individual student/supervisor meetings.

Individual guidance and support will be provided through meetings with personal tutors.

Overall Workload
Your overall workload consists of face-to-face sessions and independent learning. While your actual contact hours may vary according to the optional modules you choose to study, the following gives an indication of how much time you will need to allocate to different activities at each level of the programme. At Imperial, each ECTS credit taken equates to an expected total study time of 25 hours. Therefore, the indicative total study time is 2250 hours over the entire MSc programme (including the summer), this being composed of roughly 1500 hours associated with modules and 750 hours with the research project. As these are indicative study times, you may need to make reasonable adjustments to these suggested times to account for your individual learning style.

You will spend around 300 hours in lectures, problem classes and tutorials over the entire MSc programme. The remaining time is for self-study (including project work) and meetings with your project supervisor.

Assessment Strategy

Assessment Methods

Formative assessment of modules: Coursework, mini-projects and quizzes (from 10% to 100% of module mark depending on module).

Summative assessment of modules: Written or oral examination (from 0% to 90% of module mark depending on module).

Summative assessment of research project:

- Oral presentations (10% of research-project mark)
- Dissertation (90% of research-project mark)

Academic Feedback Policy

Any assessed coursework done as part of a module will be marked and returned to the student within two weeks. Students are encouraged to discuss difficulties with the module lecturer.

There is access to lecturers informally and through a formal 'office hours' system. Meetings with personal tutors are held twice a term. Another feedback channel is through the student representatives, which also take part in staff-student committee meetings.

On the project, students will meet their supervisor, typically weekly, to discuss their progress. They should choose modules to complement their project, and discuss their work on these with their supervisor.

Students will submit an early report to their project supervisor (shortly following the May-June examinations), formulated as an extended project proposal, which may include a literature review, description of the problem to be addresses and its background, and preliminary results if available. The project supervisors will meet with the students shortly afterwards to provide the student with feedback on their progress.

The students will also receive comments on their project report and oral presentations.

Re-sit Policy

The College's Policy on Re-sits is available at: www.imperial.ac.uk/student-records-and-data/for-current-students/undergraduate-and-taught-postgraduate/exams-assessments-and-regulations/

Mitigating Circumstances Policy

The College's Policy on Mitigating Circumstances is available at: www.imperial.ac.uk/student-records-and-data/for-current-students/undergraduate-and-taught-postgraduate/exams-assessments-and-regulations/

Additional Programme Costs

No additional costs are anticipated.

Important notice: The Programme Specifications are the result of a large curriculum and pedagogy reform implemented by the Department and supported by the Learning and Teaching Strategy of Imperial College London. The modules, structure and assessments presented in this Programme Specification are correct at time of publication but might change as a result of student and staff feedback and the introduction of new or innovative approaches to teaching and learning. You will be consulted and notified in a timely manner of any changes to this document.

Programme Structure[1]					
FHEQ Level 7 **Full-time students choose 4 modules in term 1 and 4 modules in term 2. Work on the individual research project should begin during term 2, with the majority of the work carried out during term 3 and the summer. Part-time students choose 4 modules in Year 1 and 4 modules in Year 2 (2 modules per term). They normally spread the work on the project over both years.**					
Code	Module Title	Core/ Elective	Group	Term	Credits
MATH70001	Fluid Dynamics 1	Elective	-	1	7.5ECTS
MATH70002	Fluid Dynamics 2	Elective	-	2	7.5ECTS
MATH70003	Introduction to Geophysical Fluid Dynamics	Elective	-	2	7.5ECTS
MATH70051	Vortex Dynamics	Elective	-	2	7.5ECTS
MATH70052	Hydrodynamic Stability	Elective	-	2	7.5ECTS
MATH70004	Asymptotic Methods	Elective	-	1	7.5ECTS
MATH70005	Optimisation	Elective	-	2	7.5ECTS
MATH70006	Applied Complex Analysis	Elective	-	2	7.5ECTS
MATH70007	Dynamics of Learning and Iterated Games	Elective	-	1	7.5ECTS
MATH70008	Dynamical Systems	Elective	-	1	7.5ECTS
MATH70009	Bifurcation Theory	Elective	-	2	7.5ECTS
MATH70053	Random dynamical systems and Ergodic Theory (Seminar Course)	Elective	-	2	7.5ECTS
MATH70010	Geometric Mechanics	Elective	-	2	7.5ECTS
MATH70011	Classical Dynamics	Elective	-	1	7.5ECTS
MATH70012	Mathematical Finance: An Introduction to Option Pricing	Elective	-	2	7.5ECTS
MATH70014	Mathematical Biology	Elective	-	1	7.5ECTS
MATH70015	Quantum Mechanics 1	Elective	-	1	7.5ECTS
MATH70016	Special Relativity and Electromagnetism	Elective	-	1	7.5ECTS
MATH70017	Tensor Calculus and General Relativity	Elective	-	2	7.5ECTS
MATH70018	Quantum Mechanics 2	Elective	-	2	7.5ECTS
MATH70054	Introduction to Stochastic Differential Equations and Diffusion Processes	Elective	-	1	7.5ECTS

[1]In some cases, students may also take modules from the Department's Pure Mathematics MSc and in exceptional cases certain modules from other Master's courses in the department and college, with approval of the involved programme. Students may also take modules from the Department's Undergraduate courses up to a maximum of 15 ECTS at level 6 of the FHEQ with approval of the MSc Course Director. In any case, no more than 15 ECTS points (divided between at most two modules) can be taken from outside the list herein.

MATH70019	Theory of Partial Differential Equations	Elective	-	1	7.5ECTS
MATH70020	Function Spaces and Applications	Elective	-	2	7.5ECTS
MATH70021	Advanced Topics in Partial Differential Equations	Elective	-	2	7.5ECTS
MATH70022	Finite Elements: Numerical Analysis and Implementation	Elective	-	2	7.5ECTS
MATH70023	Numerical Solution of Ordinary Differential Equations	Elective	-	1	7.5ECTS
MATH70024	Computational Linear Algebra	Elective	-	1	7.5ECTS
MATH70025	Computational Partial Differential Equations	Elective	-	2	7.5ECTS
MATH70026	Methods for Data Science	Elective	-	2	7.5ECTS
MATH70027	Scientific Computation	Elective	-	2	7.5ECTS
MATH70031	Markov Processes	Elective	-	2	7.5ECTS
MATH60062	Stochastic Differential Equations in Financial Modelling	Elective	-	2	7.5ECTS
MATH60132	Mathematical Foundations of Machine Learning	Elective	-	2	7.5ECTS
MATH60131	Analytic Methods in Partial Differential Equations	Elective	-	2	7.5ECTS
MATH70087	Applied Mathematics Research Project	Core	-	2,3 & summer	30 ECTS
				Credit Total	90ECTS

Core modules are those which serve a fundamental role within the curriculum, and for which achievement of the credits for that module is essential for the achievement of the target award. Core modules must therefore be taken and passed in order to achieve that named award. **Compulsory** modules are those which are designated as necessary to be taken as part of the programme syllabus. Compulsory modules can be compensated. **Elective** modules are those which are in the same subject area as the field of study and are offered to students in order to offer an element of choice in the curriculum and from which students are able to select. Elective modules can be compensated.

Progression and Classification

Degree classification is based on assessment results from each of the 8 modules and project mark (each of these assessment results is on the 0-100 scale). These results are then combined, weighted by ECTS, to produce the overall weighted average which is used for the purpose of degree classification.

Example: module results of 65, 73, 63, 79, 55, 71, 79, 72 (60 ECTS) along with a project mark of 73 (30 ECTS) would produce an overall weighted average of 71.4.

Award and Classification for Postgraduate Students

Award of a MSc Degree
To qualify for the award of the Applied Mathematics MSc degree a student must have:

1. accumulated credit to the value of no fewer than 90 credits at level 6 or above of which at least 75 must be from credit level 7.
2. and no more than 15 credits as a Compensated Pass;

Classification of Postgraduate Taught Awards

1. Distinction:
    a. The student has achieved an overall weighted average of 70.00% or above across the programme.
    b. Students must normally achieve a distinction (70.00%) mark in the research project element of the MSc in order to be awarded a distinction.

2. Merit:
    a. The student has achieved an overall weighted average of above 60.00%.
    b. Students must normally achieve a minimum of a merit (60.00%) mark in the research project element in order to be awarded a merit

3. Pass: The student has achieved an overall weighted average of 50.00% but less than 60.00%.

Modules taken at level 6 as part of the programme specification for a named postgraduate award will contribute to the determination of pass, merit or distinction for any taught postgraduate award and are included in the calculation of the overall weighted average.

Overall weighted averages 0.5% from the degree borderlines will be automatically rounded up in accordance with item 13.19 in the 2020-2021 regulations. The board of examiners will consider other borderline cases, as they are defined in items 13.20–13.22 of the Regulations for Taught Programmes of Study 2020-2021.

Exit Degrees:

Award of a Postgraduate Certificate (PG Cert)
To qualify for the award of a postgraduate certificate a student must have a minimum of 30 credits at Level 7 (this may include a maximum of 10 credits from Level 6 where this is approved as part of the award). This may be composed of the project element (worth 30 ECTS), or 30 ECTS worth of modules.

Award of a Postgraduate Diploma (PG Dip)
To qualify for the award of a postgraduate diploma a student must have passed modules to the value of no fewer than 60 credits at Level 7 (this may include a maximum of 15 credits from Level 6 and no more than 10 credits as a Compensated Pass. The 60 credits may include the project element (worth 30 ECTS) and 30 ECTS worth of modules, or 60 ECTS worth of modules.

Programme Specific Regulations

N/A

Supporting Information
The Programme Handbook is available at: www.imperial.ac.uk/mathematics/postgraduate/msc/msc-in-applied-mathematics/current-students/
The Module Handbook is available at: www.imperial.ac.uk/mathematics/postgraduate/msc/msc-in-applied-mathematics/modules/
The College's entry requirements for postgraduate programmes can be found at: www.imperial.ac.uk/study/pg/apply/requirements
The College's Quality & Enhancement Framework is available at: www.imperial.ac.uk/registry/proceduresandregulations/qualityassurance
The College's Academic and Examination Regulations can be found at: www.imperial.ac.uk/about/governance/academic-governance/regulations
Imperial College is an independent corporation whose legal status derives from a Royal Charter granted under Letters Patent in 1907. In 2007 a Supplemental Charter and Statutes was granted by HM Queen Elizabeth II. This Supplemental Charter, which came into force on the date of the College's Centenary, 8th July 2007, established the College as a University with the name and style of "The Imperial College of Science, Technology and Medicine". www.imperial.ac.uk/admin-services/secretariat/college-governance/charters/
Imperial College London is regulated by the Office for Students (OfS) www.officeforstudents.org.uk/advice-and-guidance/the-register/
This document provides a definitive record of the main features of the programme and the learning outcomes that a typical student may reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities provided. This programme specification is primarily intended as a reference point for prospective and current students, academic and support staff involved in delivering the programme and enabling student development and achievement, for its assessment by internal and external examiners, and in subsequent monitoring and review.

Modifications			
Description	**Approved**	**Date**	**Paper Reference**
Conditions for pass/merit/distinction updated to new college regulations, introduced exit degrees (PG Certificate and Diploma)	Department of Mathematics Teaching Committee	2021-22	