UNIVERSITY OF CAMBRIDGE

Faculty of Mathematics

SCHEDULES OF LECTURE COURSES

AND FORM OF EXAMINATIONS

FOR THE MATHEMATICAL TRIPOS 2023-24

TERM	COURSES						
1	Vectors and Matrices (24)	Differential Equations (24)	Groups (24)	Numbers and Sets[1] (24)	Mechanics[2] (10)		
2	Analysis I (24)	Probability (24)	Vector Calculus (24)	Dynamics and Relativity[1] (24)			
3	Variational Principles[3] (12)	Optimisation[4] (12)	Computational Projects[5] (8)				
4	Linear Algebra (24)	Analysis and Topology (24)	Methods (24)	Quantum Mechanics (16)	Markov Chains (12)		
5	Groups, Rings and Modules (24)	Geometry (24)	Complex Methods *or* Complex Analysis[6] (16)	Statistics (16)	Numerical Analysis (16)	Electromagnetism (16)	Fluid Dynamics (16)
6	Variational Principles[3] (12)	Optimisation[4] (12)					

Notes

1. Students taking the option *Mathematics with Physics* take courses from the *Natural Sciences Tripos* instead of both Numbers and Sets and Dynamics and Relativity.
2. Students who have not studied at least three mechanics modules at A-level (or the equivalent) should attend all or part of the 10-lecture *non-examinable* Mechanics course in the Michaelmas term.
3. Variational Principles is normally taken in the third term.
4. Optimisation may be attended in the Easter term of either the first or second year, i.e. the third or sixth term.
5. The Computational Projects may be done at any time after the Computational Projects Manual is made available (in late July or early August of the first year). Students should attend the associated lectures in their third term.
6. Students may choose to take either Complex Methods or Complex Analysis.

THE MATHEMATICAL TRIPOS 2023-24

CONTENTS

This booklet is the formal description of the content and structure of Parts IA, IB and II of the Mathematical Tripos.[1] In particular, it contains the schedules, or syllabus specifications, that define each course in the undergraduate Tripos, and it contains detailed information about the structure and marking of examinations, and the classification criteria. In addition, the booklet contains many useful pieces of advice and information for students regarding the Mathematical Tripos. It is updated every year to reflect changes approved by the Faculty Board.

Lectures and Examinations Post COVID-19

On 5 May 2023 the WHO Director-General declared, with great hope, the end to COVID-19 as a global health emergency. Therefore, it is the working assumption of the Faculty that lectures and examinations in 2023-24 will all be held 'normally' and in person. Students are expected to attend lectures in order to take full advantage of the benefits of in-person teaching.

SCHEDULES

Syllabus

The *schedule* for each lecture course is a list of topics that define the course. The schedule is agreed by the Faculty Board. Some schedules contain topics that are 'starred' (listed between asterisks); all the topics must be covered by the lecturer but examiners can only set questions on unstarred topics.

The numbers which appear in brackets at the end of subsections or paragraphs in these schedules indicate the approximate number of lectures likely to be devoted to that subsection or paragraph. Lecturers decide upon the amount of time they think appropriate to spend on each topic, and also on the order in which they present topics. There is no requirement for this year's lectures to match the previous year's notes. Some topics in Part IA and Part IB courses have to be introduced in a certain order so as to tie in with other courses.

Recommended Books

A list of books is given after each schedule. Books marked with † are particularly well suited to the course. Some of the books are out of print; these are retained on the list because they should be available in college libraries (as should all the books on the list) and may be found in second-hand bookshops. There may well be many other suitable books not listed; it is usually worth browsing college libraries (and/or the internet).

In most cases, the contents of the book will not be exactly the same as the content of the schedule, and different styles suit different people. Hence you are advised to consult library copies in the first instance to decide which, if any, would be of benefit to you. Up-to-date prices, and the availability of hard- and soft-back versions, can most conveniently be checked online.

STUDY SKILLS

The Faculty produces a booklet *Study Skills in Mathematics* which can be obtained online in PDF format linked from https://www.maths.cam.ac.uk/undergrad/studyskills/.

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[1] This booklet, full name *Schedules of Lecture Courses and Form of Examinations for the Mathematical Tripos* but often referred to simply as *'The Schedules'*, can be found online linked from https://www.maths.cam.ac.uk/undergrad/course/.

There is also a booklet, *Supervision in Mathematics*, that gives guidance to supervisors, which can be obtained online in PDF format linked from https://www.maths.cam.ac.uk/undergrad/supervisions/ which may also be of interest to students.

Aims and objectives

The **aims** of the Faculty for Parts IA, IB and II of the Mathematical Tripos are:

- to provide a challenging course in mathematics and its applications for a range of students that includes some of the best in the country;
- to provide a course that is suitable both for students aiming to pursue research and for students going into other careers;
- to provide an integrated system of teaching which can be tailored to the needs of individual students;
- to develop in students the capacity for learning and for clear logical thinking, and the ability to solve unseen problems;
- to continue to attract and select students of outstanding quality;
- to produce the high calibre graduates in mathematics sought by employers in universities, the professions and the public services.
- to provide an intellectually stimulating environment in which students have the opportunity to develop their skills and enthusiasms to their full potential;
- to maintain the position of Cambridge as a leading centre, nationally and internationally, for teaching and research in mathematics.

The **objectives** of Parts IA, IB and II of the Mathematical Tripos are as follows:

After completing Part IA, students should have:

- made the transition in learning style and pace from school mathematics to university mathematics;
- been introduced to basic concepts in higher mathematics and their applications, including (i) the notions of proof, rigour and axiomatic development, (ii) the generalisation of familiar mathematics to unfamiliar contexts, (iii) the application of mathematics to problems outside mathematics;
- laid the foundations, in terms of knowledge and understanding, of tools, facts and techniques, to proceed to Part IB.

After completing Part IB, students should have:

- covered material from a range of pure mathematics, statistics and operations research, applied mathematics, theoretical physics and computational mathematics, and studied some of this material in depth;
- acquired a sufficiently broad and deep mathematical knowledge and understanding to enable them both to make an informed choice of courses in Part II and also to study these courses.

After completing Part II, students should have:

- developed the capacity for (i) solving both abstract and concrete unseen problems, (ii) presenting a concise and logical argument, and (iii) (in most cases) using standard software to tackle mathematical problems;
- studied advanced material in the mathematical sciences, some of it in depth.