Programme Information		
Programme Title	Programme Code	HECoS Code
Applied Computational Science and Engineering	F6UC	For Registry Use Only

Award	Length of Study	Mode of Study	Entry Point(s)	Total Credits	
				ECTS	CATS
MSc	1 calendar year (12 months)	Full-time	Annually in October	90	180
PG Diploma	N/A	N/A	N/A	60	120
PG Certificate	N/A	N/A	N/A	30	60
The PG Diploma and PG Certificate are exit awards only and are not available for entry. You must apply to and join the MSc.					

Ownership			
Awarding Institution	Imperial College London	Faculty	Faculty of Engineering
Teaching Institution	Imperial College London	Department	Earth Science and Engineering
Associateship	Diploma of Imperial College (DIC)	Main Location(s) of Study	South Kensington Campus
External Reference			
Relevant QAA Benchmark Statement(s) and/or other external reference points		Masters Awards in Engineering	
FHEQ 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. Gerard Gorman
Student cohorts covered by specification	2023-24 entry
Date of introduction of programme	October 18
Date of programme specification/revision	March 23

Programme Overview

The MSc Applied Computational Science and Engineering will educate future domain-specialists in computational science. The programme differs to other programmes offered within the department since it takes you through a programme of learning that will enable a deepening of knowledge and skills associated with cutting edge computational techniques for science and engineering applications.

The programme is aimed at three different groups of potential students:

- those with strong methodological backgrounds in mathematics or physical sciences who are wishing to move to an applied field with vast potential for developing novel approaches to applications in science and engineering
- those with a more applied background in geophysics or engineering, wishing to learn about computational science and how it can be used as a problem solving tool
- those with a background in computer science wishing to expand their knowledge of numerical methods and the ways in which these can be utilised to solve large scale engineering science problems.

Applicants are expected to have some prior programming experience, but are not necessarily expected to be coding experts at the start of the programme. Pre-sessional, extension and primer material in Python and C++, the languages used on the programme, will be provided at appropriate times.

The overall objective of the MSc programme is to ensure that you are able to use appropriate computational methods to evaluate, define and develop solutions to a range of science and engineering problems. On successful completion of the programme you will have acquired a strong background in computational techniques, numerical methods, development of computer code using a range of languages, parallel algorithms, and have applied these skills and techniques to a range of science and engineering applications utilising High Performance Computing resources.

The knowledge and experience gathered through completion of the programme will place you in an ideal position to potentially:

- pursue academic careers (through a PhD for instance) in many fields: computational techniques, numerical analysis, optimisation and inversion, fluid mechanics, heat transfer, machine learning applications.
- work as an expert analyst in industry, for example oil and gas, mineral exploration, climate science

The programme consists of nine taught modules of either 5 ECTS (the first 3 modules of the programme) or 7.5 ECTS, delivered over the first three terms of the academic year, followed by a research project undertaken in terms 3 and 4 (summer period). The nine taught modules will cover a range of computational methods including how these can be practically applied. Each module will explore examples and applications to engineering and science problems in order to explore the subject matter.

The research project is chosen with the support of staff teaching on the programme. A list of proposed topics by advisors within the Earth Science & Engineering Department is released by the 5th week of Term 2, and students are matched with potential supervisors by the Easter vacation. Students are free to propose their own project topic within this schedule, providing it meets the programme guidelines & aims and that a suitable academic advisor can be found and approved.

The programme will be taught by expert staff members who will draw on their research and industrial application experience at national and international level to ensure you are provided with an opportunity to engage with a

broad range of modern techniques and applications. You will also have the opportunity to undertake research with academics within the top-rated Earth Science and Engineering Department from the Research Excellence Framework (REF) 2014 and Research Assessment Exercise (RAE) 2008.

The programme will be focused on the South Kensington Campus, within the Earth Science and Engineering department's facilities in the Royal School of Mines Building. A fundamental component of the programme is the use of computing resources, for this you will have access to the College's High Performance Computing resources. This will allow you to cement principles introduced on the taught part of the programme, as well as inspiring the future cohort of experts in Computational Science.

Learning Outcomes

Upon successful completion of the programme, you will be able to:

1. undertake reproducible computational science
2. use a variety of programming languages to create, test, verify and validate contextually appropriate software
3. select between and derive methods in mathematical modelling, numerical methods, machine learning and control optimisation which are commonly used in science and engineering applications
4. relate the underpinning mathematics of continuum mechanics to important physical processes in science and engineering
5. use systematic knowledge of high performance computing and parallel computing to employ appropriate computational techniques when using these resources
6. formulate computational techniques to solve a range of science and engineering problems
7. generate and document original thinking and research on how to use and combine existing computational techniques to address questions arising from science and engineering applications
8. construct relevant and original research questions from existing data sets and models, and select appropriate techniques to address them
9. undertake original independent research in an area of computational science, under the guidance of academic staff
10. critically evaluate the work of others and propose alternative techniques, approaches or solutions
11. plan your individual work and your contributions to collaborative work
12. write technical reports and summarise your work using presentations

On successful completion of the PG Diploma[1] in Applied Computational Science and Engineering you will be able to:

1. undertake reproducible computational science
2. use a variety of programming languages to create, test, verify and validate contextually appropriate software
3. select between and derive methods in mathematical modelling, numerical methods, machine learning and control optimisation which are commonly used in science and engineering applications
4. relate the underpinning mathematics of continuum mechanics to important physical processes in science and engineering
5. use systematic knowledge of high performance computing and parallel computing to employ appropriate computational techniques when using these resources
6. apply knowledge of computational techniques to a range of science and engineering applications
7. formulate computational techniques to solve a range of science and engineering problems
8. plan your individual work and your contributions to collaborative work

On successful completion of the PG Certificate[2] in Applied Computational Science and Engineering you will be able to:

1. undertake reproducible computational science
2. use a variety of programming languages to create, test, verify and validate contextually appropriate software

[1] Corresponding to the Autumn, Spring and Summer Term taught modules.
[2] Corresponding to taught modules from the Autumn and Spring Terms.

3. select between and derive methods in mathematical modelling, numerical methods, machine learning and control optimisation which are commonly used in science and engineering applications
4. relate the underpinning mathematics of continuum mechanics to important physical processes in science and engineering
5. apply knowledge of computational techniques to a range of science and engineering applications
6. formulate computational techniques to solve a range of science and engineering problems

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

In accordance with these core competencies, set out below, our aim is for our graduates to:

- Demonstrate deep conceptual understanding of their chosen discipline
- Work effectively in multi-cultural, international teams and across disciplinary boundaries
- Approach challenges with curiosity, critical-thinking and creativity
- Innovatively apply their skills to tackling complex real-world problems
- Understand and value different cultures and perspectives
- Have developed into independent learners with high self-efficacy
- Display a strong sense of personal and professional identity

Entry Requirements	
Academic Requirement	Normally a 2:1 UK Bachelor's Degree or equivalent, in an engineering or science-based discipline.
Non-academic Requirements	Applicants who do not meet the academic requirements above but who have substantial relevant industry experience may be admitted following completion of a 'Special Qualifying Exam' (SQE)
English Language Requirement	Standard Requirements: IELTS 6.5 with a minimum of 6.0 in each element or equivalent Standard requirement (PG) Please check for other Accepted English Qualifications
Admissions Test/Interview	Applicants will be invited to attend a post-application interview

Learning & Teaching Approach

Learning and Teaching Delivery Methods

- Lectures
- Seminars and practical coding activities
- Case studies
- Group work exercises
- Individual research
- Formal presentations

All the module content will be available online in addition to the face to face teaching sessions. The lectures themselves will have a strong emphasis on skills development, where short lectures will be punctuated by individual or paired exercises with the support of teaching staff.

Individual and group projects will run throughout the year. These are primarily software based projects that make heavy use of automated assessment to enable self-assessment. These smaller projects also help prepare you for the independent project at the end of the year.

You will undertake your research project within a research group. There will be no external placements.

Overall Workload
Your overall workload consists of face-to-face sessions and independent learning. While your actual contact hours may vary, 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 expected total study time is 2,250 (90 ECTS) hours per year.

The programme is structured with lectures and practical sessions in the morning, with the afternoons free for private or guided study. This structure spans 9 months punctuated with three week-long project sessions where you will have the opportunity to work in teams or individually.

Three months will be devoted exclusively to the summer individual research project.

Assessment Strategy

Assessment Methods

All assessment will be based on coursework with no formal written examinations.

Formative assessment to provide feedback and aid learning will be provided through the practical sessions that will run throughout each module. During project work, this will be provided through ongoing supervision from the teaching staff. The feedback will be provided in written form and orally by members of the teaching staff and graduate teaching assistants working on each module.

Summative assessment will be provided by at least two items of assessed coursework for each module which can be completed in class and at home. Dependent on the module, this may be a combination of written homework, solving problems, as well as numerical and coding exercises. For project work assessment will also be based on oral presentation of the work and from project reports.

A final thesis and presentation will also be required for the summative assessment of the final summer research project. 80% of the total mark will be based on written material and 20% on a presentation and demonstration of the software developed.

In group project work, team members will receive one mark, moderated to a limited extent by students' individual contribution. Support for project work will be provided by graduate teaching assistants and teaching staff with tutorial staff available to guide you through difficulties in team working.

Academic Feedback Policy

You will be provided with feedback on coursework in line with the College's Policy on Academic Feedback. This will include both written feedback and verbal feedback on both formative and summative assessments as in the section above. The good practice guidelines of feedback being provided within two weeks of the submission date will be employed.

The final numerical marks will be provided to you by the College Registry after the Board of Examiner's meeting at the end of the academic year.

The College's Policy on Academic Feedback and guidance on issuing provisional marks to students is available at: www.imperial.ac.uk/about/governance/academic-governance/academic-policy/exams-and-assessment/

Re-sit Policy

The College's Policy on module failure is available in the Assessment section of the Academic regulations: www.imperial.ac.uk/about/governance/academic-governance/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
N/A

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[3]					
FHEQ Level 7 **For the MSc you will need to complete all core and compulsory modules.**					
Code	Module Title	Core/ Compulsory/ Elective	Group	Term	Credits
EART70169	Modern Programming Methods	Compulsory		Autumn	5
EART70161	Computational Mathematics	Compulsory		Autumn	5
EART70162	Applying Computational/Data Science	Compulsory		Autumn-Summer	7.5
EART70160	Data Science and Machine Learning	Compulsory		Autumn	5
EART70167	Deep Learning	Compulsory		Autumn	7.5
EART70170	Modelling and Numerical Methods	Compulsory		Autumn	7.5
EART70171	Advanced Programming	Compulsory		Spring	7.5
EART70172	Inversion and Optimisation	Compulsory		Spring	7.5
EART70177	Patterns for Parallel Programming	Compulsory		Summer	7.5
EART70168	Applied Computational/Data Science Project	Core		Summer	30
				Credit Total	90

[3] **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

Award of a Postgraduate Certificate (PG Cert)
To qualify for the award of a postgraduate certificate you must have passed modules to the value of no fewer than 30 credits at Level 7 from the taught modules in the Autumn, Spring and Summer terms. No credits may be compensated.

Award of a Postgraduate Diploma (PG Dip)
To qualify for the award of a postgraduate diploma you must have passed modules to the value of no fewer than 60 credits at Level 7 from the taught modules in the Autumn, Spring and Summer terms

1. and no more than 10 credits as a Compensated Pass.

Award of a Masters Degree
To qualify for the award of an MSc in Applied Computational Science and Engineering you must have:

1. accumulated credit to the value of no fewer than 90 credits;
2. and no more than 15 credits as a Compensated Pass.

Classification of MSc Award

The College sets the class of Degree that may be awarded as follows:

1. Distinction: 70.00% or above.
2. Merit: 60.00% or above but less than 70.00%.
3. Pass: 50.00% or above but less than 60.00%.

For a Masters, your classification with be determined through the Programme Overall Weighted Average and the designated dissertation or final major project module meeting the threshold for the relevant classification band.

Your degree algorithm provides an appropriate and reliable summary of your performance against the programme learning outcomes. It reflects the design, delivery, and structure of your programme without unduly over-emphasising particular aspects.

Programme Specific Regulations

N/A

Supporting Information
The Programme Handbook is available from the department.
The Module Handbook is available from the department.
The College's entry requirements for postgraduate programmes can be found at: www.imperial.ac.uk/study/apply/postgraduate-taught/entry-requirements/accepted-qualifications/
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 you may reasonably be expected to achieve and demonstrate if you take 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.