

Programme Information		
Programme Title	Programme Code	HECoS Code
MSc in Advanced Aeronautical Engineering	H404	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 Certificate	N/A	Full-Times	N/A	30	60

The PG Certificate is an intermediate award and are not available for entry. All students must apply to and join the MSc.

Ownership			
Awarding Institution	Imperial College London	Faculty	Faculty of Engineering
Teaching Institution	Imperial College London	Department	Aeronautics
Associateship	N/A	Main Location(s) of Study	South Kensington Campus
External Reference			
Relevant QAA Benchmark Statement(s) and/or other external reference points	Master's Degree in Engineering		
FHEQ Level	Level 7		
EHEA Level	2nd Cycle		
External Accreditor(s) (if applicable)			
External Accreditor 1:	Royal Aeronautical Society		
Accreditation received:	2020	Accreditation renewal:	2022
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. Oliver Buxton		
Student cohorts covered by specification	2021-22 entry		

Date of introduction of programme	October 21
Date of programme specification/revision	March 21

Programme Overview

Air travel is vital for the continued prosperity of the world economy and is predicted to grow significantly over the next 20 years. The challenge facing aviation is to meet the predicted growth in demand in a way that ensures that the environment is protected. This MSc programme provides modules on the fundamental disciplines that are of prime importance for developing new enabling technologies vital to the design of more environmentally friendly future aircraft.

The degree is assessed by written examination, associated coursework, and a substantial individual research project, run as a background activity from December to May and then full time from May to September. It may be possible for projects to be carried out in industry. The normal duration of the programme is one year full-time.

The taught modules are confined to the Autumn and Spring terms, with the associated examinations held in two stages; the first examination session is in the first two weeks of the Spring term, for modules taught in the preceding Autumn term. The second examination session takes place in the first two weeks of the Summer term and for modules taught in the preceding Spring term.

Learning Outcomes

Upon completing the MSc degree programme you will be able to:

1. Demonstrate and appraise the fundamental concepts and physical principles of aerodynamic (including flight control), thermodynamic, and structural design of next generation aircraft
2. Evaluate and manipulate the relevant mathematics underpinning aeronautical engineering and associated computational methods
3. Employ the systems approach for solving complex real-world problems
4. Appraise different types of aerodynamic and structural computations
5. Critically evaluate advanced analytical concepts
6. Synthesise a feasible solution to a complex problem of design when faced with conflicting, and sometimes mutually exclusive, requirements using knowledge from a number of diverse areas
7. Recognise the commercial, economic and social context of aeronautical engineering, the need for professional and ethical conduct in engineering management techniques, including project and change management, and the requirement to promote sustainable development
8. Plan, monitor and improve upon a programme of original research, including the ability to undertake effective self-learning and evaluate and improve personal performance and self-efficacy as the foundation for lifelong learning and continuous personal development.
9. Work effectively within diverse, interdisciplinary teams to accomplish an aeronautical engineering goal predicated on inputs from a number of different specialisms thereby requiring communication and negotiation of ideas
10. Devise strategies to work effectively at an advanced level both individually and in groups, to show independence and to manage time

Upon completing the PG Certificate¹ you will be able to:

1. Formulate a critical understanding of the interdisciplinary nature of aeronautical engineering
2. Critically evaluate the legitimacy of different knowledge claims relevant to aeronautical engineering
3. Apply mathematical and computational concepts underpinning aeronautical engineering to related problems
4. Solve common aeronautical engineering related problems in a skilled and confident way, independently and as part of a team
5. Identify and consider trade-offs in problem-solving and decision-making

¹ The PG Certificate is an intermediate award that may be offered at the discretion of the Board of Examiners and is not available for entry. All students must apply to and join the MSc. A PG Diploma is not available as an exit award on this programme.

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	At least a 2.1 (first strongly preferred) UK Bachelor's Degree with Honours in an Aerospace or Mechanical Engineering related degree with some experience of fluid and structural dynamics (or a comparable qualification recognised by the College)
Non-academic Requirements	None
English Language Requirement	Standard requirement (PG) IELTS score of 6.5 overall (minimum 6.0 in all elements) Please check for other Accepted English Qualifications
Admissions Test/Interview	N/A

The programme's competency standards documents can be found at: <https://www.imperial.ac.uk/media/imperial-college/faculty-of-engineering/aeronautics/Competency-Standards.pdf>

Learning & Teaching Approach

Learning and Teaching Delivery Methods

You will be given access to optional pre-sessional revision modules which will consist of lecture recordings that you can work through in your own time, covering the following topics:

- Revision Stress Analysis
- Introduction to Programming
- Introductory Mathematics
- Control Theory
- Introduction to Compressible Flow
- Aircraft Performance and Flight Mechanics
- Introduction to Fluid Dynamics

These revision lectures will not be assessed and therefore do not count for credit. Formative, self-assessment (e.g. tutorial problem sheets with model solutions supplied) will be provided to guide you through these modules.

You will be introduced to core knowledge primarily through large class sessions, ranging in format from traditional lectures to more active learning sessions (e.g. group work, flipped classrooms etc.), where you are required to self-study assigned materials ahead of the session and build on that knowledge in subsequent reinforcement and guided problem-solving sessions.

You will also be expected to spend significant further time (approximately 4 hours for every timetabled contact hour) working independently and with peers, reviewing lecture notes, lecture video recordings, books, journal papers, e-learning materials and solving problem sets.

This programme features two design projects carried out in small groups of 3-6 students. Both of these are designed to encourage active learning, where you will explore possible options, consider constraints and develop your own knowledge, supported by the teaching staff and graduate teaching assistants. You will also work under the guidance and supervision of a member of the academic staff to complete your individual research project.

Professional skills, such as technical report writing and presenting, are cultivated throughout the degree in various individual and group-based coursework.

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 College London, each ECTS credit taken equates to an expected total study time of 25 hours. Therefore, the expected total study time is 2,250 hours per year for an average student.

The Department expects you to allocate approximately 4 hours in self-study for every hour spent in lectures and tutorials for a typical lecture-based module.

The pattern of work is greatly dependent on your selected elective modules, however on average you can expect to spend about 216 hours in lectures and tutorials with a further 909 hours, over the first two terms, being devoted to independent study. You will also be expected to spend 1,125 hours on self-directed research work for your Major Individual Research Project, spread out over all three terms (but full time from May onwards).

Assessment Strategy

Assessment Methods

The Department aims to employ assessment both to test your achievement of module objectives, referred to as summative assessment, and to provide opportunities for you to identify areas of strengths and weakness to improve your learning and maximise the learning outcomes, referred to as formative assessment.

A variety of formative and summative assessment methods are utilised in this programme. Written examinations are utilised for modules where theoretical knowledge and its application within a disciplinary setting is introduced. In addition to a final summative assessment, such modules will typically offer opportunities for you and your instructors to assess your level of understanding and progress by completing in-class or online formative progress tests and tutorial classes.

Design and research projects are assessed through a variety of methods such as coursework in the form of:

- Individual and group project reports
- Peer-assessment
- Research dissertation

and practical such as:

- Oral presentations
- Viva voce

The exact balance of the summative assessment through the programme depends upon which elective modules are taken, but an indicative breakdown is:

Coursework	60%
Exams	30%
Oral assessment	10%

To achieve a pass in a particular module, candidates must gain a weighted overall mark of 50% or greater.

Academic Feedback Policy

Feedback is an essential part of learning and the Department gives high priority to the timeliness and quality of feedback offered to you on all modules. The primary purpose of feedback is to assist learning and the development of skills, by highlighting strengths and weaknesses on one hand, and by identifying actions for improvement on the other. It is not meant to exclusively provide justification for assessment results. It is important to recognize that: 1) feedback comes in various forms and 2) feedback requires your active engagement.

Feedback will be provided for all assessments carried out as part of this programme. For examinations, a written examiner's report, commenting and providing quantitative information on the performance of the entire cohort, detailing common mistakes, and highlighting alternate approaches to the published solution, will be made available. For coursework, written feedback will normally be provided within three working weeks of submission. For the research dissertation, feedback will be provided ahead of the next opportunity where said feedback will be of use to you.

All modules will further aim to provide you with the opportunity to receive feedback ahead of any major summative assessment. Such feedback may be provided in the form of in-class progress tests, online self-assessment

exercises, tutorial sheets, etc. Where possible, as in the case of in-class tutorial sessions, oral examinations and poster sessions, oral feedback will be provided immediately by tutors or assessors.

You should keep in mind that not all feedback is structured, and important feedback may be obtained from self-reflection on your progress to date, from peers when studying or working together in a team, in dialogue with a lecturer or teacher in or outside of a tutorial, class or laboratory, or by email.

Examinations are held in January and April/May. Following the January examinations provisional marks are returned to the students within an indicative time frame of six weeks. The Department do not provide exact marks to students but indicate grades on Blackboard Learn. Students are given guidance on an individual basis if required following release of the results by the academic course organisers, especially where the results will have an impact on their Spring term module selections. We are conscious at the MSc level, where students have not had the 'long history' of a student completing the degree year of an undergraduate degree course, that this form of feedback is of considerable importance.

The Board of Examiners will meet to consider the results of the examinations in mid-late October and results will be released to students only via student e-service within 10 days. Students who have not managed a clear pass will be emailed by the Course Director with an individual letter, setting out possible courses of action within 10 days of the examiner's board.

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

This section should outline any additional costs relevant to this programme which are not included in students' tuition fees.

Description	Mandatory/Optional	Approximate cost
N/A	N/A	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 ²					
Year 1 – FHEQ Level 7 Students study all core modules (Group A) Students must choose exactly five electives from Group B.					
Code	Module Title	Core/ Elective/ Compulsory	Group	Term	Credits
	Aerospace Structures	Core	A	1-2	5
	Aircraft Design and Airworthiness	Core	A	1-2	5
	Applied Aerodynamics	Core	A	1	5
	Emerging Technologies for Green Aviation	Core	A	1	5
	Major Individual Research Project	Core	A	1-3	45
	Advanced Manufacturing	Elective	B	1	5
	Advanced Propulsion	Elective	B	2	5
	Aeroelasticity (to be introduced in academic year 2022/23)	Elective	B	2	5
	Aerothermodynamics of Launchers and Re-Entry Vehicles	Elective	B	1	5
	Analytical Characterisation of Composite Materials	Elective	B	2	5
	Artificial Intelligence for Aerospace Engineers	Elective	B	2	5
	Composite Innovation – Nanocomposites and Structural Power	Elective	B	2	5
	Computational Mechanics	Elective	B	2	5
	Control Theory for Flow Management	Elective	B	2	5
	Finite Elements	Elective	B	1	5
	Flow Instability & Transition	Elective	B	1	5
	Innovation Management	Elective	B	1	5
	Lightweight Structures	Elective	B	1	5
	Orbital Mechanics	Elective	B	1	5
	Spacecraft Structures	Elective	B	1	5
	Spacecraft Systems	Elective	B	2	5
	Structural Integrity and Health Monitoring	Elective	B	1-2	5

² **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.

	Systems Engineering for Unmanned Aerial Vehicles	Elective	B	2	5
	Turbulence and Turbulence Modelling	Elective	B	1	5
Credit Total					90

Classification of Postgraduate Taught Awards

Award of a PG Certificate

To qualify for the award of a postgraduate certificate a student must have a minimum of 30 ECTS credits at Level 7 obtained only from the taught modules taken, i.e. excluding the Major Individual Research Project.

Award of an MSc Degree

To qualify for the award of an MSc degree a student must have:

- Accumulated no fewer than 90 ECTS credits at Level 7 of which no more than 10 ECTS credits may be from a Compensated Pass
- Met any specific requirements for an award as outlined in the approved programme specification for that award

For MSc programmes in the Department of Aeronautics, the class of the Degree may be awarded as follows:

1. Distinction: The student has achieved a mark of 70.0% or greater for their taught modules' assessment aggregate AND a mark of 70.0% or greater for their project.
2. Merit: The student has achieved a mark of 60.0% or greater for their taught modules' assessment aggregate AND a mark of 60.0% or greater for their project but either the taught modules' assessment aggregate or the project mark or both are below 70.0%
3. Pass: The student has achieved a mark of 50.0% or greater for their taught modules' assessment aggregate AND a mark of 50.0% or greater for their project but either the taught modules' assessment aggregate or the project mark or both are below 60.0%

Programme Specific Regulations

As an accredited degree, students on this MSc programme are subject to the standards set by the Engineering Council in relation to compensation. A maximum of 10 ECTS credits can be compensated across the programme.

Supporting Information

The Programme Handbook is available at: [https://www.imperial.ac.uk/media/imperial-college/faculty-of-engineering/aeronautics/msc/Advanced-Aeronautical-Engineering-Handbook-2020-21-\(2\).pdf](https://www.imperial.ac.uk/media/imperial-college/faculty-of-engineering/aeronautics/msc/Advanced-Aeronautical-Engineering-Handbook-2020-21-(2).pdf)

The Module Handbook is available at: <https://www.imperial.ac.uk/aeronautics/study/pg/advanced-aeronautical-engineering/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
Curriculum Review	Programmes Committee	30/03/2021	PC.2020.24