MSc Advanced Computational Methods for Aeronautics, Flow Management and Fluid Structure Interaction

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 intended as a reference point for prospective students, current students, external examiners and academic and support staff involved in delivering the programme and enabling student development and achievement.

Programme Information				
Programme Title	Advanced Computational Methods for Aeronautics, Flow Management and Fluid Structure Interaction			
Award(s)	MSc			
Programme Code	H1U6 (1YFT)		H1U624 (2YPT)	
Awarding Institution	Imperial College London			
Teaching Institution	Imperial College London			
Faculty	Faculty of Engineering			
Department	Department of Aeronautics			
Main Location of Study	South Kensington Campus			
Mode and Period of Study	1 calendar year (12 months), full-time or 2 calendar years (24 months), part-time			
Cohort Entry Points	Annually in October			
Relevant QAA Benchmark Statement(s) and/or other external reference points	Master's Degree in Engineering			
Total Credits	ECTS:	90	CATS:	180
FHEQ Level	Level 7			
EHEA Level	2nd cycle			
External Accreditor(s)	The Royal Aeronautical Society (RAeS) Accreditation received: 2010 Accreditation renewal: 2019			
Specification Details				
Student cohorts covered by specification	2018-19 entry			

Person responsible for the specification	Professor Sergei Chernyshenko, Programme Director
Date of introduction of programme	
Date of programme specification/revision	April 2018

Programme Overview

This taught postgraduate programme provides advanced training in computational methods, the underlying theory and physical principles, and appropriate experimental techniques for aeronautics and other sectors.

This degree is suitable for applicants who wish to enhance their Engineering training or to convert to an advanced engineering discipline from backgrounds in Mathematics, Physics or Computer Science.

The course provides advanced training in computational methods, the underlying theory and physical principles. Graduates from the course are likely to find employment over a broad spectrum of opportunities, both aerospace and non-aerospace.

The course is assessed by written examination, associated coursework, and a substantial individual research project of four months' duration. It may be possible for projects to be carried out in industry. The normal duration of the course is one year full-time or two years part-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, involving subjects taught in the preceding Autumn term. The second examination session takes place in the first two weeks of the Summer term and involves subjects taught in the preceding Spring term.

Learning Outcomes

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

Knowledge and Understanding of:

- The fundamental concepts and physical principles underlying CFD and structural analysis;
- Mathematics underpinning the engineering and computational methods;
- Numerical analysis, programming and computational methods.

Intellectual Skills

- Understanding advanced analytical concepts;
- Programming and identifying solution strategies;
- Communicating work through course work submission and project reports;
- Plan, conduct and report on a programme of original research.

Practical Skills

- Data analysis for random processes;
- Ability to write programs in a standard language.

Transferable Skills

- Communicate effectively through report writing and data presentation;
- Present results of individual research project in a lecture to staff and students;
- Learn how to work effectively at an advanced level, to show independence and to manage time.

Entry Requirements	
Academic Requirement	Normally a 2.1 UK Bachelor's Degree with Honours, preferably in Engineering, Physics, Mathematics or Computer Science (or a comparable qualification recognised by the College).
English Language Requirement	Standard requirement IELTS 6.5 with a minimum of 6.0 in each element or equivalent.
Learning & Teaching Strategy	
Scheduled Learning & Teaching Methods	• Lectures; • Tutorials; • Group Work
E-learning & Blended Learning Methods	• Blackboard VLE; • Student Portal on Sharepoint; • Panopto recordings.
Placement Learning Methods	• Major Individual Research Project
Assessment Strategy	

Assessment Methods	• Written Examinations • Coursework • Tutorial Material • Oral Presentations • Progress Reports

Academic Feedback Policy

Strict deadlines are provided to teaching staff as to when feedback and marks should be provided for each examination or assessment. These marks and feedback are then uploaded to Blackboard so that the students can access them. Students are informed immediately after this upload has taken place via an email or Blackboard announcement. The Postgraduate Administrator aims to ensure that all marks and feedback are provided to students within 3-4 weeks.

If there are any issues with the amount or quality of feedback then the two student representatives are able to discuss these concerns with the Director of Studies at the Student-Staff Committee meetings. These issues are then addressed by the Director of Studies by talking to staff responsible for the assessment and, if necessary, arranging further marking.

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

In line with College policy, students who are unsuccessful in any of their examinations may usually be allowed an opportunity to re-sit at the discretion of the Board of Examiners.

Specific information regarding re-sits for Taught Master's degrees can be found in the relevant Academic Regulations available at: https://www.imperial.ac.uk/about/governance/academic-governance/regulations/.

Mitigating Circumstances Policy

Students may be eligible to apply for mitigation if they have suffered from serious and unforeseen circumstances during the course of their studies that have adversely affected their ability to complete an assessment task and/or their performance in a piece of assessment.

The College's Policy on Mitigating Circumstances is available at: https://www.imperial.ac.uk/about/governance/academic-governance/academic-policy/exams-and-assessment/.

Programme Structure

Full-time	Pre-session	Term One	Term Two	Term Three	Term Four
Core Modules	0	5	0	0	0
Elective Modules	0	6-15			0

Projects	0	0	0	1	
Part-time (Year One)	Pre-session	Term One	Term Two	Term Three	Term Four
Core Modules	0	0-5	0	0	0
Elective Modules*	0	0-15			0
Projects**	0				
Part-time (Year Two)	Pre-session	Term One	Term Two	Term Three	Term Four
Core Modules	0	0-5	0	0	0
Elective Modules*	0	0-15			0
Projects**	0-1		0	1	

*All elective modules are optional so students can pick and choose which term/year they attend modules.
**Part time students undertake their project in their second year or.

Assessment Dates & Deadlines	
Written Examinations	January and May
Coursework Assessments	Continuous
Project Deadlines	Mid-September
Practical Assessments	Continuous

Assessment Structure

Marking Scheme

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

Pass

- Achieve a minimum aggregate mark of 50% in the Advanced Computational Methods Taught module (comprised of the best 12 units completed) and;
- Achieve a minimum aggregate mark of 50% for the Major Individual Research Project.

Merit

- Achieve a minimum aggregate mark of 60% in the Taught module (comprised of the best 12 units completed) and;
- Achieve a minimum aggregate mark of 60% for the Major Individual Research Project.

Distinction

The award of distinction is at the discretion of the Board of
Examiners. To be considered for a distinction a candidate must achieve excellence both in the taught courses and in the project. This normally will require the candidate to:

- Achieve a minimum aggregate mark of 70% in the Advanced Computational Methods Taught module (comprised of the best 19 units completed) and;
- Achieve a minimum aggregate mark of 70% for the Major Individual Research Project.

Module Weightings	
Module	% Module Weighting
Introduction to Fluid Dynamics (Online)	0%
Introduction to Programming	0%
Introductory Mathematics	0%
Technical Writing and Presentations	0%
Revision Stress Analysis	0%
6 - 12 x elective modules*	50%
Major Individual Research Project	50%

*The number of elective modules is dependent on the number of units associated with each. Modules are worth 1 or 2 units and students are advised that the minimum award requirements are a pass in 12 units.

Indicative Core Module List – 35 ECTS											
Code	Title	Core/ Elective	L&T Hours	Ind. Study Hours	Place-Ment Hours	Total Hours	% Written Exam	% Course -work	% Practical	FHEQ Level	ECTS
AEM-ADV01	Introduction to Fluid Dynamics	CORE	2	18	0	20	N/A	N/A	N/A	7	0
AEM-ADV02	Introduction to Programming	CORE	20	0	0	20	N/A	N/A	N/A	7	0
AEM-ADV03	Introductory Mathematics	CORE	2	18	0	20	N/A	N/A	N/A	7	0
AEM-M01	Technical Writing and Presentations	CORE	1	0	0	1	N/A	N/A	N/A	7	0
AEM-CM02	Revision Stress Analysis	CORE	2	0	0	2	N/A	N/A	N/A	7	0
AEM-ADV17	Major Individual Research Project	CORE	3	872	0	875	N/A	N/A	N/A	7	35

Indicative Elective Module List – 55 ECTS											
Code	Title	Core/ Elective	L&T Hours	Ind. Study Hours	Place-Ment Hours	Total Hours	% Written Exam	% Course -work	% Practical	FHEQ Level	Units *
AE3-401	Advanced Mechanics of Flight	ELECTIVE	13	72	0	85	100%	0%	0%	7	1
AE3-420	Innovation Management	ELECTIVE	20	133	0	153	100%	0%	0%	7	2
AEM-ADV09	Aeroservoelasticity	ELECTIVE	12	64	0	76	100%	0%	0%	7	1
AEM-AAE06	Aircraft Performance and Flight Mechanics	ELECTIVE	14	62	0	76	80%	20%	0%	7	1

Indicative Elective Module List – 55 ECTS											
Code	Title	Core/ Elective	L&T Hours	Ind. Study Hours	Place-Ment Hours	Total Hours	% Written Exam	% Course-work	% Practical	FHEQ Level	Units *
AEM-ADV16	An Introduction to Flow Control	ELECTIVE	24	128	0	153	100%	0%	0%	7	2
AEM-CM16	Analysis of Laminated Composites	ELECTIVE	10	66	0	76	100%	0%	0%	7	1
AEM-ADV10	Compressible Flow	ELECTIVE	12	65	0	153	100%	0%	0%	7	1
AEM-ADV19	Computational Fluid Dynamics	ELECTIVE	24	129	0	153	70%	30%	0%	7	2
AEM-ADV20	Control Theory	ELECTIVE	14	77	0	91	70%	30%	0%	7	1
AEM-ADV08	Computational Linear Algebra	ELECTIVE	24	132	0	156	0%	100%	0%	7	2
AEM-ADV11	Finite Element Methods	ELECTIVE	12	66	0	78	0%	100%	0%	7	1
AEM-ADV07	Fundamentals of Fluid Mechanics	ELECTIVE	24	132	0	156	100%	0%	0%	7	2
AE3-422	High-Performance Computing	ELECTIVE	26	99	0	125	25%	75%	0%	7	2
AEM-ADV12	Hydrodynamic Stability	ELECTIVE	12	66	0	78	100%	0%	0%	7	1
AEM-ADV13	Navier Stokes Equations and Turbulence Modelling	ELECTIVE	26	123	0	149	70%	30%	0%	7	2
AE3-402	Separated Flows and Fluid-Structure Interaction	ELECTIVE	24	129	0	153	100%	0%	0%	7	2
AEM-ADV15	Structural Dynamics	ELECTIVE	30	123	0	153	70%	30%	0%	7	2

Indicative Elective Module List – 55 ECTS												
Code			Title	Core/ Elective	L&T Hours	Ind. Study Hours	Place-Ment Hours	Total Hours	% Written Exam	% Course -work	% Practical	FHEQ Level	Units *
			*Students must complete a minimum of 12 units to pass the programme and 19 units to be considered for Distinction									

Supporting Information
The Programme Handbook is available at: https://workspace.imperial.ac.uk/aeronautics/Public/Postgraduate%20(MSc)%20Programmes/Advanced%20Computational%20Methods%20Handbook%202017-18.pdf
The Module Handbook is available at: http://www.imperial.ac.uk/aeronautics/study/pg/advanced-computational-methods/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: https://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". http://www.imperial.ac.uk/admin-services/secretariat/college-governance/charters/
Imperial College London is regulated by the Office for Students (OfS) https://www.officeforstudents.org.uk/