ROYAL HOLLOWAY
University of London

PROGRAMME SPECIFICATION

This document describes **Honours Degree and Honours MSci Degree programmes in Mathematics**. For Joint and Combined Honours Degree programmes, please also refer to the equivalent document(s) for the other subject(s). This specification is valid for new entrants from **September 2010**.

The aims of all Honours Degree programmes and the Honours MSci Degree programme in Mathematics are:

- to provide students with technical manipulative skills, the ability to read and write in the compressed language of mathematics, and the ability to distil a problem into a mathematical description of its essential detail;
- to ensure that students gain an appreciation of, and interest in, the logical structure of mathematics, and its use as an analytical and predictive tool in applications;
- to offer a wide range of optional course units to suit students' interests and strengths;
- to provide access to personal, academic and pastoral support;
- to enable students, on graduation, to compete effectively in employment or postgraduate study.

Programmes are delivered in either three stages (BSc) or four stages (MSci), each of which comprises one year of full-time study during which the student must follow courses to the value of four whole units (one unit is equivalent to 30 national credits).
Stage one is largely compulsory. In the six compulsory courses it seeks to provide a broadly based introduction to mathematics, which will develop manipulative skills, understanding of the key concepts and the ability to construct logical arguments. In the options students choose two areas of application in mathematics.
In Stage two, students must take eight courses, which continue their study of abstract pure mathematics and its applications.
In Stage three, students choose eight courses. Students are advised on appropriate combinations and pathways depending on their interests, Stage one and two options, and possible future career paths. They may choose to undertake an extended project.
In Stage four, students must undertake the project course MT4000 (which is one course-unit) and choose six options, of which up to two may be chosen from the stage three list.
The programme structures will obviously vary depending on the chosen programme of study. A list of all programmes related to Mathematics and their specific structures can be found further into this document.

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This document provides a summary of the main features of the programme(s), and of the outcomes which a student might reasonably be expected to achieve if full advantage is taken of the learning opportunities provided. Further information is contained in the College prospectus, the College Regulations and in various handbooks issued to students upon arrival. Whilst Royal Holloway keeps all its information for prospective applicants and students under review, programmes and the availability of individual courses are necessarily subject to change at any time, and prospective applicants are therefore advised to seek confirmation of any factors which might affect their decision to follow a specific programme. In turn, Royal Holloway will inform applicants and students as soon as is practicable of any substantial changes which might affect their studies.

Learning outcomes

Teaching and learning in the programme are closely informed by the active research of staff. In general terms, the programmes provide opportunities for students to develop and demonstrate the following learning outcomes:

Knowledge and understanding

- of mathematical methods;
- of mathematical concepts such as number and function;
- of abstract structures such as groups, matrices, and fields;
- of some results from a range of major areas of mathematics, statistics or operational research;
- of at least one major area of applications in which the mathematics is used in a serious manner and is essential for proper understanding;

Skills and other attributes

- a high level of numeracy;
- ability to manipulate and analyze complex mathematical expressions accurately;
- ability to understand the role of logical mathematical argument and deductive reasoning, including formal proof;
- familiarity with computer methods in mathematics and statistics;
- ability to formulate problems in mathematical or statistical form using appropriate notation;
- the ability to solve equations or inequalities arising from a problem analytically or numerically, and to interpret the results;
- accurate analysis of a situation, the factors involved and possible approaches to solution. This is embedded in a general ethos of numeracy and of analytical approaches to problem solving;
- ability to take theoretical knowledge gained in one area and apply it elsewhere;
- ability to make a sequence of logical steps, and reflect on the result;
- ability to communicate mathematical results clearly, to both mathematicians and lay persons;
- spatial awareness in two and three dimensions;
- good general skills of time-management and organization;*
- to learn independently, using a variety of media including books, learned journals, the internet etc;*
- to work independently with persistence and patience, pursuing the solution of problems to their conclusion;*
- develop IT skills, including word-processing and use of the internet;*
- personal motivation and the planning of a career path;*
- good written and oral communication skills, which enable them to write coherently and turn a rough draft into a convincing argument and contribute to discussions;*
- ability to work together with others as a team.*

* transferable skills

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Teaching, learning and assessment

Teaching and learning is mostly by means of lectures, small group tutorials, problem-solving workshop sessions, written and oral feedback on coursework, practical sessions in statistics and computational mathematics, guided independent study and oral presentations. Students are in addition encouraged to read around the subject, and at the end of the first and second stages they write essays or projects on topics of their own choice. Assessment is typically by formal examinations and in certain courses in-term tests, projects, coursework essays and oral presentations. Full details of the assessment methods for individual courses may be obtained from the Department.

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Details of the programme structure(s)

Please note that not all courses run each year. A full list of courses including optional courses for the current academic year can be obtained from the Department.

Single Honours Degree programmes and Combined Honours programmes taught wholly within Mathematics

Stage one:

Students following **G100, G103** must take:

- MT1100 From Euclid to Mandelbrot (½ unit)

- MT1710 Calculus (½ unit)
- MT1720 Functions of Several Variables (½ unit)
- MT1810 Number Systems (½ unit)
- MT1820 Matrix Algebra (½ unit)
- MT1940 Numbers and Functions (½ unit)

and two options from:

- MT1210 Introduction to Applied Mathematics (½ unit)
- MT1300 Principles of Statistics (½ unit)
- MT1510 Computational Mathematics I (½ unit)

Students following **G1G3** must take: MT1100 (not Core), MT1710, MT1810, MT1940, MT1300, MT1720, MT1820 plus one option from MT1210 or MT1510.

Stage two:

Students following **G100, G103** must take:

- MT2800 Linear Algebra and a Group Project (½ unit)
- MT2900 Complex Variable (½ unit)
- MT2940 Real Analysis (½ unit)

plus five options from a list of Stage two courses offered by the department.

Students following **G1G3** must take: MT2800, MT2320, MT2900 plus

- MT2300 Linear Statistical Methods (½ unit)

and four options from a list of Stage two courses offered by the department.

The Core status of MT2940 does not apply to Stage 2 students who have not had the opportunity to take MT1940 at Stage 1. Such students take MT1940 in place of MT2940 at Stage 2.

Stage three:

Students following **G100, G103** must take eight options from a list of Stage three courses offered by the department.

Students following **G1G3** must take

- MT3320 Inference (½ unit)
- MT3340 Time Series Analysis (½ unit)
- MT3360 Applied Probability (½ unit)

plus five options from a list of Stage three courses offered by the department.

Students taking **G100, G103 and G1G3** may also choose options from the stage four list if they wish. Students are advised on appropriate combinations and pathways depending on their interests, stage one and two options, and possible future career paths. They may choose to undertake an extended project as MT3000.

Stage four:

Students following **G103** must take:

- MT4000 MSci Project (1 unit)

and six options from the list of stage three and four courses offered by the department. No more than two of these options may be chosen from the stage three list. Courses which are given in alternating years count as stage four courses for this purpose.

Combined Honours Degree programmes with Mathematics as a major or minor element

Stage one:

Students following **G1L1, G1N2** must take: MT1710, MT1810, MT1940, MT1300, MT1720, MT1820 plus one course unit from appropriate courses taught in their other departments.

Students following **G1R1, G1R2, G1R3, G1R4, G1V5** must take: MT1710, MT1810, MT1940, MT1720, MT1820 and one option from MT1210, MT1300 and MT1510 plus one course unit from appropriate courses taught in their other departments.

Students following **L1G1, R1G1, R2G1, R3G1, N2G1** must take: MT1810, MT1820 plus three course units from appropriate courses taught in their other departments.

Stage two:

Students following **G1L1** must take: MT2300, MT2800, MT2900 plus three options from the list of stage two courses offered by the Department and one course unit from appropriate courses taught in their other departments.

Students following **G1N2** must take: MT2300, MT2800, MT2900 plus three options from the list of stage two courses offered by the Department and one course unit from appropriate courses taught in their other departments.

Students following **G1R1, G1R2, G1R3, G1R4, G1V5** must take: MT2800, MT2900 plus four options from the list of stage two courses offered by the Department and one course unit from appropriate courses taught in their other departments.

Students following **L1G1, R1G1, R2G1, R3G1, N2G1** must take two options from the list of stage two courses offered by the Department together with MT1710, plus three course units from appropriate courses taught in their other departments.

Stage three:

Students following **G1L1, G1N2, G1R1, G1R2, G1R3, G1R4, G1V5** have six options from the list of stage three courses offered by the Department and one course unit from appropriate courses taught in their other departments.

Students following **L1G1, R1G1, R2G1, R3G1, N2G1** have two options from the list of stage three courses offered by the Department and three course units from appropriate courses taught in their other departments.

Joint Honours Degree programmes with Mathematics as an equal element

Stage one:

Students following **GG41, GN12, FG61, GF13, GFC3, GW13, GC18** must take: MT1710, MT1810, MT1720, MT1820 plus four options from appropriate courses taught in their other departments.

Students following **LG11, NG31** must take: MT1710, MT1810, MT1300, MT1720, MT1820 plus three options from appropriate courses taught in their other department.

Stage two:

Students following **GG41** must take: MT2630, MT2800 plus two options from the list of stage two courses offered by the Department and two course units from appropriate courses taught in their other department.

Students following **LG11, NG31** must take: MT2300, MT2630 plus one option from the list of stage two courses offered by the Department and 2½ course units from appropriate courses taught in their other department.*

Students following **GN12** must take: MT2800, MT1300 plus two options from the list of stage two courses offered by the Department and two course units from appropriate courses taught in their other department.

Students following **FG61, GF13, GFC3** must take: MT2800, MT2900 plus two options from the list of stage two courses offered by the Department and two course units from appropriate courses taught in their other departments.

Students following **GW13, GC18** must take: MT2800 plus three options from the list of stage two courses offered by the Department and two course units from appropriate courses taught in their other departments.

Stage three:

Students following **NG31** must take MT3470 and MT4470 plus two options from the list of stage three courses offered by the Department and two course units from appropriate courses taught in their other department.

Students **not** taking **NG31** have four options from the list of stage three courses offered by the Department and two course units from appropriate courses taught in their other departments.

Stage four:

Students following **GFC3** must take either MT4000 (one unit) or PH4100 (one unit). In addition, they must take 1½ course units from appropriate courses offered by the Mathematics Department, and 1½ course units from appropriate courses offered by the Physics Department.

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Progression and award requirements

The progression and award requirements are essentially the same across all Honours Degree programmes at Royal Holloway. The Mathematics Department does not require that any specific course-units must be passed before progression to the next stage; however students must pass units to the value of at least three units (including the compulsory units in other departments) on each stage of the programme. On some programmes there may be a requirement to pass specific courses in order to progress to the next stage, or to qualify for a particular degree title. Students are considered for the award and classified on the basis of a weighted average. This is calculated from marks gained in courses taken in Stages two and three, and gives twice the weighting to marks gained in Stage three. In order to qualify for the award, students must gain a weighted average of at least 35%.

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Student support and guidance

- Each student is allocated an adviser who meets with him or her regularly through the programme. The adviser's role is to guide the student's academic progress, and give advice on academic, pastoral and welfare issues. The Academic Coordinator and First Year Coordinator provide a back-up system for academic and pastoral advice.

- In the first term of stage one all students are assigned to tutorial groups of 3-5, which meet weekly with a member of staff. These may be used for help and encouragement with understanding material from lectures, for help with study skills, and for stimulation – 'treating them as mathematicians'.
- In the core stage one and two courses all students meet weekly in groups of 15-20, again with a member of staff. In these, students start problem sheets and are encouraged to discuss worksheets with each other.
- In all courses, coursework is returned to the student with feedback on his or her performance. This is valuable for students and lecturers alike.
- The Departmental Undergraduate Handbook gives comprehensive details about the Department, how it operates and all the programmes.
- In the first week of the first term an induction programme including study methods, information sources and the Departmental computing facilities. Other sessions are held at the start and end of every session, run by the Academic Coordinator, dealing with various aspects of the system.
- All staff are accessible through a dedicated office hours system.
- The Student-Staff Committee meets at least twice in terms 1 and 2 and once in term 3 to consider issues raised by students. In addition, the contributing departments have their own Student-Staff Committees, which are open to representation from Mathematics students.
- Detailed student handbook and course resources can direct students to sources of support at College level.
- Extensive supporting materials and learning resources in College libraries and computer centre.
- All Mathematics courses use Moodle as a vehicle for communication of information, learning resources and appropriate links.
- There is a dedicated Departmental computing laboratory.
- College Careers Service and Departmental Careers Service liaison officer. Regular seminars on careers for mathematics students are held.
- Access to all College and University support services, including Student Counselling Service, Health Centre and the Educational Support Unit for students with special needs.

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Admission requirements

The Department's standard conditional offer is available on the Course Catalogue web page. However, the Department also has considerable flexibility in its admissions and offers policy and strongly encourages applications from non-standard applicants. Students whose first language is not English may also be asked for a qualification in English Language at an appropriate level. It may also be helpful to contact the Admissions Office for specific guidance on the entrance requirements for particular programmes.

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Further learning and career opportunities

Mathematics graduates are in high demand and have a wide range of employment prospects. Mathematicians are logical, numerate, have careful analytical skills and are confident in handling formulae or large data sets. These skills are in short supply in many key areas of industry, finance and government. Professional mathematicians are found in research teams working on problems as diverse as aircraft design, operational research or cryptography. Recent graduates have also started lucrative careers in finance, actuarial work, accountancy, and management. For further details please refer to the Careers Service.

Many graduates go on to further study (MSc or PhD) either within the Department or elsewhere. Because many subjects are taught by experts in their field, students have an excellent opportunity to progress onto postgraduate study. The Department has a thriving postgraduate research school and the internationally renowned Information Security Group. Together they offer MSc courses in Mathematics for Applications, Mathematics of Cryptography and Communications, and Information Security.

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Indicators of quality and standards

Royal Holloway's position as one of the UK's leading research-intensive institutions was confirmed by the results of the most recent Research Assessment Exercise (RAE 2008) conducted by the Higher Education

Funding Council (HEFCE). The new scoring system for the RAE 2008 measures research quality in four categories, with the top score of 4* indicating quality that is world-leading and of the highest standards in terms of originality, significance and rigour. 60% of the College's research profile is rated as world-leading or internationally excellent outperforming the national average of 50%. The College is ranked 16th in the UK for research of 4* standard and 18th for 3* and 4* research. The Mathematics Department is proud of its reputation in teaching and in research, with the excellence of its research in algebra, combinatorics and number theory being especially commented on by the RAE panel. The Department takes pride in its friendly atmosphere, in the stimulating courses, and in the achievements of its graduates who leave equipped for first-class careers.

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List of programmes

All the programmes are taught entirely by staff at Royal Holloway, University of London, and lead to awards of the University of London. The QAA subject benchmark statement in Mathematics, Statistics and Operational Research (revised 2007) describes the general features which one might expect from Honours Degree programmes in the subject, and can therefore be used as a point of reference when reading this document (see www.qaa.ac.uk). UCAS codes are given in parentheses (see www.ucas.ac.uk).

Single Honours Degree programmes & Combined Honours programmes taught wholly within Mathematics

- BSc Mathematics (G100)
- MSci Mathematics (G103)
- BSc Mathematics with Statistics (G1G3)

Combined Honours Degree programmes with Mathematics as a major or minor component

- BSc Mathematics with Economics (G1L1)*
- BSc Mathematics with Management (G1N2)
- BSc Mathematics with French (G1R1)
- BSc Mathematics with German (G1R2)
- BSc Mathematics with Italian (G1R3)
- BSc Mathematics with Spanish (G1R4)
- BSc Mathematics with Philosophy (G1V5)
- BSc Economics with Mathematics (L1G1)*
- BA French with Mathematics (R1G1)
- BA German with Mathematics (R2G1)
- BA Italian with Mathematics (R3G1)
- BSc Management with Mathematics (N2G1)

Joint Honours Degree programmes with Mathematics as an equal component

- BSc Computer Science and Mathematics (GG41)
- BSc Economics and Mathematics (LG11)
- BSc Finance and Mathematics (NG31)
- BSc Mathematics and Management (GN12)
- BA Mathematics and Music (GW13)
- BSc Mathematics and Physics (GF13)
- MSci Mathematics and Physics (GFC3)
- BSc Mathematics and Psychology (GC18)

* Not available to new entrants.

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