

MSc Computing (Artificial Intelligence and Machine Learning)

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	Computing (Artificial Intelligence and Machine Learning)		
Award(s)	MSc		
Programme Code	G5U10		
Awarding Institution	Imperial College London		
Teaching Institution	Imperial College London		
Faculty	Faculty of Engineering		
Department	Department of Computing		
Main Location of Study	South Kensington Campus		
Mode and Period of Study	1 academic year, full-time		
Cohort Entry Points	Annually in October		
Relevant QAA Benchmark Statement(s) and/or other external reference points	Master's Degrees in Computing		
Total Credits	ECTS:	90	CATS: 180
FHEQ Level	Level 7		
EHEA Level	2 nd cycle		
External Accrator(s)	BCS - The Chartered Institute for IT The IET (The Institution of Engineering and Technology)		
Specification Details			
Student cohorts covered by specification	2019/20 entry		
Person responsible for the specification	Dr Damian Cerase, Teaching Quality Officer		

Date of introduction of programme	
Date of programme specification/revision	March 2019
Programme Overview	
<p>This course specialises in the foundations and advanced tools and techniques of logic and statistical based approaches in artificial intelligence, including machine learning.</p> <p>This taught postgraduate course is aimed at students who may not have studied computing exclusively, but who have studied a considerable amount of computing and mathematics already.</p> <p>Graduates of the course will be specialists in AI who understand the state of the art and who are able to use the techniques to solve problems and develop applications.</p> <p>This course is one of our MSc Specialism degrees. We also offer Specialisms in:</p> <ul style="list-style-type: none"> • Computational Management • Security and Reliability • Software Engineering • Visual Computing and Robotics. <p>Each specialism has a flexible mix of breadth and depth, consisting of some possible compulsory modules as well as choices from a selection of specialised and optional modules.</p>	
Learning Outcomes	
<p>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</p>	
<p>Knowledge and Understanding of:</p> <ul style="list-style-type: none"> • Practical programming skills; • The mathematical and logic-based foundations of AI and Machine learning (ML); • A choice of advanced topics in AI and ML; • Tools and techniques in AI and ML and their suitability for different problem domains and different types of data; • Emerging trends in Computing and AI and ML and an awareness of how these techniques can be adapted in industrial applications; • Practical programming skills in suitable languages such as Prolog, Matlab or Python; • Research skills, including time management, research effectiveness, personal effectiveness, and critical reading of literature; • Communication skills, writing skills, presentation skills, technical presentation skills; • Project and risk management; • Professional issues, including ethics, professional conduct, computer law and plagiarism. <p>Intellectual Skills:</p> <ul style="list-style-type: none"> • Match problems to tools and techniques most suitable for solving them; • Analyse computing and computing related problems and devise solutions to them; 	

- Develop an understanding and practice of more advanced computing topics, including deep learning, robotics, vision, logic-based learning;
- Plan, conduct and write-up a programme of original research and software or application development.

Practical Skills:

- Design and develop programs of varying levels of complexity using suitable languages such as Prolog, Matlab or Python;
- Use computing tools and techniques, for software and application development;
- Analyse computing and computing related problems and devise solutions to them;
- Give technical presentations;
- Appreciate the needs of end-users and issues related to design, management and performance of large scale software;
- Prepare technical reports;
- Conduct detailed literature searches;
- Conduct in-depth research on tools and languages available on line.

Transferable Skills:

- Communicate effectively through oral presentations, computer presentations and written reports;
- Program in the major computer programming paradigms;
- Integrate and evaluate information from multiple and diverse sources;
- Work within and contribute to a team, apply management skills such as coordination, project design and evaluation and decision processes;
- Manage resources and time;
- Transfer techniques and solutions from one area to another;
- Learn independently with open mindedness and critical enquiry;
- Learn effectively for the purpose of continuing professional development.

Entry Requirements

Academic Requirement	Normally a 2.1 UK Bachelor’s Degree with Honours in a science or engineering discipline, including computing (or a comparable qualification recognised by the College).
Non-academic Requirements	<p>Applicants must provide Graduate Record Examination (GRE) scores for Quantitative Reasoning and Verbal Reasoning. As well as entering the scores on the application form, applicants must ask the GRE organisation to send validating certificates to the Department.</p> <p>Only the first scores submitted will be considered. While there is no minimum requirement for GRE scores, a strong application would include scores higher than 160 for Quantitative Reasoning and higher than 145 for Verbal Reasoning.</p>

	Find out more about the GRE.
English Language Requirement	Higher requirement IELTS score of 7.0 overall (minimum 6.5 in all elements).
Learning & Teaching Strategy	
Scheduled Learning & Teaching Methods	<ul style="list-style-type: none"> • Lectures • Tutorials • Practical work • Laboratory • Group work
Project and Placement Learning Methods	<ul style="list-style-type: none"> • Research project
Assessment Strategy	
Assessment Methods	<ul style="list-style-type: none"> • Written examinations • Coursework • Laboratory work • Presentations • Product demonstration • Technical report • Dissertation
Academic Feedback Policy	
<p>Feedback will be provided on coursework within two weeks of submission. This will be in the form of, for example:</p> <ul style="list-style-type: none"> • Personal discussion • Discussions in small-group tutorials • Marked-up coursework, laboratory exercises or tests • Verbal presentation, e.g. during or after lectures • Written class-wide summaries • Interactive problem solving sessions • Model answers to coursework <p>In lieu of feedback on examinations, selected examination questions are routinely set as unassessed problems in the following year, with model answers provided.</p>	
Re-sit Policy	
<p>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.</p> <p>The College's Policy on Examination Re-sits and SQTs is available at: https://www.imperial.ac.uk/about/governance/academic-governance/academic-policy/exams-and-assessment/</p>	

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/>

Assessment Structure

Marking Scheme

In order to PASS the MSc students have to satisfy all of the following requirements:

1. An aggregated mark of at least 50% on 9 components which must be made up as follows:
 - a. The assessments of 6 taught courses. The taught courses must be from the specified list for the specialism, and must include all that are compulsory.
 - b. The assessments of either a further 3 taught courses freely selected from any of the courses offered to the specialism, or 2 such taught courses and 1 ISO, which can be, but need not be, in the area of the specialism.
2. Normally, a mark of at least 50% on each of the 9 components. No mark below 40% is accepted as a condoned pass mark.
3. A mark of at least 51% on the individual project.

In order to be considered for the MSc with MERIT students have to satisfy all of the following requirements:

1. Pass the MSc, but without DISTINCTION;
2. An aggregated mark of at least 60% on the 9 components;
3. A mark of at least 61% on the individual project.

In order to be considered for the MSc with DISTINCTION students have to satisfy all of the following requirements:

1. Pass the MSc;
 2. An aggregated mark of at least 70% on the 9 components;
- A mark of at least 71% on the individual project.

Indicative Module List											
Code	Title	Core/ Elective	L&T Hours	Ind. Study Hours	Place- ment Hours	Total Hours	% Written Exam	% Course -work	% Practical	FHEQ Level	ECTS
CO542	MSc Computing Science (Specialist) Individual Project	Core	See module leader			1125	0%	0%	100%	7	45
CO496	Mathematics for Machine Learning	Elective (A)	See module leader			125	90%	10%	0%	7	5
CO304	Logic-Based Learning	Elective (A)	See module leader			125	90%	10%	0%	6	5
CO316	Computer Vision	Elective (A)	See module leader			125	90%	10%	0%	6	5
CO333	Robotics	Elective (A)	See module leader			125	90%	10%	0%	6	5
CO395	Machine Learning	Elective (A)	See module leader			125	67%	33%	0%	6	5
CO433	Advanced Robotics	Elective (A)	See module leader			125	90%	10%	0%	7	5
CO450	Dynamical Systems and Deep Learning	Elective (A)	See module leader			125	90%	10%	0%	7	5
CO477	Computational Optimisation	Elective (A)	See module leader			125	90%	10%	0%	7	5
CO491	Knowledge Representation	Elective (A)	See module leader			125	90%	10%	0%	7	5
CO493	Probabilistic Inference	Elective (A)	See module leader			125	90%	10%	0%	7	5
CO495	Advanced Statistical Machine Learning and Pattern Recognition	Elective (A)	See module leader			125	90%	10%	0%	7	5
CO531	Prolog	Elective (A)	See module leader			125	80%	20%	0%	7	5

Indicative Module List											
Code	Title	Core/ Elective	L&T Hours	Ind. Study Hours	Place- ment Hours	Total Hours	% Written Exam	% Course -work	% Practical	FHEQ Level	ECTS
CO469	Probabilistic Model Checking and Analysis	Elective (A)	See module leader			125	90%	10%	0%	7	5
CO303	Systems Verification	Elective (A)	See module leader			125	90%	10%	0%	6	5
CO474	Machine Learning	Elective (A)	See module leader			125	90%	10%	0%	7	5
CO467	Principles of Decentralized Ledgers	Elective (A)	See module leader			125	90%	10%	0%	7	5
CO317	Graphics	Elective (B)	See module leader			125	90%	10%	0%	6	5
CO318	Custom Computing	Elective (B)	See module leader			125	90%	10%	0%	6	5
CO331	Network and Web Security	Elective (B)	See module leader			125	90%	10%	0%	6	5
CO332	Advanced Computer Architecture	Elective (B)	See module leader			125	90%	10%	0%	6	5
CO337	Simulation and Modelling	Elective (B)	See module leader			125	90%	10%	0%	6	5
CO338	Pervasive Computing	Elective (B)	See module leader			125	67%	33%	0%	6	5
CO343	Operations Research	Elective (B)	See module leader			125	90%	10%	0%	6	5
CO347	Distributed Algorithms	Elective (B)	See module leader			125	90%	10%	0%	6	5
CO349	Information and Coding Theory	Elective (B)	See module leader			125	90%	10%	0%	6	5
CO409	Cryptography Engineering	Elective (B)	See module leader			125	90%	10%	0%	7	5

Indicative Module List											
Code	Title	Core/ Elective	L&T Hours	Ind. Study Hours	Place- ment Hours	Total Hours	% Written Exam	% Course -work	% Practical	FHEQ Level	ECTS
CO417	Advanced Computer Graphics	Elective (B)	See module leader			125	90%	10%	0%	7	5
CO422	Computational Finance	Elective (B)	See module leader			125	90%	10%	0%	7	5
CO438	Complexity	Elective (B)	See module leader			125	90%	10%	0%	7	5
CO471	Advanced Issues in Object Oriented Programming	Elective (B)	See module leader			125	90%	10%	0%	7	5
CO484	Quantum Computing	Elective (B)	See module leader			125	90%	10%	0%	7	5
CO512	Independent Study Option	Elective (B)	See module leader			125	0%	0%	100%	7	5
CO572	Advanced Databases	Elective (B)	See module leader			125	90%	10%	0%	7	5
CO382	Type Systems for Programming Languages	Elective (B)	See module leader			125	90%	10%	0%	7	5

Supporting Information

The Programme Handbook is available at:

<http://www.imperial.ac.uk/computing/current-students/pg-info/mcs-ml/>

The Module Handbook is available at:

<http://www.imperial.ac.uk/computing/current-students/pg-info/mcs-ml/>

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:

<http://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/charter-and-statutes/>

Imperial College London is regulated by the Office for Students (OfS)

<https://www.officeforstudents.org.uk/>