

## Programme Specification 2020-2021

### MATHEMATICAL TRIPOS

|                                            |                                                  |
|--------------------------------------------|--------------------------------------------------|
| <b>Awarding body</b>                       | University of Cambridge                          |
| <b>Teaching institution</b>                | Faculty of Mathematics                           |
| <b>Accreditation details</b>               | None                                             |
| <b>Name of final award</b>                 | Bachelor of Arts                                 |
| <b>Programme title</b>                     | Mathematical Tripos                              |
| <b>UCAS code</b>                           | G100 BA/MPA                                      |
| <b>HECoS code(s)</b>                       | 100403 (mathematics)                             |
| <b>Relevant QAA benchmark statement(s)</b> | Mathematics, Statistics and Operational Research |
| <b>Qualifications framework level</b>      | 6 (Honours)                                      |
| <b>Date specification produced</b>         | April 2021                                       |

### 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

### **Transferable Skills**

At Cambridge, as at any institution of higher education, mathematical skills are highly transferable. The courses arranged by the Statistical Laboratory are perhaps the most immediately transferable, but mathematics underpins all the Natural Sciences, Computing, Engineering, Economics, Business and Management Studies and a whole range of industrial and commercial processes and enterprises.

The Mathematical Tripos lays particular emphasis on problem-solving skills which easily transfer to non-mathematical contexts and are highly valued by employers.

Transferable computing skills are fostered via the CATAM (Computer-Aided Teaching of All Mathematics) Computational Projects which provide an education in solving mathematical problems using a computing environment. The aim is for students to learn to use basic computational techniques and software packages to solve interesting problems, many of which are analytically intractable or algebraically messy, thus preparing students for the real, untidy world. CATAM projects develop highly transferable skills of widespread value in industrial and commercial work, as well as in scientific research.

### **Learning, Teaching and Assessment Methods**

Cambridge is one of the very few universities that does not offer a modular system. This allows a very tightly structured course which is ideal for students who want to specialise in mathematics.

In the first year, there are two options: Pure and Applied Mathematics and Mathematics with Physics. Pure and Applied Mathematics is designed for students intending to continue with mathematics while Mathematics with Physics is designed for students with strong mathematical interests who plan to study Physics after the first year.

The first year presents an introduction to advanced mathematics. The underlying themes are the generalisation of familiar ideas (such as linear equations, differentiation, integration) to higher dimensions and the importance of mathematical rigour. In addition, there are courses introducing Dynamics and Special Relativity, which provides a first look at theoretical physics from a mathematical point of view, Group Theory and Probability. In the second year, the course becomes broader and deeper. On the pure side, the foundations of calculus are examined further and new algebraic systems (extending the concept of a group) are developed. On the applied side, there are courses on some of the most important developments in 19th and 20th century physics (electromagnetism, fluid dynamics and

quantum mechanics). There are also lectures on what is called 'applicable mathematics', here including statistics, Markov chains, and optimisation (choosing the best route through a network, for example). In addition, there is a Computational Projects course, for which students investigate mathematical problems using numerical or algebraic techniques on computers. This course is optional, but nearly all students take it.

There are about 37 courses to choose from in Part II. Students can choose about eight. The courses are divided into two groups, labelled C and D. There are 10 C courses and 27 D courses.

The fourth year of the Tripos, Part III, can be thought of as a one-year graduate course. It is taken by students who have studied Mathematics or Theoretical Physics at Cambridge or who come for Part III from around the world.

Students coming to Cambridge to read Undergraduate Mathematics have widely varied mathematical backgrounds. To cater for different backgrounds and for the different speeds at which students work, there is a great deal of flexibility both in the subject areas covered and in the workload.

In the first year, it is expected that all students will study all of the courses provided. In the second year, more courses are available than most students could reasonably tackle, so students specialise in the areas they are most interested in. There is no fixed number of courses to be taken; instead, students decide the number of courses according to whether they want to study courses in great depth or want to cover greater breadth of material. There are no courses that all students must take; instead, students choose according to their interests, bearing in mind the courses that they might want to take in Part II. In the third year, most students take only about 20% of the available courses, choosing to specialise in the area of mathematics that most interests them. Again, there is no fixed number of courses that they must take. Extra courses generally mean more choice in the examination rather than extra credit.

Lecture courses in Mathematics are organised by the Faculty of Mathematics for all students in the University. Each lecture course has a fixed syllabus. The purpose of the lectures is to explain the material in the syllabus and give applications of the theory. Attendance\* at lectures is not compulsory but few people manage to cover the material adequately by themselves even when good textbooks are available. (\*Owing to Covid-19, lectures in 2020-21 were delivered remotely, but the number, content and style of the usual in-person lectures were all maintained.)

Lectures are given for eight weeks in each of the Michaelmas and Lent terms and for four weeks in the Easter term, finishing about ten days before the examinations.

There is an examination at the end of each of the first three years of the Tripos,

There is no element of continuous assessment in the course, but work for the second and third year Computational Projects courses is handed in before the examinations. All the examinations contain some questions of a very straightforward nature to test basic understanding, as well as more demanding problems.

### **Support for Students and their Learning**

The annually-produced Schedules of courses are provided to all students.

Students have access to appropriate textbooks and other materials through the University and College libraries and computing facilities.

Students are assigned a Director of Studies and, normally, a personal Tutor by their College. Small group tutorials (supervisions) are arranged through the Colleges.

In addition, the Faculty provides a specially written booklet, "Study Skills in Mathematics".

### **Criteria for Admission**

It is essential for students to have obtained at least three GCE A levels or an equivalent qualification, one of which must be Mathematics, and AS level Further Mathematics. A-level Further Mathematics and STEP papers in Mathematics are considered to be highly desirable, although admissions policy is determined by the individual Colleges. Typical offers from Colleges would be A\*A\*A and a STEP condition, usually grades 1 and 1 on STEP 2 and 3.

### **Mechanisms for evaluating and improving the quality of student learning support**

Students have termly meetings with their College Tutor and/or Director of Studies to monitor and review their progress in the Tripos. This is facilitated by reports submitted to the Colleges by the student's supervisors on each course.

The Faculty has a Teaching Committee and a Curriculum Committee, which regularly review the syllabus and content of the Tripos, student feedback and comments from examiners. Students have representation on these committees.

All Parts of the Tripos have External Examiners, who are required to submit a report to the University. This is normally responded to by the Faculty Board in consultation with the Teaching Committee. The report and response is scrutinised by the General Board's Education Committee.

The Faculty is reviewed by the General Board once every six years.

### **Employment and Careers**

The Careers Service maintains links with relevant employers and takes into account employer needs and opinions in the services which it provides for students. The Careers Service also allocates a Careers Adviser to each College, Faculty and Department to act as a point of contact.

Every effort has been made to ensure the accuracy of the information in this programme specification. At the time of publication, the programme specification has been approved by the relevant Faculty Board (or equivalent). Programme specifications are reviewed annually, however, during the course of the academical year, any approved changes to the programme will be communicated to enrolled students through email notification or publication in the *Reporter*. The relevant faculty or department will endeavour to update the programme specification accordingly, and prior to the start of the next academical year.

Further information about specifications and an archive of programme specifications for all awards of the University is available online at: <https://www.camdata.admin.cam.ac.uk/>