

MSc in MATHEMATICS AND FINANCE

2023-2024

Information Summary

Welcome from the Programme Directors

Welcome to the MSc in Mathematics and Finance in the Department of Mathematics, Imperial College London. We hope you will enjoy studying here and take profit from all the opportunities offered by the department and by the College as a whole.

Mathematical Finance is a mathematically challenging subject deployed every day by sophisticated practitioners in the financial markets. Our objective is to provide you with everything you need to get into this area at a level where you can understand – and contribute to – the latest progress.

To achieve this, we have designed a full-year course, consisting of lectures, seminars, projects and a final thesis. Through the modules offered during the year, you will learn the mathematical and statistical tools used on financial markets, and will become aware and critical of the current practices in the financial industry at large: some modules concentrate on the financial aspects (option pricing, market microstructure, algorithmic trading), while others provide training in Mathematics (stochastic analysis, partial differential equations, Statistics); several modules, in particular machine learning, numerical methods and programming will allow you to test the theory against real data, and a range of elective modules to choose from will give you the opportunity to specialise on some specific areas of mathematical finance.

The final part of the curriculum is devoted to a research project which culminates in an MSc thesis.

In addition, a certain number of modules are offered by the College, covering a range of transferable skills such as presentation, academic writing and negotiation skills.

This booklet provides an overview of the programme structure. We encourage you to read it carefully and to keep it for future reference.

Dr Jack Jacquier
Dr Eyal Neuman

Programme Information

The Mathematical Finance group, part of the Mathematics Department in Imperial College London, is one of the largest in the world, and the research interests of its members span broad areas of the field. As a large group, many research-related activities are organised throughout the year, including seminars, conferences, colloquia, providing a unique view of cutting-edge research in Mathematical Finance and Stochastic Analysis. Most seminars and conferences are free to attend, and registration may or may not be required. You are more than welcome, and in fact strongly encouraged, to attend them.

Personal Tutors

Every student is assigned a personal tutor from the Mathematical Finance Section, with whom a meeting is arranged during the first week of term and the dates specified on the handbook. The tutor is the first point of contact and offers advice regarding module selection, internship details, and other matters. Your personal tutor is likely to be one of the people you may ask later for reference letters; it is therefore advisable that they get to know you, and you are encouraged to keep in touch with them while enrolled in the MSc and to keep them informed about any factors, such as illness, that may affect your performance. Communication between students and their personal tutors (and potentially the Course Directors) is treated in full confidentiality. The personal tutor is not responsible for administrative issues, and for any such matter, the MSc Mathematics Administrator, Ms Shweta Sharma, will be able to help you.

Should you have any difficulties contacting your personal tutor, you are strongly encouraged to contact the MSc Course Directors.

Blackboard

Most of the information you shall need during the year, from lecture notes, coursework, past exams, to timetables and special events are available on Blackboard: <https://bb.imperial.ac.uk>. A calendar with all events and timetables can be found on your personal Blackboard.

Alumni Network

A key strength of the MSc programme, apart from its academic contents, relies on its large network of Alumni since its inception in 2000. The Imperial College Mathematics and Finance MSc Alumni Group has a LinkedIn group dedicated to alumni of the programme, and advertises job positions and events: <https://www.linkedin.com/groups/4807498/>

Several events will be organised throughout the year to allow you to expand your network. The annual MSc Alumni reception will take place on Wednesday 4 October, and attendance is mandatory.

Meeting with Practitioners

Compulsory weekly meetings with practitioners are organised the [Careers in Quantitative Finance](#) and the [Practitioners' Lecture series](#), in order to familiarise yourself with the many sides of the financial industry, from hard-core quantitative research to hedge funds, risk management, regulators, and software development. These meetings will also help you find a project for the end of the year. You are strongly encouraged to be proactive during those.

Programme Structure

To qualify for the degree of MSc in Mathematics and Finance, you must take examinations in 12 modules, achieving a passing grade (50%) in at least ten of them, an overall average of at least 50%, and at least 40% in each examination. You must achieve a grade of at least 50% in the Project Thesis at the end of the year. The 12 modules taken must include the seven Core modules. The remaining five modules can be selected from the available Electives. Precise details about the grading structure shall be provided at the beginning of the year.

Autumn Term 2 October – 15 December 2023

Week 1 [Not assessed] refresher in probability and analysis (I. Gasteratos)

Weeks 2 - 11 The following Core modules must be taken:

- Fundamentals of Option pricing (P. Siorpaes)
- Stochastic Processes (E. Neuman)
- Quantitative Risk Management (L. Gonon)
- Statistical Methods in Finance (C. Salvi)
- Computing for Finance, Part I -- Python (A. Jacquier and A. Muguruza)

Three Elective modules are available in the Autumn term:

- Portfolio Management (O. Bonesini)
- Data Science for Fintech, Regtech and Suptech (J. Cambe)
- Deep Learning (L. Gonon)
- Quantum Computing (A. Jacquier and A. Kondratyev)

Spring Term 8 January–25 March 2024

Week 1 Examinations on the Autumn Term modules.

Weeks 2 - 11 The following three Core modules must be taken:

- Computing for Finance, Part II -- C++ (P. Bilokon)
- Interest Rate Models (D. Brigo)
- Simulation Methods for Finance (Y. Zhang)

In addition, the following Elective modules are available:

Weeks 2 - 6

- Advances in Machine Learning (P. Bilokon)
- Convex Optimisation (Y. Shodami)
- Market microstructure (M. Rosenbaum)
- Stochastic Control in Finance (D. Itkin)
- Numerical Methods in Finance (W. Stockinger)

Weeks 7 - 11

- Rough Path and Signatures in Machine Learning (C. Salvi)
- Topics in Derivatives Pricing (V. Piterbarg)
- Algorithmic and High-Frequency Trading (K. Webster and J. Muhle-Karbe)
- Selected Topics in Quantitative Finance (A. Jacquier and V. Lucic)

Summer Term 29 APRIL–30 SEPTEMBER 2024

Weeks 1 - 2 Examinations of the Spring Term modules.

Weeks 3 - 9 Thesis work begins (*Submission deadline: no later than 3/9/2024*)

Notes:

- 1) You are entitled to attend any module, whether or not you take the examination. You must take the examinations in all Core modules and in five Elective modules. You will be asked to complete a form stating what examinations you plan to take.
- 2) Examination arrangements vary. Each Core module, except *Computing in Finance*, is assessed by a three-hour written examination; Elective modules are assessed either by a final 1.5-hour exam or by a project. In most cases, a component of assessed coursework, or a small project to be completed in a limited time, will also be required. Each lecturer will specify exactly what the examination arrangements will be. Previous examination papers are usually available.
- 3) Credits: The lecture modules taken together are worth 75 ECTS, and the project 15 ECTS.

Module Descriptions can be found in the handbook which will be available later on the website and blackboard pages.

Placements and the Project

The College defines a placement as: “work experience, assessed project work, a period of course-based study or a period of research (for which academic credit is awarded and/or where the student remains subject to College student regulations during the relevant period) and where there is a transfer of direct supervision of the student to a third party (i.e. where a member of staff at the third party acts as the day-to-day supervisor/manager) for a period of two weeks or more.”

Academic departments are responsible for managing any study or work placement which forms part of your degree programme. It is expected that you will contribute to the process of planning your placement. For guidance on this, see the College’s Placement and Learning Policy and associated good practice: www.imperial.ac.uk/about/governance/academic-governance/academic-policy/placement-learning

Your Departmental Placement Coordinators:

Mrs Rula Murtada

Dr Jack Jacquier

Dr Eyal Neuman

Project Overview

The project is a substantial component of the MSc in Mathematics and Finance, occupying up to four months of the MSc programme. It is a piece of original work undertaken by you under the direction of an academic project supervisor and in most cases also an external supervisor. Our intention is that most projects will be carried out in association with a bank, finance house, hedge fund, consultancy, or systems provider in the finance industry, and we endeavour to arrange suitable placements. The project may be an ‘internship’, where you work at the bank full time, or a collaborative arrangement where you work in the College and visit the company on a regular basis to discuss the project. In either case you will be assigned an academic project supervisor who will be a member of staff of the Mathematical Finance Section.

Arranging placements is a complex process where we are ultimately dependent on the goodwill of our industrial partners and on market conditions. Students must also bear in mind that they must pass companies’ own assessment processes before being offered a placement. It cannot be guaranteed that everybody will get exactly what he or she wants, but every effort will be made to achieve reasonably satisfactory arrangements. If you have your own contacts in the industry, or specific ideas

as to your project topic, you should discuss these with your tutor at the earliest possible time, so that these can be taken into consideration. A detailed document on the project/placement roadmap and interview tips can be found on blackboard pages. Support from [Careers Service](#) is available at the beginning of term for CV and cover letter writing.

Company Presentations

From October there will be a series of talks given by our industry partners. These events provide an opportunity for students to find out more about companies and offer the chance to network with employees in an informal environment. You will be invited to apply to their internship programmes after attending the events.

CV Book

Before you start the course, you will be asked to provide us with your CVs. These are collated into a CV book which is distributed to our industry partners, who may get in touch with students directly with intern opportunities.

Student Referral

Most of the project allocation takes place from February, once the first term assessments are completed. Opportunities will be advertised, and students will be invited to express an interest in applying. The Programme team will shortlist students based on how well the specified criteria is met. Companies then select who they wish to invite for interview. Alongside our referrals, we also expect students to be proactive in applying for placements and finding their own opportunities. Only MSc students who have achieved an acceptable level of academic competence will be offered as candidates to an external sponsor.

Placement requirements

When you seek your own placement, the duration should be at least 10 weeks and the topic of project should be quantitative in nature. If your internship or job opportunity is not compatible with a suitable project, then you can instead work on an internal project with a member of academic staff at Imperial.

Project theses must be submitted to the MSc administrator by 4pm on 5 September 2023. The length of the thesis is normally 30-50 typed pages, and it must be typed in LaTeX following a provided template.

For more information on placements visit the Placements website: www.imperial.ac.uk/placements

If you are considering or planning a placement outside the UK you should also refer to the Placement Abroad Handbook: www.imperial.ac.uk/placements/information-for-imperial-college-students

MSc Prizes

The MSc Programmes offers several prizes for the best students. Details are available here: <https://www.imperial.ac.uk/mathematics/postgraduate/msc/mathematical-finance/current-students/prizes/>