Programme Information		
Programme Title	Programme Code	HECoS Code
Environmental Data Science and Machine Learning	H2G16	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 – H2G16P	N/A	N/A	N/A	60	120
PC Cert	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 Rossella Arcucci	

Student cohorts covered by specification	2025-26 entry
Date of introduction of programme	October 21
Date of programme specification/revision	March 23

Programme Overview

The MSc Environmental Data Science and Machine Learning will educate future environmental scientists in data science, machine learning and associated computational technologies. The programme differs to other programmes offered within the department since it takes you through a curriculum that will enable a deepening of knowledge and skills associated with cutting-edge data science, machine learning and associated computational and observational techniques, and their application to a broad range of environmentally motivated 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, or specialise in, an applied field with an environmental slant
- those with a more applied background in environmental science or engineering, wishing to learn about data science and machine learning (the underlying theory/algorithms and how to implement/utilise them in code) and how these can be used as modern data-driven problem-solving and analysis tools
- those with a background in computer science wishing to expand their knowledge of applied data science, machine learning and associated computational and observational techniques in an environmental context, and to gain experience in the ways in which these can be utilised to solve large-scale environmental science and engineering 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 data science, machine learning and associated computational and observational techniques to understand, define and develop solutions to a range of environmental science and engineering problems. On successful completion of the programme you will have acquired a strong background in (big) data science including cloud computing, remote sensing, environmental monitoring & modelling, machine learning, and the development of associated computer code and its application on high-performance and cloud computing resources.

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

- pursue academic careers (through a PhD for instance) in many fields: data and computational science, machine learning, environmental modelling and monitoring.
- work as an expert analyst in industry, for example in environmental consultancies, climate science, renewable energy, sustainability, natural hazards, earth resource exploration and extraction (including hydrocarbons and minerals), space and planetary science, Earth observation and remote sensing.

The programme consists of nine taught modules of either 5 ECTS (the first three modules in the year) or 7.5 ECTS (the other 6 modules), delivered over the three terms of the academic year, followed by a research project over terms 3 and 4 in the summer period. The nine taught modules will cover a range of data science, machine learning, modelling and monitoring topics including how these can be practically implemented and applied using rigorous scientific programming and best-practice software development principles. Each module will explore examples and applications to environmental science and engineering 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. It is possible for projects to be carried out partly or wholly at an external organisation.

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, predominantly 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 Imperial's high-performance computing resources, as well as the use of external cloud computing services. 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 environmental data science in its broadest terms.

Learning Outcomes

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

1. undertake reproducible computational science, including data analysis and analytics
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, data science, machine learning and remote sensing which are commonly used in environmental science and engineering applications
4. use systematic knowledge of high-performance, parallel and cloud computing to employ appropriate computational techniques when using these resources
5. modify standard data science, machine learning, computational modelling and monitoring techniques to solve new problems in a range of environmental science and engineering applications
6. appreciate the unique aspects of environmental data that make it challenging, e.g. that is tends to be uncertain, intermittent, occur over a wide range of spatial and temporal scales, and be able to apply methodologies to deal with these challenges
7. generate and document original thinking and research on how to use and combine existing data science, machine learning, computational modelling and monitoring techniques to address questions arising from environmental 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 environmental science and engineering using a range of data science, machine learning, modelling and monitoring techniques, under the guidance of academic staff
10. critically evaluate own work through the appropriate design of experiments and an acknowledgement of the limitations of data, algorithms and models
11. critically evaluate the work of others and propose alternative techniques, approaches or solutions
12. plan your individual work and your contributions to collaborative work
13. write technical reports and summarise your work using presentations

On successful completion of the PG Diploma[1] in Environmental Data Science and Machine Learning you will be able to:

1. undertake reproducible computational science, including data analysis and analytics
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, data science, machine learning and remote sensing which are commonly used in environmental science and engineering applications
4. use systematic knowledge of high-performance, parallel and cloud computing to employ appropriate computational techniques when using these resources
5. modify standard data science, machine learning, computational modelling and monitoring techniques to solve new problems in a range of environmental science and engineering applications.
6. appreciate the unique aspects of environmental data that make it challenging, e.g. that is tends to be uncertain, intermittent, occur over a wide range of spatial and temporal scales, and be able to apply methodologies to deal with these challenges

[1] Corresponding to the Autumn, Spring and Summer Term taught modules

7. plan your individual work and your contributions to collaborative work

On successful completion of the PG Certificate[2] in Environmental Data Science and Machine Learning you will be able to:

1. undertake reproducible computational science, including data analysis and analytics
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, data science, machine learning and remote sensing which are commonly used in environmental science and engineering applications
4. modify standard data science, machine learning, computational modelling and monitoring techniques to solve new problems in a range of environmental science and engineering applications.
5. appreciate the unique aspects of environmental data that make it challenging, e.g. that is tends to be uncertain, intermittent, occur over a wide range of spatial and temporal scales, and be able to apply methodologies to deal with these challenges

The Imperial Graduate Attributes are a set of core competencies which we expect students to achieve through completion of any Imperial degree programme. The Graduate Attributes are available at: https://www.imperial.ac.uk/about/education/our-graduates/

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	

[2] Corresponding to taught modules from the Autumn and Spring term

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 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 will be primarily computational and data analysis based projects and will make 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.

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 will also be required for the summative assessment of the final summer research project, alongside a code repository developed during the project. 95% of the total mark will be based on the thesis and code, and 5% based on an initial project plan. The student will also present and defend their work in front of two assessors in a viva.

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 Imperial'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 Imperial Registry after the Board of Examiner's meeting at the end of the academic year. Imperial'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
Imperial'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
Imperial's Policy on Mitigating Circumstances is available at: www.imperial.ac.uk/about/governance/academic-governance/academic-policy/exams-and-assessment/

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
EART70159	Numerical Programming in Python	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
EART70178	Environmental Data	Compulsory		Spring	7.5
EART70171	Advanced Programming	Compulsory		Spring	7.5
EART70172	Inversion and Optimisation	Compulsory		Spring	7.5
EART70179	Big Data Analytics	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 at level 7;
2. and no more than 15 credits as a Compensated Pass;
3. met any specific requirements for an award as outlined in the approved programme specification for that award.

Classification of Postgraduate Taught Award

The university 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 will 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.
Imperial's entry requirements for postgraduate programmes can be found at: www.imperial.ac.uk/study/apply/postgraduate-taught/entry-requirements/accepted-qualifications/
Imperial's Quality & Enhancement Framework is available at: www.imperial.ac.uk/registry/proceduresandregulations/qualityassurance
Imperial's Academic and Examination Regulations can be found at: www.imperial.ac.uk/about/governance/academic-governance/regulations
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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.