SCHOOL OF
MATHEMATICAL
SCIENCES

UNDERGRADUATE
HANDBOOK

2007–8
Mile End Campus map
Queen Mary, University of London is based on a fully-integrated residential campus

Main lecture theatres
19 Drapers’ Lecture Theatre (Geography Building)
18 Mason Lecture Theatre (Francis Bancroft Building)
33 Skeel Lecture Theatre (People’s Palace)

Schools, departments and research centres
11 Arts Research Centre
24 Biological and Chemical Sciences
18 Business Management (Francis Bancroft Building)
16 Chemistry (Walter Besant Building)
25 Computer Science
8 Department of Law
1 Economics
32 Engineering Annexe, IRC in Biomedical Materials
31 Engineering: Aerospace, Mechanical, Medical
31 Electronic Engineering
9 Faculty of Arts
42 Graduate Centre for Humanities and Social Science (Lockkeeper’s Cottage)
31 Materials
16 Materials (Walter Besant Building)
19 Geography
30 Mathematical Sciences
2 Physics

The School of Medicine and Dentistry is located at Whitechapel and Charterhouse Square/West Smithfield campuses. Please see location map.

Student residences and Student Village
1 Residents Office
28 Albert Stern House
14 Chapman House
14 Chesney House
12 Hatton House
29 Ifor Evans Place
4 Lindop House
14 Lodge House
13 Maynard House
14 Selincourt House
15 Varey House

Westfield Student Village
36 Beaumont Court
40 Creed Court
41 France Court
38 Lynden Court
37 Maurice Court
39 Pooley House
43 Richard Feilden House
Stocks Court is located in Globe Road near the corner of Mile End Road next to Stepney Green Tube Station.

Student support
19 Advice and Counselling
18 Disability and Dyslexia Service
19 Health Centre
22 Nursery
26 Students’ Union
43 Students’ Union offices
School of Mathematical Sciences
Undergraduate Handbook
2007–8

Inside front cover: Campus Map

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Part 2: Key Facts about Exams

Part 3: General Guidance

Part 4: Changes from Last Year

Part 5: Study Programmes

Part 6: Subject Streams

Part 7: Module Details

Part 8: Blank Timetables

Each part of this handbook that consists of more than a page or two has its pages numbered separately starting from 1 in the form “Part m – Page n”.

Most parts of this handbook are available on the School of Mathematical Sciences undergraduate web site www.maths.qmul.ac.uk/undergraduate/handbook as PDF files and some are available as separate web pages listed in the menu on the left of the undergraduate pages.

Information in the printed handbook is believed to be correct at the time of printing, but the information on the web may be more up to date.
## Module Summary

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Key Facts about Exams

This list is a brief summary; for further details please see Part 3: General Guidance.

Examination periods

- Main exams: late April – early June.
- Late summer exams: second half of August. Resits must be taken at the earliest opportunity and first sits should be taken no later than the following summer.
- An exam that has not been taken counts as a fail unless the absence has been certified.

Distribution of exam results

- Provisional results can be collected from the Maths Office after 1:00 pm on Thursday 19th June 2008 or will be sent to you by post if you give a stamped addressed envelope to the Maths Office beforehand. Include your student number on the envelope.
- Official results are sent to your home address by the Student Administration Office, usually in July.
- Exam results are not released via the web, communicated by phone or emailed on an individual basis.

Late summer exams

- First year students: late summer resits and first sits may be available for maths exams.
- Second / third / final year students: no late summer resits for maths exams (resits take place during the following main exam period).
- Other departments may have other rules.

Registration

- Registration for modules and main exams takes place within the first two weeks of each semester.
- Registration for resits (apart from first-year late summer resits) must be done at the same time as registration for modules and main exams.

Examination details

Details of each exam (duration, rubric, assessment ratio split, etc.) are available from the module organiser and can usually be found on the module web page.

Progression rules (BSc)

- From first to second year: pass Essential Mathematical Skills (EMS) and 6 course units in total (counting resits but not EMS). Students passing fewer than 5 course units do not progress.
- From second to third year: pass 12 course units in total (counting resits but not EMS). Students passing fewer than 11 course units do not progress.
- Course units at level 0 do not count for progression. Usually 1 course unit = 1 module.

Certified absences

Students with a certified absence (usually supported by a medical certificate) may be granted a first sit at the earliest opportunity. Requests for first sits must be handed in (with evidence) to the Maths Office at the earliest opportunity and no later than one week after the end of the examination period (mid June).

Contact

For queries concerning any academic matter you should first contact your adviser, who is likely to give the most competent advice.
Key facts for Mathematical Sciences students

This handbook is intended for all undergraduate students who are following a programme of study that involves the School of Mathematical Sciences. Some of the information given here is intended only as a guide; other sources, such as the Queen Mary Student Guide, give more detailed and definitive information. The Student Guide is available on the Queen Mary web site at http://www.studentadmin.qmul.ac.uk/students/studentguide.pdf.

The information in the printed handbook is believed to be correct at the time of printing. It is also all available on the School of Mathematical Sciences web site at www.maths.qmul.ac.uk/undergraduate/handbook and the web version may be more up to date than the printed version. Please try to resolve any queries by looking at the printed handbook or the web.

What and where is the School of Mathematical Sciences?

The School of Mathematical Sciences consists of mathematicians who work in pure and applied mathematics, statistics and astronomy. It is located in the Mathematical Sciences Building, which is the “tower” by the Mile End Road at the southwest corner of the campus.

The postal address for the School is:

School of Mathematical Sciences, Queen Mary, University of London, Mile End Road, London E1 4NS

The fax number for the School is 020 8981 9587; for email addresses and telephone numbers please see “All undergraduate teaching, advising and administrative staff” on page 5.

Where do I find things and people in Mathematical Sciences?

The main notice board is on the left immediately inside the main entrance to the Mathematical Sciences Building and the pigeon-holes for student post are in the room immediately to the left of the main entrance. You should check both frequently. The main notice board is for official postings by staff and sometimes carries essential information such as changes to examination rooms.

Your point of contact for administrative matters is the Maths Office, room 101 on the east side of the first floor of the Mathematical Sciences Building. There is another important notice board and a box for posting letters to staff outside the Maths Office. Printed copies of this handbook are available from the Maths Office while stock last.

Maths Office opening hours: 9:30 am – 12:30 pm and 1:30 pm – 4:30 pm every weekday except Wednesdays afternoons.

Other academic and administrative staff offices are listed under “All undergraduate teaching, advising and administrative staff” on page 5.

There are brightly coloured locked coursework collection boxes located opposite the lifts in the basement and on the ground and second floors.

What are the term dates?

The three terms of the Queen Mary academic year consist of two 12-week teaching semesters followed by a 6-week examination period. The first semester is preceded by a three-day induction and enrolment period. Dates for the academic year 2007–8 are as follows.

Enrolment Period: Wednesday 19 September 2007 – Friday 21 September 2007


3 week vacation

Semester B: Monday 7 January 2008 – Friday 4 April 2008 (with split-week vacation Tuesday 20 – Wednesday 26 March around Easter Day, which is Sunday 23 March)

3 week vacation
**Examination Period:** Monday 28 April 2008 – Friday 6 June 2008

For future term dates see [qm-web.qmul.ac.uk/info/dates-terms.html](http://qm-web.qmul.ac.uk/info/dates-terms.html) on the Queen Mary intranet.

**What must I do as a student?**

- Read this handbook carefully and use it as a point of reference.
- Maths staff will normally communicate with you by email sent to your qmul.ac.uk email address. We will also send you weekly updates on your coursework and test marks. Check the email sent to your qmul.ac.uk address at least every two days.
- Check your pigeon-hole and the student information notice boards in the Mathematical Sciences Building at least twice a week.
- Visit your adviser at the start of each semester at least and answer messages from your adviser promptly. (NB: In the Queen Mary Student Guide advisers are referred to as personal tutors.)
- Keep your adviser informed of your circumstances and any problems.
- Notify your adviser, the Maths Office (in the Mathematics Building) and the College Student Administration Office (in the Queens’ Building) of any change in your contact details (home address, term address, landline and mobile phone numbers).
- Submit all coursework required for each module by the stated deadline.
- Inform the module organiser if you withdraw from a module or enter a module late.
- Ensure you are registered for the correct study programme, which should be the same as your UCAS course unless you have submitted a “Change of Programme of Study” form.
- Ensure that you know and respect your adviser’s and lecturers’ office hours and those of the Maths Office; “office hours” are the times when you may normally visit the office. You can find full staff contact details including normal office hours on the web by clicking on a staff name in the list at [www.maths.qmul.ac.uk/personnel/academicstaff](http://www.maths.qmul.ac.uk/personnel/academicstaff), but before travelling any distance always arrange an appointment by email or phone.
- Provide your own pens and paper; the Maths Office cannot provide these for you.
- Respect the College policy on harassment, which states that all members of the College are entitled to work within an environment where they are treated with dignity and respect and where harassment of any kind is unacceptable.

**Can I take part-time employment?**

- You may take part-time employment at weekends or in the evening during term but you must be available to attend College every weekday between 9 am and 6 pm. Note that tests and other activities may be arranged at short notice.
- You should not work late at night because this is likely to interfere with your ability to study the next day.
- You should not undertake more than 12 hours per week of part-time employment during term.
- Part-time employment will not be accepted as a valid reason for missing lectures, classes, tests or examinations, or for submitting work late.
- As a full-time, registered student you have accepted that your main full-time occupation is that of studying for a degree, and you have the same responsibilities to the College (and any funding body) as you would to an employer.
- In the School of Mathematical Sciences you are expected to spend a minimum of 40 hours per week studying. Part-time employment is equivalent to taking a second job in addition to a full-time main job.

**What is your commitment to me and my studies?**

**What is Queen Mary’s mission statement?**

As detailed in its Strategic Aims, Queen Mary seeks “to teach its students to the very highest academic standards, drawing in creative and innovative ways on its research.”
What are the aims of taught mathematics?

- To ensure that students, when they leave us, have the mathematical skills most likely to be useful to them and their employers. In particular these include fluency and accuracy in elementary calculation; ability to reason clearly, critically and with rigour, both orally and in writing, within a mathematical context; and, within the areas that they study, a sense of how and where their mathematical knowledge can be applied.

- To help students build up more general skills and sound habits. These include the ability to plan their work, to work independently and in groups, to explain their work to others, and to use computers and the Internet effectively and responsibly.

- To deliver to each student a set of taught courses in mathematics that form a coherent whole at the appropriate levels for each year of a university degree.

- To challenge the ablest students and encourage the weakest, within a friendly, stimulating and responsive environment.

- To exploit our research strength by designing modules that will be interesting and useful for the students but also reflect recent developments in the subject; and at the same time to build on those modules and procedures that we have found successful in the past.

- To deliver sound assessments of the students’ work in order to keep them informed of their progress during their studies and in order to reflect their overall achievements in their class of degree.

- To make our programmes available to students able to take a mathematics degree, regardless of their formal qualifications.

- An additional aim for the MSci degree is to provide a comprehensive mathematical education that offers a first-class preparation for doctoral study or highly technical employment.

What are the objectives of taught mathematics?

1. All graduates will be able to use deductive reasoning and to manipulate precise concepts, definitions and notation.

2. All graduates will be able to approach a mathematically posed problem with confidence and technical dexterity.

3. All graduates in programmes that involve analysis of data will have acquired skills in data handling, quantitative statistical analysis, and the ability to synthesise results.

4. All graduates in interdisciplinary programmes will have developed both basic knowledge and understanding of the companion discipline, and appropriate mathematical expertise.

5. All graduates will possess basic computational skills.

MSci programme objectives consist of objectives 1, 2, 3 and 5 above but generally at a higher level than for BSc programmes. This applies with particular force to objective 1. In addition:

6. All MSci graduates will be able to write a technical mathematical report that draws on and synthesises work in published sources, using the proper scholarly conventions.

7. All MSci graduates who leave with first class honours will possess the maturity and the technical ability to be independent learners of research level mathematics.

Who’s who in Mathematical Sciences?

Key staff

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head of the School of Mathematical Sciences</td>
<td>Prof. D K Arrowsmith</td>
</tr>
<tr>
<td>Deputy Head of School</td>
<td>Prof. B Khoruzhenko</td>
</tr>
<tr>
<td>Director of Undergraduate Studies</td>
<td>Dr F J Wright</td>
</tr>
<tr>
<td>Senior Tutor</td>
<td>Dr R A Sugden</td>
</tr>
<tr>
<td>Pastoral Tutor</td>
<td>Prof. R A Bailey</td>
</tr>
<tr>
<td>Student-Staff Liaison Committee Chair</td>
<td>Dr L Rass</td>
</tr>
<tr>
<td>Subject Examination Board (SEB) Chair</td>
<td>Dr L Pettit</td>
</tr>
<tr>
<td>Subject Examination Board Deputy Chair</td>
<td>Prof. C-H Chu</td>
</tr>
</tbody>
</table>
All undergraduate teaching, advising and administrative staff

The following list gives staff names and a summary of contact details. It is generally best to contact staff by email in the first instance. You should only visit or telephone academic staff during their “office hours”. These are published on their office doors and/or personal web pages. You can also find full staff contact details including normal office hours on the web by clicking on staff names in the list at www.maths.qmul.ac.uk/personnel/academicstaff, but before travelling any distance always arrange an appointment by email or phone.

When telephoning, please use the direct-dial numbers listed below rather than going through the College exchange or the Maths Office. Note that Mathematical Sciences phones ring up to 5 times and then, if unanswered, switch automatically to the Maths Office, where you can leave a message if you wish.

<table>
<thead>
<tr>
<th>Name</th>
<th>Adviser Code</th>
<th>Room</th>
<th>Email</th>
<th>Phone (020 …)</th>
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<tr>
<td>Dr C Agnor</td>
<td>4766</td>
<td>502</td>
<td>C.B.Agnor</td>
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<tr>
<td>Prof. D K Arrowsmith</td>
<td>4625</td>
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<tr>
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<td>Dr K Malik</td>
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<td>K.Malik</td>
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</table>
### Who should I ask for advice?

You should normally ask your adviser first, who may refer you to your programme director, the Senior Tutor or the Pastoral Tutor. Their roles are described below.

### What is my adviser’s role?

You will be assigned an adviser to give you information and advice during your undergraduate studies. Your adviser’s principal task is to discuss with you and approve your “course registration”, which is the list of modules you register for each year. Your adviser will be a member of academic staff in the School of Mathematical Sciences, whose contact details are listed above. Lists allocating students to advisers are posted on the notice boards on the ground floor of the Mathematical Sciences Building at the start of each academic year. If you are not allocated an adviser you should see the Senior Tutor (see below), who has overall responsibility for advising.

You should visit your adviser **at the start of each semester** to agree your programme of modules for that semester, and you should visit your adviser at least once again during each semester to discuss your progress. Advisers can access all their advisees’ coursework and test marks for Mathematical Sciences modules online. It is also important that you discuss with your adviser any academic, financial, medical or other problems as soon as they arise. These may need to be reported to the Pastoral Tutor (see below). Your adviser can then refer you to the appropriate person within the College to deal with your problem.

You should get to know your adviser, since normally you should ask your adviser to act as a referee for job applications etc. If possible, you will keep the same adviser throughout your time at Queen Mary.

### What is my programme director’s role?

Each study programme has a director, who decides which modules should be studied within that programme. Normally, your degree title will be the title of your study programme and the programme director decides what conditions you must satisfy to obtain that degree title. Current Mathematical Sciences study programmes are listed in Part 5: Study Programmes and on the web at [www.maths.qmul.ac.uk/undergraduate/study](http://www.maths.qmul.ac.uk/undergraduate/study).

For joint programmes there is also a “second adviser” in the secondary department, and Mathematical Sciences programme directors act as second advisers to students on joint programmes for which Mathematical Sciences is the secondary department.

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<table>
<thead>
<tr>
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<th>Code</th>
<th>Room</th>
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<td>Dr S McKay</td>
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</table>
What is the Senior Tutor’s role?
The Senior Tutor, Dr R A Sugden, allocates advisers and oversees the academic aspects of advising and student welfare, in particular, attendance and performance in coursework and tests, and barring students from examinations. The Senior Tutor advises the Subject Examination Board on students’ non-academic difficulties and progression from one year to the next. End-of-year summaries of non-academic difficulties should be submitted directly to the Senior Tutor.

What is the Pastoral Tutor’s role?
The Pastoral Tutor, Prof. R A Bailey, oversees the non-academic aspects of advising and student welfare and liaises with advisers, the Senior Tutor, and the Health, Counselling and Welfare services, as appropriate. Details of missed in-term assessments, missed examinations and non-academic difficulties should be reported to the Pastoral Tutor when they occur, using the forms available from the Maths Office and on the web at www.maths.qmul.ac.uk/undergraduate/forms. Completed forms should be handed in to the Maths Office, in a sealed envelope if necessary for confidentiality.

How do staff and students communicate?
Staff contacting students: Maths staff will normally contact you by email sent to your qmul.ac.uk email address. The School has developed software that sends coursework and test marks to students’ qmul.ac.uk email addresses on a weekly basis. You should check email sent to your qmul.ac.uk address at least once every two days. Please note that private email addresses will not be used for any formal communications from Queen Mary to students.

Students contacting staff: It is usually best to contact staff initially by email or by leaving a note in the box outside the Maths Office, room 101. You may visit members of staff in their offices or telephone them during their office hours. There should be a notice on each undergraduate staff member’s office door indicating their office hours, which are at least two hours per week when they will normally be available in their office to see students. You can find full staff contact details including normal office hours on the web at www.maths.qmul.ac.uk/personnel/academicstaff, but before travelling any distance always arrange an appointment by email or phone.

Post for students: Paper mail is put into the pigeon-holes in the room immediately to the left of the main entrance to the Mathematical Sciences Building. In addition to external paper mail, any internal paper mail such as letters from the College or School will be put in your pigeon-hole. It is essential that you check your pigeon-hole regularly and at least twice a week. The pigeon-holes are cleared during the summer and uncollected mail is discarded.

Summer vacation support: During the summer vacation many academic staff will be elsewhere; you may still be able to contact them by email but not otherwise. You should contact the Maths Office if you need academic advice or assistance and cannot contact the appropriate member of staff.

Please remember: This handbook, the web and your adviser are your primary sources

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<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Prof. L H Soicher</td>
<td>G100, G110, G102, GG14</td>
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</tr>
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<td>Dr B Bogacka (Sem A) /</td>
<td>G300, GG31, G1N1, G1G3</td>
<td>G501, G504</td>
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<tr>
<td>Dr H Grossman (Sem B)</td>
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<td>Prof. J M Charap</td>
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</table>
What student services are available?

What library and computing services does Queen Mary provide?

We include a demonstration of the library and computing services as part of the induction programme on the Friday of the enrolment period, which new students should attend.

The main library web page is at www.library.qmul.ac.uk. A wide variety of up-to-date library and information resources, including the library catalogue and your own library user information, can be accessed from any computer connected to the Internet. The library will communicate with you by email.

Kathy Abbott is the subject librarian for the School of Mathematical Sciences and Kathy’s library web page for the School of Mathematical Sciences is at www.library.qmul.ac.uk/info/mathwww.htm.

Can I talk in the library?

You must remember that the library is a place for study and not a social space; see www.library.qmul.ac.uk/about_us/studenv.htm. Please:

- Always consider the needs and expectations of other users of the library.
- Always be silent in the main reading areas on all floors.
- Always confine group working to the designated group study areas: there is a quiet study area on the ground floor, and a group study room off the main staircase landing on the first floor, where quiet talking is allowed. You can use Level One in the catering building for group study.
- Always keep noise to a minimum in other areas, e.g. the main entrance and circulation area and the stairs.
- Never talk in anything other than a quiet voice and then only where permitted.
- Never allow your mobile phone to ring in the library.

The library operates a system of sanctions for non-compliance with the above noise rules, starting with one-day bans and escalating to four-week bans and worse for frequent offenders. The School of Mathematical Sciences fully supports these measures and may also take disciplinary action against any student who makes excessive noise in the library.

Please help to keep the library a quiet place to study.

What email and web services are available?

Email is the preferred method of communication and the web is the main source of information.

All students are assigned a Queen Mary computer username of the form ah12345, a password and a corresponding email address of the form username@qmul.ac.uk when they first enrol. This is the email address that we will use to communicate with you, so you must read email sent to your qmul.ac.uk email address regularly.

You can use your own computer to access your qmul.ac.uk email and most Queen Mary web pages off campus, although access to some web pages is restricted to the Queen Mary network. However, you can access most restricted web pages by logging in with your Queen Mary username and password.

The web site www.stu.qmul.ac.uk provides a starting point for accessing much of the information on the web relevant to Queen Mary students. You might like to make it your home page. In particular, there are links explaining how to access your qmul.ac.uk email from off campus. Other useful starting points for browsing the web are www.qmul.ac.uk for information maintained by Queen Mary and www.maths.qmul.ac.uk for information maintained by the School of Mathematical Sciences.

What is the Queen Mary teaching computer network?

You can use your Queen Mary username and password to log into any computers on the Queen Mary teaching network, such as those in the PC Labs (room W207 in the Queens’ Building and room 1.15a in the Francis Bancroft Building), the Library, Cafe Amici (ground floor of the Catering Building) and the Internet Cafe (Level 1 in the Catering Building). Please note that College
regulations specify that Queen Mary computer facilities should be used for academic purposes only. If you are taking a computing module taught by the School of Mathematical Sciences then the software you need will be available on the teaching computer network and (except for advanced modules) you will have regular timetabled computing labs with teaching assistants to help you.

The teaching computer network provides you with a small amount of file space. The computers run Microsoft Windows and a range of software is available, including word processing facilities (Microsoft Word) and laser printer output. There is a charge for printing. Basic self-help documentation is available both on paper from Computing Services’ Reception desk (room W209 in the Queens’ Building) and online from qm-web.css.qmul.ac.uk/user-support/docs.shtml.

**What is the Mathematical Sciences software server?**

This is an experimental server run by the School of Mathematical Sciences that provides access to the main software required by Mathematical Sciences students. The software runs on the server and your computer acts as a remote terminal via terminal server (remote desktop). See the web site www.maths.qmul.ac.uk/undergraduate/ugserver.shtml for details on accessing the server. As this is an experimental server, we may make changes during the coming academic year, so please visit the above web site again if you have any difficulty using the server.

The purpose of the Mathematical Sciences software server is to complement the College’s Computer Teaching Service by offering you the option of working on your coursework from home rather than from the computing terminal rooms in College. The above web site explains in detail how to use the server if your computer runs Windows XP, Mac OS X or Linux.

**What are the advice and counselling service, health centre, etc?**

If you have problems that you do not wish to discuss first with your adviser or with the Senior or Pastoral Tutors then there are a number of ways to obtain help and advice directly. The College provides an Advice and Counselling Service (see www.welfare.qmul.ac.uk) and a Health Centre, both located on the ground floor of the Geography Building. Additional details about how to find people in the College who can provide suitable help and advice are given in the Queen Mary Student Guide. The Students’ Union also provides welfare services, and there is a confidential student-run telephone service called Nightline (tel. 020 7631 0101); for details see www.nightline.org.uk.

**How do you support special needs (e.g. dyslexia)?**

If you have, or think you might have, a disability, such as dyslexia, then you may be eligible for support such as extra time in tests and examinations. You should contact the Disability and Dyslexia Service, room 2.05a, Francis Bancroft Building as soon as possible; see also www.disability.qmul.ac.uk. Do not wait until just before the examinations because it takes time to set up special examination arrangements.

You will probably need to complete an “Application for Special Examination Arrangements” form to apply for new or changed special examination arrangements. You can obtain this form from the Disability and Dyslexia Service; it may also be available from the Maths Office or on the web at www.maths.qmul.ac.uk/undergraduate/forms. When special arrangements are agreed they normally continue automatically throughout your course. The exception is when the nature of the disability suggests that the condition may deteriorate or improve, in which case a doctor’s letter may be required each year.

**How do I get help with English language and academic study?**

The English Language and Study Skills (ELSS) unit offers a range of courses, workshop classes and individual tutoring in English language, academic communication skills and related areas. All Queen Mary students are eligible to use this service, which is free of charge. Whether you are unsure about the skills required for your degree or wish to enhance your abilities in a particular area, you are encouraged to contact ELSS.

ELSS runs workshop classes covering research skills (including note-making from lectures and reading and how to avoid plagiarism), time management, oral presentation skills, academic writing, grammar
and punctuation, personal development planning and examination skills. Workshops are normally between 2 and 4 hours long. Individual tutorials, which can be on any area of English language or study skill, last for 30 minutes.

Students who have been educated in a language other than English can join longer courses (20 hours per semester) which cover both English language and study skills. These insessional English courses include General English, Lecture Comprehension and Seminar Skills, Grammar and Writing, and Academic Writing. These courses are popular with international students and can make a substantial difference to your chances of academic success.

The three Royal Literary Fund (RLF – see www.rlf.org.uk) Writing Fellows at Queen Mary offer tutoring across the disciplines on four days of the week. Their tutorials last for up to 45 minutes and can be booked through the English Language and Study Skills office.

For information on how to join ELSS courses, book tutorials, or to make an appointment with one of the three RLF Writing Fellows, please contact:

   English Language and Study Skills Office,
   Language and Learning Unit,
   Francis Bancroft Building, Room FB 1.24
   Telephone: +44 (0) 20 7882 2826
   Email: elss at qmul.ac.uk

or visit the ELSS web site at www.languageandlearning.qmul.ac.uk/elss.

Where can I get legal advice?

The Queen Mary School of Law runs a free Legal Advice Centre which is open to the public, University staff and students; see www.advicecentre.laws.qmul.ac.uk for details.

How is my degree course organised?

We refer to a whole degree course as a programme of study. We operate a modular course unit system and each year you take a number of modules that make up 8 course units. Most modules are worth 1 course unit but advanced project modules are worth 2 course units.

How are the semesters labelled?

The teaching each year is split into two semesters. The teaching semesters throughout a degree course of up to four years are numbered from 1 to 8. We also use Semester A to refer to any of Semesters 1, 3, 5, 7 and Semester B to refer to any of Semesters 2, 4, 6, 8. For example, you would study a module scheduled for Semester 3 in Semester A of your second year.

What do I need to know about modules and course units?

For a complete list of modules taught by the School of Mathematical Sciences see Part 1: Module Summary and for details see Part 7: Module Details. A longer description of each module and a link to the module web site, maintained by the module organiser, can be accessed on the web via the list at www.maths.qmul.ac.uk/undergraduate/
Information about modules from all departments is given in the Queen Mary Course Directory (which is available on the web at www.qmul.ac.uk/courses/coursedirectory).

Most modules run for one semester and contribute one course unit to your programme but advanced project modules run over both semesters in your final academic year and contribute 2 course units. You must take 8 course units per year, normally as 4 per semester. In addition, you can (and normally should) resit the final examinations for any modules you have failed, which you can do at most twice for each module.

The teaching timetable will be put on the main notice board and on the web at www.maths.qmul.ac.uk/undergraduate/timetable in September just before the start of the academic year. Note that it may be updated occasionally, especially just before the start of Semester B. Most modules consist of three lectures per week plus exercise classes and/or computing labs (where help is provided). It is essential that you attend all components of all your modules regularly.

**What is my study programme?**

Your study programme is initially the same as the course for which you were accepted. Study programme details are listed in Part 5: Study Programmes. Each study programme is administered by a programme director and it specifies compulsory core modules that you must take. Provided you meet the programme requirements, you can choose your optional modules freely, subject to the approval of your adviser. When you graduate, provided you have satisfied the programme requirements, your degree title will be your study programme title. If you do not satisfy the requirements of any study programme then your degree title may be Mathematical Sciences.

Study programmes may change a little from year to year as the curriculum develops. You should follow the current version as given in this handbook. If a change in your study programme creates difficulties for you, please discuss this with your adviser and/or your programme director.

**Can I change my study programme?**

You may be allowed to change your study programme, but all such changes require careful consideration and formal approval.

You must follow the procedures below in the order shown and complete a College Change of Programme of Study form, which is available from the Student Administration Office, room CB05 in the Queens’ Building, and on the web at www.studentadmin.qmul.ac.uk/students/studentforms.shtml. If this form is not completed and returned to the Student Administration Office then you will not have changed your study programme.

**How do I change to a new study programme run by Mathematical Sciences?**

1. First discuss the change with your adviser. If your adviser agrees to the change then you should make a decision, with your adviser, as to whether you will continue with the same adviser, which is normally preferable to preserve continuity. In exceptional circumstances, the Senior Tutor may allocate you a new adviser but you will need to discuss this with the Senior Tutor first. You must complete a Change of Programme of Study form. Do not forget to include your student number. Obtain your current adviser’s signature at the very bottom of the front of the form to show that your adviser approves the change. (There is no designated area for this signature.)

2. On a copy of the new study programme (in Part 5: Study Programmes of your printed handbook or printed from the web):
   - put a tick against all modules passed in previous years; and
   - put a cross against all (proposed) modules to be taken or resat in the current year.

3. Take the completed form and marked study programme to the programme director shown at the top of the proposed new programme and discuss the proposed change with him/her. If he/she agrees to the change then leave the form with the programme director, who will sign it at the very bottom of the front of the form (by your adviser’s signature) to accept your transfer into the new study programme and then forward it to the Senior Tutor to complete the processing. Keep the marked study programme as a guide for yourself (and your adviser).

Transfers to GL11 Mathematics, Statistics and Financial Economics, G1N1 Mathematics with
Part 3: General Guidance

Business Management or GN13 Mathematics, Business Management and Finance will be allowed only in exceptional circumstances and students will need to have demonstrated excellent performance to be considered. To change to GL11, first obtain approval from the programme director, then obtain a signature from the Head of the Department of Economics, and finally give the form to the Senior Tutor for Mathematical Sciences via the Maths Office. To change to G1N1 or GN13, first obtain approval from the programme director, then obtain a signature from the Head of the School of Business and Management, and finally give the form to the Senior Tutor for Mathematical Sciences via the Maths Office.

How do I change to a new Study Programme not run by Mathematical Sciences?
1. First discuss the change with your adviser. If you still wish to proceed then visit the department that runs the study programme you want to transfer to and discuss it with them. If they agree to the change then complete a Change of Programme of Study form. Do not forget to include your student number.
2. Take the completed form to the Senior Tutor for Mathematical Sciences for approval of your release from the School of Mathematical Sciences.
3. Take the completed form to the other department and follow their procedure for approving a change of study programme. They may require you to return the form to the Student Administration Office yourself.

Can I study abroad?
The College runs an American Universities exchange programme, co-ordinated by the Study Abroad Adviser, Mr H Gibney, in the Student Administration Office. You normally spend the second year of a three-year programme abroad and you need to begin arrangements fairly early in the first year.

The School of Mathematical Sciences participates in the Erasmus exchange programme administered by the European Community. The programme offers students the opportunity to study for a period of several months to a year at a university in another European Union country. The particular networks with which the School of Mathematical Sciences is connected involve more than 40 universities in the European Union, every country in the EU being represented by at least one university. Any student interested in this opportunity should contact Dr R Klages in Mathematical Sciences (see “All undergraduate teaching, advising and administrative staff” on page 5).

How do I enrol and register for modules?
You do this as part of your induction programme during the enrolment period, which for the academic year 2007–8 is from Wednesday 19 September 2007 to Friday 21 September 2007. You should be sent general information about the induction programme by the Student Administration Office, which should arrive at your home address by mid September at the latest, but is also on the web at www.qmul.ac.uk/enrolment.

Full information about the induction programme for Mathematical Sciences students will be available on the web at www.maths.qmul.ac.uk/undergraduate/induction. It is essential that you attend your induction programme.

If I am a new student...
1. If you are new to Mathematical Sciences then you must attend the main induction meeting on the Wednesday afternoon of the enrolment period, in which we will tell you who your adviser is. In most cases, after the induction meeting you should visit your adviser in their office in the Mathematical Sciences Building (see “All undergraduate teaching, advising and administrative staff” on page 5 for staff offices and contact details). Lists of adviser allocations will also be posted in the Mathematical Sciences Building. If you miss the induction meeting then visit your adviser and programme director (see “What is my programme director’s role?” on page 6) as soon as possible. If you wish to change immediately to a different study programme then contact the Senior Tutor as soon as possible.
2. Your adviser will give you the documents that you need including a departmental enrolment form, which you should complete and return to your adviser or the Maths Office as soon as possible. Your adviser will ask you to check and sign your personal course registration form. Note that you normally take 8 course units per year, but you will be pre-registered for 9 course units, which include Essential...
Mathematical Skills. Therefore, you will need to drop one course unit at the beginning of Semester B, which should be Essential Mathematical Skills provided you pass it before January; see “What is Essential Mathematical Skills?” on page 20.

3. Your adviser will give you a copy of the induction schedule. Make sure that you attend the rest of your induction programme as explained in the main Mathematical Sciences induction meeting. In particular, ensure that you enrol in the Octagon on the Friday afternoon of the enrolment period. Please make sure that you keep to the time period allocated by the Student Administration Office.

4. Your adviser will give you a sample Essential Mathematical Skills test for you to try. All first year Mathematical Sciences students must pass an Essential Mathematical Skills test; see “What is Essential Mathematical Skills?” on page 20. Tests take place at various times during the year. We provide an Essential Mathematical Skills module that you must attend until you successfully pass a test. We will explain the details of this module in the main Mathematical Sciences induction meeting. Make sure that you attend the first Essential Mathematical Skills lecture during the induction programme; see your induction schedule.

5. Your adviser will give you a timetable that should include all first semester modules taken by Mathematical Sciences students. Use your study programme to select the modules you are taking, including Essential Mathematical Skills.

6. Spend some time during the enrolment period making sure you know where your first-semester lectures will be and where the College computing facilities are. Register with Computing Services as soon as possible (which should happen when you enrol) and then email your adviser from your new qmul.ac.uk email address to confirm that you have completed the enrolment process. If you have your own computer and a network connection then find out how to access facilities such as your Queen Mary email account from off campus; see “What email and web services are available?” on page 8.

If I am a continuing student…

Continuing students must enrol online at https://webapps.is.qmul.ac.uk/selfenrol. Your adviser will have your course registration form when it becomes available and will retain your completed course registration form.

Visit your adviser on the Thursday or Friday of the enrolment period to discuss your choice of modules. Note that your adviser may have changed. Updated adviser lists for continuing students and the first semester timetable will be displayed on the student information noticeboard. Please ensure that you are following the requirements of your study programme (see Part 5: Study Programmes). If you are considering changing your study programme then you should follow the procedure described above: see “Can I change my study programme?” on page 11.

If you have taken late summer resit or first sit examinations then your adviser should be able to tell you the results. If your progression depends on the late summer examinations then you will not be able to enrol and your course registration form will not be available until the first week of teaching.

You should register for all 8 new course units that you propose to take during the current academic year and include all additional examinations that you plan to resit or for which first sits have been granted. If you have attempted an examination 3 times then no further attempts are permitted. You cannot under any circumstances resit examinations that you have already passed. You may also sample additional modules for up to two weeks; see “Can I sample modules before deciding?” on page 14. You should be pre-registered for core modules.

Most modules have prerequisites and some also have overlaps; these are given in the Course Directory, which can be accessed online at www.qmul.ac.uk/courses/coursedirectory, and in the module specifications in Part 7: Module Details. You cannot take a module if it overlaps with one that you have already passed or that you are currently taking or will resit. You may normally take a module only if you have passed all the prerequisite modules. If you have taken but not passed one or more prerequisite modules or have not taken them then you should seek approval from the module organiser before registering; otherwise you may find the module too difficult.
Registrations for some modules must be validated, meaning that you must obtain approval (usually from the module organiser) to register for that specific module. **Obtaining this approval is entirely your responsibility!** Information about module validation is provided at the back of the Course Directory and online at [www.qmul.ac.uk/courses/coursedirectory/registration.php](http://www.qmul.ac.uk/courses/coursedirectory/registration.php). Note that all elective modules in Business Management must be validated by the School of Business and Management; see Part 5: Study Programmes – Page 2.

You must normally have written permission from both the Senior Tutor and the Student Administration Office to take modules taught outside Queen Mary; for approved modules run by other colleges and institutes of the University of London you must complete an intercollegiate course registration form. It is your responsibility to ensure that you satisfy all the requirements of all the modules for which you register.

**What if I have failed modules?**

You may attempt any examination at most three times until you pass it. Normally your second and third attempts will be pegged resits of the examination alone, but it is also possible to retake a complete module if you are retaking a year.

You can (and normally should) resent the examination for each module you have failed (without attending any of the teaching for the module) but you must do this at the first opportunity (and you can do this at most twice). A resit examination does not count as one of the 8 course units that you take in each academic year. However, when you resent an examination the maximum overall mark you can obtain for the module is normally limited to the minimum pass mark; we say that the mark is “pegged”.

You should register for all resit examinations when you complete your course registration form in September and **you must ensure that all resit examinations are included in your course registration and examination entry form in January.** This is your responsibility, not your adviser’s!

The best mark from the original and any resit results is used to determine your degree classification.

If a module has been discontinued or changed substantially and no comparable examination paper is being set then a special resit paper for that module will be produced if required on **one occasion and no more.** You may not be allowed to resit modules that have a large element of continuous assessment, such as modules with a large computing component, and **before you register for the resit you must check with the module organiser whether you can resit,** and how the continuously assessed component will be handled for resit candidates. You are responsible for checking whether there are any minor changes to modules that may affect any examinations that you resent in the main examination period.

In summary, the following regulations normally apply to resit examinations:

- You must resent each examination at the first opportunity.
- You are normally allowed a total of three attempts at any one module (i.e. two resits).
- Where there is a change in either style or content of the examination paper from one year to the next, resit candidates will be set a special resit paper which is comparable to the original one; they will not be given the option of taking the current year’s paper.
- Any request to waive any of these regulations must be made in detail in writing by the student to the SEB chair by:
  - 31st January for examinations the following May;
  - 15th July for examinations the following August.

**Can I sample modules before deciding?**

You may register temporarily for more than 8 course units and “sample” modules briefly. If you do this, you must cancel the excess registrations for each semester by the Friday of the second teaching week of the semester and **you must inform the module organisers yourself.** Course amendment forms will be available from the Student Administration Office (Queens’ Building, room CB05). Your adviser must approve your initial module registration and all changes to it. Your adviser should retain all such forms, which the Maths Office will return to the Student Administration Office after copying for our files.

You are not allowed to be examined in more than 8 course units per year and you should
not take fewer than 8 because your degree will be assessed over 8 course units per year. With the approval of your adviser you may attend more than 8 course units, but you should register to “study only” any modules in which you do not intend to be examined (there is a “study only” column on the course registration form). You should inform the organisers of any modules that you are taking for study only and you should register to “study only” any modules in which you do not intend to be examined (there is a “study only” column on the course registration form). You should inform the organisers of any modules that you are taking for study only and you should register to “study only” any modules in which you do not intend to be examined (there is a “study only” column on the course registration form).

**What is the registration reinstatement fee?**

The College reserves the right to charge an administration fee in respect of reinstating the record of any student whose registration has previously been terminated under the College’s Ordinances for the non-payment of tuition fees. The fee is currently £250.

**How are modules organised?**

Each module is run by a “module organiser” (usually the lecturer) and the teaching normally consists of three lectures per week with perhaps additional support teaching in the form of supervised exercise or computing classes. The module organiser will provide information about support teaching at the beginning of the module and will normally display details on the module web site (or possibly on the Mathematical Sciences notice board). The module organiser will also provide information about module requirements, key objectives, methods of assessment, the examination rubric and (for some modules) will provide additional material on the module web site. A link to each module web site, maintained by the module organiser, can be accessed via the list at [www.maths.qmul.ac.uk/undergraduate/modules](http://www.maths.qmul.ac.uk/undergraduate/modules).

**How are modules assessed?**

Most modules are assessed primarily by a formal written examination held during the main examination period. There is normally also a component of continuous assessment by coursework such as exercises or mini projects. Assessed coursework is marked and returned to you. For many core modules the assessment also includes one or more tests held during the semester. If you take a project module you will be examined by a project report and frequently also an oral examination during the examination period.

This is to ensure that the project is your own work and provide an opportunity for you to clarify any misunderstandings about the project work. **You should ensure at the beginning of each of your modules that you understand fully the examination requirements.**

You must attend all parts of all your modules regularly, submit coursework regularly and attend all tests. Attendance registers may be taken but we also use coursework submission records as an attendance register. If your participation in modules is unsatisfactory you risk being barred from entering the examinations, and if your attendance at College generally is unsatisfactory you will have your registration terminated. The College is obliged to inform grant-paying authorities if you do not attend regularly (see “What does it mean to be barred from a module?” on page 24).

**How do I submit my coursework solutions?**

Large modules use the brightly coloured locked coursework collection boxes located opposite the lifts in the basement and on the ground and second floors. The organiser of each module will inform you if a collection box is being used and if not how coursework will be collected. For modules that use a collection box, you must "post" your coursework through the slot in the correct box by the deadline specified by the module organiser, usually each week. The boxes are coloured and labelled. The course organiser will tell you the location of the coursework box and its colour. **You must ensure that you use the correct box! If you put it in the wrong box then it will be considered not to have been submitted.**

The work you submit must be your own; the College has strict rules on cheating and plagiarism (see “What is an examination offence?” on page 24). You must clearly print your name as registered with the College, with your surname underlined, and your student number at the top of the first page of all work submitted for assessment of any kind (coursework, tests, reports, etc.). Work that does not meet this requirement may not be accepted, in which case you will score a mark of zero.

**How do I get help?**

If you have administrative or technical questions relating to a specific module then
you should approach the module organiser, either at the end of a lecture or in the module organiser’s office hours. Many modules, especially in the first year, have exercise or computing classes, where you have an opportunity to ask questions of the teaching assistants (who range from senior staff to graduate students). Some module organisers may also provide additional support for students who are finding the module difficult – ask about this if necessary.

**What is PASS: Peer Assisted Study Support?**

- PASS offers help with all first year maths modules to smooth the transition from school or work to university study.
- PASS consists of friendly drop-in study sessions run by peer student mentors who have successfully completed the first year.

**We can help you pass**

Peer mentors have been trained in running effective PASS sessions. They are volunteers who are keen to share their knowledge and experience to help you succeed.

**A student mentor explains:** PASS sessions are more like discussion groups than exercise classes. The mentors encourage you to have discussions amongst yourselves before asking for help.

For further details contact Dr Robert Johnson (see “All undergraduate teaching, advising and administrative staff” on page 5), or see the PASS posters around the Mathematical Sciences Building.

**Do I need to buy textbooks?**

Most module organisers recommend one or more textbooks, most of which should be available in the Queen Mary library. Buying textbooks is normally optional although you will find it helpful to have some textbooks of your own. However, you must buy the recommended textbook for Calculus I and II, Thomas’ Calculus, which includes an access code for Course Compass, the web-based teaching resource we use. You can buy the book together with an access code at the start of the academic year from the Queen Mary bookshop at a subsidised price of £30, which is significantly less than the price of the access code alone on the open market. Therefore, we recommend that you do not buy this book elsewhere and do not buy it second hand because a new access code will cost you almost as much as the book itself.

**What are lectures, exercise classes, etc?**

This section provides some guidance primarily for new students. In place of the classroom teaching normally used in schools, we hold lectures together with exercise classes to teach most of our modules. We also hold occasional tests.

**Lectures:** In a lecture, the lecturer stands at the front of the room and talks about mathematics. The lecturer will normally write on a board or project slides onto a screen. The written information may include everything important or it may include only key points, depending on the style of the lecturer. You need one or two pens and a pad of paper to write your own lecture notes. What you write is up to you but it will normally form your main record of what you have been taught in the module. You will generally need to copy carefully what is on the board or screen. You should review and correct your notes regularly, note any points you do not understand and try to resolve them, asking in the exercise classes if you cannot sort them out for yourself. Nobody will look at your lecture notes except you. It is very important that you keep up with the module since mathematical modules tend to refer back to, and rely on, material covered earlier in the module. You should keep your lecture notes, exercises and coursework for revision.

**Exercise classes:** In a mathematics exercise class there will normally be several members of staff and PhD students to help you with specific problems. It is up to you to ask them questions (about any aspect of the module). However, their job is to guide you towards the solutions to problems, not just to tell you the answers! You will be set problems by the module organiser. You should try to solve the problems and look up the meanings of relevant terms in your lecture notes or appropriate textbooks or by searching the web before the class. If you cannot solve a problem then look for similar worked examples in your notes. There is not enough time to write out all the solutions during the classes, but there should be time to ask questions about the things you do not understand provided you have thought about them beforehand. The exercise classes for some modules are held in a computing laboratory.
**Tests:** These are mini-exams, normally held in week 7 of each semester. Examination regulations apply to tests. Many departments use week 7 as a “reading week” but the School of Mathematical Sciences uses it as a “consolidation, revision and test week”.

**Timetable:** Ideally you should make up your own study timetable, including lectures, and specify when you are going to read the lecture notes and do the exercises each week. Studying at university is a full-time job; the standard expectation of time spent by students studying for a degree is 1200 hours per year. That is equivalent to 150 hours for each course unit and to 40 hours per week for 30 weeks of the year.

**Exercises:** Doing the exercises is essential in order to understand each module. It is essential to keep up to date: most modules build on earlier material. Moreover, we use the handing in of exercise solutions as an “attendance register”.

**What if I am prevented from studying?**

We will make allowance if you are prevented from studying provided we accept that the reason is a good one that is outside your control, but **you must inform us immediately.** In particular, we will not generally accept notification after the examination board has met and agreed your results.

If you are absent from College for more than a day or two then please always let your adviser know at the earliest opportunity.

**What if I miss coursework submissions or tests?**

If you fail to submit coursework and/or miss tests through illness, injury or other good cause then you should submit a “Missed In-Term Assessment Report Form” to the Pastoral Tutor as soon as possible via the Maths Office. The form is available from the Maths Office and on the web at [www.maths.qmul.ac.uk/undergraduate/forms](http://www.maths.qmul.ac.uk/undergraduate/forms).

We will excuse you from any coursework or test you miss if we accept your reason for missing it. You will normally be excused from a test only if you have submitted at least half the coursework set so far for the module. An excused mark will be shown as E.

If you are absent for more than 5 days you must provide supporting documentary evidence such as a letter from your GP. We will not process the form if any sections are not satisfactorily completed; “see attached letter” in the “briefly explain” box is not sufficient. We may not take account of your report if you could have submitted it earlier.

The Senior Tutor will retain any supporting evidence you provide. It will not be distributed to other staff with the form, but may be disclosed in confidence to relevant College officials. The form itself will be processed by the Maths Office. Copies will go to your file, your adviser and all the relevant module organisers, and will be available to any staff writing a reference for you. Module organisers in the School of Mathematical Sciences will state at the start of each module how allowance will be made for missed coursework and tests that have been reported in the correct manner and approved by the Pastoral Tutor. We normally ignore any excused marks when computing your overall average mark.

If you miss coursework and/or tests for modules taught by other departments then you should speak to the module organiser directly and follow the rules of the department concerned.

**How do you allow for religious observance?**

If there are any times during which you cannot take a test because of religious observance then you must inform the Director of Undergraduate Studies by email within the first week of the semester. You must include your full name and student number. If you do this then we will either schedule the test to avoid these times or excuse you from the test. Otherwise, no allowance will be made for tests that are missed for religious reasons.

**What if my studies are generally disrupted?**

An extenuating circumstance is a significant event that is outside your control and either disrupts your studies for a substantial period of time or has a substantial direct effect on your examination performance.

You should report extenuating circumstances by completing an “Extenuating Circumstances Report Form” and submitting it to the Maths Office as soon as possible. **You must do**
this before the end of the examination period. The form is available from the Maths Office and on the web at www.maths.qmul.ac.uk/undergraduate/forms. You are strongly advised to discuss your case with the Senior or Pastoral Tutor before completing the form.

If you wish the department to take account of your extenuating circumstances when determining progression or degree classification then you should support your report with documentary evidence such as a letter from the College Medical Centre, a GP, a hospital or the police. The Mathematics Examination Board will not consider extenuating circumstances that are not supported by documentary evidence.

How do I interrupt my studies or withdraw?

If you decide to withdraw from Queen Mary, either temporarily or permanently, you should discuss the matter with your adviser. If you decide to proceed, you must complete an "Interruption of Study/Withdrawal from College" form, which is available from the Student Administration Office, room CB05 in the Queens’ Building, and on the web at www.studentadmin.qmul.ac.uk/students/studentforms.shtml. Then take the form to the Senior Tutor, who will want to discuss it with you before agreeing to sign it.

If you wish to interrupt, i.e. withdraw temporarily, then you must do so by the end of the second semester. Interruption of studies is normally for one complete year, but in exceptional circumstances the period may be up to two years. If you interrupt your studies then you lose the automatic right to enter examinations for modules that you took before you interrupted, and you will not be allowed to enter for any examination in which you would be the only candidate.

How are the main examinations organised?

You must complete a second course registration form each academic year at the start of Semester B. This is to confirm your examination entry, which must be agreed by your adviser. It is essential that you include any resit examinations on this form since there is no automatic entry for examinations in the main examination period. After you have entered for the examinations, you may not add any modules. However, you have a period of time when you can withdraw from modules using a “Course Amendment Form”, available from the Student Administration Office. This allows time for sampling modules in the Semester B. You cannot sit examinations in more than 8 new course units (i.e. excluding examinations that are resits).

You will be invited by email to collect your individual examination timetable from the Maths Office at the end of Semester B. Please make sure you do so, because your individual examination timetable confirms your examination entries. Please check your individual timetable to make sure that you are entered for the correct modules and report any errors to the Student Administration Office immediately.

If you require new or altered special examination arrangements then you need to complete a “Special Examination Arrangement Form”; see “How do you support special needs (e.g. dyslexia)?” on page 9.

Past examination papers are available in the College Library and on the Library web site. The examination timetable is displayed on the notice boards in the Mathematical Sciences Building when it is ready. There will be amendments made from time to time, so please check carefully! No information regarding the timetable will be given over the telephone.

Main examinations (but not tests) are normally “anonymously marked”, which means that you will be identified only by your examination number and not by your name or student number. We can only record your main examination mark against your examination number.

You must write your examination number, which is on your student card, and your desk number on your main examination answer books. Do not use your examination number for any purpose other than main examinations. We cannot decode it and will not know who you are.

How and when do I get my results?

• If you would like to have your provisional results posted to you in June then please leave a stamped addressed envelope with the Maths Office. This envelope must show your full name and student number clearly.

• Provisional classifications for finalists will be displayed (showing student numbers but not names) in the Mathematical Sciences Building by 1:00 pm on
Thursday 19th June 2008. (If you prefer not to have your results displayed then you should advise Caroline Griffin in the Maths Office by the end of the examination period.)

- Provisional results not sent by post can be collected from the Maths Office after 2:00 pm on Thursday 19th June 2008.
- Once the provisional results are released, advisers will be available on 19th and 20th June 2008 to discuss future options with all their advisees. Please collect your results before visiting your adviser.

Note that the results are “provisional” because they have yet to be formally approved by the Degree Examination Board and only the Student Administration Office can give official results. However, the results cannot be changed by any member of the School of Mathematical Sciences at this stage.

- The Student Administration Office will send out official notices of results, approved by the Degree Examination Board, in July.
- Results are released only to students who are not in debt to the College and will not be given over the phone or sent by email on an individual basis.

What if I miss examinations?

Do not delay! If you miss an examination for a good reason outside your control then you can apply to sit the examination later without any penalty. To do this you must submit a completed “Missed Examinations Report Form” at the earliest opportunity. This form is available from the Maths Office and on the web at www.maths.qmul.ac.uk/undergraduate/forms. We must receive it within one week after the end of the examination period. If your application is approved then the missed examination does not count as an attempt. A delayed first attempt is called a “first sit”.

The form should be submitted to the Pastoral Tutor via the Maths Office and must be supported by documentary evidence such as a medical certificate or letter (a prescription is not acceptable) from the College Medical Centre, a GP, a hospital or the police. Please note that a medical certificate or letter from the Health Centre or your GP must clearly state that you were unfit to sit examinations during a specified time period. We will not process the form if insufficient information is provided or if it arrives late. If you submit the form by post then it is your responsibility to ensure that it arrives in time.

The Mathematics Examination Board will decide whether the “first sits” requested on the submitted report form will be allowed and you will be informed of the decision. You normally take “first sits” the following May but you may be allowed to take those necessary for progression in August.

If you are a finalist and you miss some examinations for good reason, i.e. you have extenuating circumstances, but you also have enough units to graduate then you may request that we take the missed examinations into account when classifying your degree. The procedure to follow when making such a request is given in “What if my exams are disrupted?” on page 22.

Note that if you attend an examination but later tell us that you were ill during the examination then we may not be able to grant you a first sit. If you feel ill before an examination then you may be best advised not to attend the examination but instead to seek medical advice and a medical certificate.

Am I eligible for late summer examinations?

Note that the results of resit examinations are normally limited (“pegged”) to a bare pass mark of 40E. (However, first sits are normally unpegged.)

Late summer examinations are currently not available for finalists. Non-finalists will be offered late summer first sits if their progression depends on them. Otherwise, individual departments decide whether to offer late summer examinations for modules they teach and if so whether to offer them only to students in their first developmental year. Students are entered automatically for late summer examinations for which they are eligible.

The following departments offer optional late summer examinations to students in their first developmental year only:

- Engineering
- Environmental Science
- Geography
- Materials
- Mathematics
The following departments offer optional late summer examinations to students in their first and second developmental year:

• Biological and Chemical Sciences
• Economics
• Physics

The late summer examination timetable and results for Mathematical Sciences modules will be put on the web at [www.maths.qmul.ac.uk/undergraduate](http://www.maths.qmul.ac.uk/undergraduate).

Note in particular that the Department of Computer Science and the School of Business and Management do not offer late summer resit examinations.

Please note also that academic staff are available to help you with your modules during term time, but not generally during vacation time, and certainly not without you first making an appointment.

**How do I progress to the next year or graduate?**

There are conditions that you must satisfy in order to move into the next year of your programme, or to be assessed for a degree at the end of your programme. These conditions are called ‘hurdles’, and they are of two kinds:

- To progress from the first to the second year of any programme based in the School of Mathematical Sciences you must pass an Essential Mathematical Skills test.
- You must pass enough course units at level 1 or higher.

**What is Essential Mathematical Skills?**

All first-year Mathematical Sciences students must pass an Essential Mathematical Skills test. Essential Mathematical Skills is a level-0 module that is initially taken in addition to the eight course units shown in your study programme. It is taught in the first semester and assessed by at most 4 in-term tests, the last being given the following January. You pass as soon as you obtain a mark of 80% or more in one of the tests. If you pass at this stage you will have the module recorded as “transcriptable only”, which means it will not be one of the 8 course units that contribute in any way to your assessment.

If you do not pass by the end of January then you will be required to include the Essential Mathematical Skills module as one of your 8 counted course units (so it will not be recorded as “transcriptable only”). You will therefore have to drop one level-1 module in Semester 2; see Part 5: Study Programmes for guidance on what to drop.

You will be required to attend further classes and mini-tests during the second semester and you will be assessed as a resit candidate by 3 further tests, the last being held during the late summer resit period. Again, you pass as soon as you obtain a mark of 80% or higher in one of the tests, but the maximum College mark you can obtain is the minimum pass mark of 40%.

You must pass Essential Mathematical Skills to progress to the second year. If you fail the resit test then a second (and final) resit attempt will be available the following year and will consist of three tests, the last again being held during the late summer resit period.

Students who have progressed from the Science and Engineering Foundation Programme and already passed Essential Foundation Mathematics must still pass Essential Mathematical Skills, which covers different, although similar, material.

**How many course units must I pass?**

In the following, level-0 modules including MAS010 Essential Mathematical Skills do not contribute to the minimum numbers of course units required either for progression from one year to the next or for obtaining a degree. (However, the marks from level-0 modules do count towards your degree class.)

You must normally accumulate passes in 18 course units to obtain a BSc degree and 28 course units to obtain an MSci degree.

Furthermore, a BSc student must pass 6 course units to progress into the second year and 12 course units altogether to progress into the final year, whilst an MSci student must pass 7 course units to progress into the second year, 14 course units altogether to progress into the third year and 20 course units altogether to progress into the final year. These numbers include modules passed by resitting examinations failed at an earlier stage (see “What if I have failed modules?” on page 14) but do not include level-0 modules.

The Subject Examination Board (SEB) has the discretion to allow you to progress to the second or third year if you have passed 5 or
11 course units and obtained an average of 40% or more in your best 6 or 12 course units respectively.

If you fail to obtain the required number of units at the end of any given year (i.e. including late summer examinations if available) you will not normally be entitled to continue studying at College. However, after a year out of College, you may resit the following year those examinations you have failed in order to obtain the necessary number of course units.

**Can I transfer between BSc and MSci?**

At the end of the first year, we invite BSc students who have obtained an A-grade average to transfer to the four-year MSci programme. We may also allow BSc students who have obtained a B-grade average to transfer to the MSci programme at their request. Transfer to MSci is possible up to early in your third year, but you may not be able to extend your funding if you transfer after the start of your second year.

An MSci candidate may opt to transfer to a BSc degree, which has lower “hurdles”, at any time up to the beginning of the third year of study. Later transfer to BSc may also be possible but will have to be approved by the Student Administration Office. An MSci candidate who fails to obtain a sufficient number of units for the award of the MSci can be considered for a BSc, although the award of the BSc may be delayed until the time when the MSci programme would have been completed.

**Can I retake a year or progress exceptionally?**

If you have not met the hurdle to progress, but have extenuating circumstances, you may ask to retake the year or progress exceptionally, provided you do so before the end of the examination period. Retaking the year is appropriate only if you have failed almost all your modules and progressing exceptionally is only appropriate if you have narrowly missed the hurdle but are generally a strong student.

You should provide the Senior Tutor with a summary detailing your case, which must fit on a single A4 sheet of paper and be printed using a font no smaller than 12 points or written neatly and legibly. At the top of the summary, state your student number, your surname in underlined capitals, your forenames (not underlined and not in capitals) and your current developmental year (first, second, third or final). Summarize briefly any extenuating circumstances affecting the current year, one per paragraph. The summary would normally refer to extenuating circumstances that have been reported on Extenuating Circumstances Report Forms during the year (see “What if I am prevented from studying?” on page 17). However, if they occurred very recently then the Extenuating Circumstances Report Form and supporting documentation may be attached to the summary.

You will also need to complete a College “Retake of Academic Year” form, which is available from the Student Administration Office, room CB05 in the Queens’ Building, and on the web at www.studentadmin.qmul.ac.uk/students/studentforms.shtml. Completed forms should be handed in to the Maths Office.

**Can I continue attending College?**

If you fail to reach a progression hurdle or to graduate then you are not normally allowed to attend College although you may resit examinations. If you take a year out, you may occasionally consult your adviser or seek information from a lecturer, but only very limited advice and assistance can be offered. You cannot attend lectures or exercise classes, use College facilities, or seek additional help and advice from members of staff. Some limited use of the library or computing services may be permitted upon the recommendation of your adviser.

**How is my degree classified?**

This section explains the rules that the Mathematical Sciences Subject Examination Board (SEB) will apply. Note that in exceptional circumstances these rules can be modified by the SEB.

A candidate needs to pass at least 18 course units at level 1 or above to obtain a BSc degree and at least 28 course units at level 1 or above to obtain an MSci degree. The degree awarded will be classified as either a first, upper second, lower second or third class degree, or as a pass degree. (All University of London degrees, including pass degrees, are honours degrees.) A pass degree may occasionally also be
recommended for some students who have passed 16 or 17 course units; see below.

**If I entered the first year in 2004 or later…**

Your degree classification will be based on your complete set of marks. For a BSc the first, second and third years will be weighted 1:3:6 respectively. For an MSci the weighting will be (provisionally) 1:2:4:4. The year referred to here is "developmental year", which indicates progression through a study programme and hence corresponds to the number of course units passed, not to the number of calendar years of study. The resulting College mark will be on a percentage scale.

Your degree classification will be based on the scale below but if your weighted mark places you at the borderline between two degree classes the SEB can take account of other relevant information.

<table>
<thead>
<tr>
<th>College mark</th>
<th>Degree classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 70%</td>
<td>First class honours</td>
</tr>
<tr>
<td>70% &gt; College mark ≥ 60%</td>
<td>Second class honours, upper division</td>
</tr>
<tr>
<td>60% &gt; College mark ≥ 50%</td>
<td>Second class honours, lower division</td>
</tr>
<tr>
<td>50% &gt; College mark ≥ 45%</td>
<td>Third class honours</td>
</tr>
</tbody>
</table>

If you have passed sufficient course units for the award of a degree but your College mark falls below 45% then you will normally be eligible only for the award of a pass degree.

If you are a BSc candidate and you have either (i) passed 18 or more course units in total but fewer than 18 at level 1 or above or (ii) passed only 16 or 17 course units at level 1 or above, and you have a College mark above 40% and your performance has been affected by illness or other acceptable cause then you may be offered the award of a pass degree. You may opt to receive the pass degree or resit failed examinations next year in an attempt to meet the requirements for a third-class degree.

If you are an MSci candidate and you fail to achieve the required number of course units at the end of the MSci degree programme then you may opt to resit failed examinations next year or transfer to a BSc degree, in which case modules taken in your final year will count towards your degree class.

If you have passed enough units to obtain a degree then you will normally be classified for honours. However, you may request postponement of honours, whereby classification is deferred for a year, under either of the following circumstances:

- you transferred from one degree programme to start another from the beginning, so that only the modules taken in association with the second degree programme will count or be included in the calculation of the College mark;
- your overall performance has been significantly affected by absence from final year examinations for reasons acceptable to the SEB. You may request to sit the missed exams as if for the first time the following year.

**If I entered the first year in 2003 or earlier…**

Please refer to a copy of the printed undergraduate handbook for 2005–6 or earlier, or to the document Degree_Classification_2003 on the web at www.maths.qmul.ac.uk/undergraduate/handbook.

**What if my exams are disrupted?**

It is essential that you inform the Senior Tutor in writing well before the date of the Subject Examination Board Meeting in late June of any difficulties that have affected your examination performance. The board cannot take account of difficulties you have not reported. It must be stressed that the fact that the board was not aware of such difficulties is not grounds for you to appeal against your degree class unless you can prove that it was impossible for you to inform the board.

Medical certificates and similar material are considered by the Subject Examination Board (SEB). However, even when allowance is made for medical or other problems, full compensation cannot always be given. The SEB will recommend only the degree class it is confident you would have achieved, not what you might have obtained in other circumstances. Thus medical or other
extenuating circumstances that affect a substantial portion of your study cannot be taken into account, but the SEB may be able to make allowance for circumstances that result in you performing worse in some examinations than others.

If there are any extenuating circumstances that you wish the SEB to take into account when finally classifying you for honours then you must provide the Senior Tutor with a summary before the end of the examination period. The summary must fit on a single A4 sheet of paper and be printed using a font no smaller than 12 points or written neatly and legibly.

At the top of the summary, state your student number, your surname in underlined capitals, your forenames (not underlined and not in capitals) and your current developmental year (first, second, third or final). Then summarize briefly any extenuating circumstances affecting your whole time at Queen Mary, one per paragraph. If your academic results are such that your extenuating circumstances might make a difference then your summary will be considered by the SEB.

The extenuating circumstances mentioned in your summary should already have been reported formally, with supporting documentation, on Extenuating Circumstances Report Forms (see “What if I am prevented from studying?” on page 17). However, if they occurred very recently then the Extenuating Circumstances Report Form and supporting documentation may be attached to the summary.

Whilst we always endeavour to ensure that all relevant extenuating circumstances that have been formally reported at any time are made available to the SEB, we take responsibility only for considering those that are included in your summary.

What prizes are awarded and to whom?

In every academic year the best first year undergraduate in Mathematical Sciences is awarded a prize worth £100. The College awards prizes each year worth £100 to outstanding second, third and final year undergraduates. Seven College prizes were awarded to Mathematical Sciences students in 2007. (The amount of money is not very large, but the fact of receiving the prize is a useful addition to your curriculum vitae!)

In recent years there have also been Institute of Mathematics and its Applications (IMA) prizes, consisting of a year’s free subscription, awarded to the best two students in the final year in Mathematical Sciences, and a Pfizer Prize in Statistics awarded to the student with the best statistics results in the final year.

The University awards the Sherbrooke Prize, worth £250, for the best Bachelor's Degree in Mathematical Sciences, and the Lubbock Memorial Prize worth £500 to the most meritorious candidate obtaining First Class Honours in a degree involving at least half Mathematical Sciences. These prizes are usually shared among several candidates, who are nominated by all the University of London colleges.

The School, College or University (as appropriate) will inform you if you have been awarded any prize. Here is a list of the Mathematical Sciences students who won prizes in summer 2007.

**Departmental and college prizes**

**First year – Lois Hatton Prize:**
Ms Fahmida Begum Basith

**Intermediate years – Westfield Trust Prizes:**
Mr Andrew Drizen
Mr Dimitrios Germanis
Mr Matthew James Spencer
Mr Chong Sun
Ms Kinga Paulina Taranek

**Final year:**
Ms Yin Zhen Deng – Principal's Prize
Mr Salah Mahmood – Westfield Trust Prize

**Institute of Mathematics and its Applications Prizes**
Ms Faiha Siraj
Ms Yin Zhen Deng

**Pfizer UK Prize for Statistics**
Mr Noman Burki

**How must I behave?**

Student behaviour is covered in the Queen Mary Student Guide, which is available on the Queen Mary web site at [www.studentadmin.qmul.ac.uk/students/](http://www.studentadmin.qmul.ac.uk/students/).
Below is more detail of the behaviour required of Mathematical Sciences students.

**How do you monitor my attendance?**

The College has an obligation to try to ensure your well-being. In particular it must ensure that you are pursuing your studies. Within the School of Mathematical Sciences, we compile records of attendance for each module based on the weekly coursework you hand in and in some cases on attendance registers. You will be required to explain any absences. If you do not provide a satisfactory explanation then we will terminate your registration with the College. We will send letters of warning by email to your qmul.ac.uk email address and send a paper copy to your current term-time address as recorded in our files. It is your responsibility to ensure that you read such emails and letters promptly.

The College is obliged to notify any grant-awarding Local Education Authority (LEA) if it believes that a student is failing to attend regularly. In these circumstances the LEA will cease payment of the grant and will require some, or all, of the grant to be repaid, especially when the College has cancelled a student’s registration. Similar comments apply to Student Loans.

**How do you monitor my progress?**

We use a computerised Student Information Database (SID) to monitor student progress automatically. At the start of each module, the module organiser will inform you about the module’s requirements. Coursework and tests are an essential part of each module and if you fail to submit sufficient coursework or attend tests you will be deemed to have failed the module. Any student in this position will therefore be barred from continuing with that module and from taking any final examination; see below.

If you are having difficulties, you should still attempt coursework and hand it in, even if it is incomplete. If you make a reasonable attempt at coursework and tests you will not normally be barred from a module. Please discuss any potential problems with your adviser as soon as possible, so as to avoid some of the difficulties mentioned above. Also, please remember that there is considerable help available in exercise classes and you are urged to take advantage of this.

**What does it mean to be barred from a module?**

A module organiser may bar you from a module if you are considered not to be taking the module seriously. This means that, without any good reason, you have failed to attend lectures and/or classes, failed to submit coursework and attend tests, or obtained unacceptably low marks. (If there is a good reason or extenuating circumstance then you must inform the module organiser immediately.) You will be warned at least once before you are barred. A warning may be given verbally in a lecture, sent by email or given in writing by a note in your pigeon-hole. It is therefore essential that you attend lectures, read your email and check your pigeon-hole regularly! If, after being warned in writing, there is no substantial improvement then you will be barred with no further warning. If you face barring from more than two course units then you may be required to leave the College.

If you are barred then you cannot continue with any element of the module, and in particular you cannot sit the examination. Therefore, you will not be able to resit the examination later, although you may (at the discretion of the module organiser) be allowed to retake the module. An important consequence of this is that if you are barred from a module then you will lose one course unit and marks, which cannot be recovered, from your overall final assessment for honours.

Barring of students from modules will normally be completed by the end of the first week of the Easter vacation.

**What is an examination offence?**

Queen Mary takes your assessment very seriously. This means that we must strictly obey the rules governing assessments, but so must you. For example, if you use a calculator in an exam where calculators are forbidden, you can expect to receive a mark of zero for the exam. Generally, calculators are not allowed in examinations, but if calculators are allowed then the examination rubric will state this clearly, so be sure to read the rubric. It is also an examination offence to take any notes into the examination room even if you do not look at them, to look at another student’s work, to disrupt the examination in any way or to fail to do what you are asked by an invigilator.
What is plagiarism?

Plagiarism is copying what somebody else has written or taking somebody else’s idea and trying to pass it off as yours. It applies primarily to essays and project reports that you write in your own time. It is extremely easy to find and copy information from the web. If you do this then you must fully reference the source and indicate clearly any text that you have copied verbatim (i.e. without rephrasing). Remember that if you found the information on the web then so can your examiners!

Queen Mary has strict rules on cheating, copying and plagiarism. These rules are to make sure that you are assessed on your own work, not that of your friends, people you have copied from, published material or information on the web, and also to help you understand the acceptable ways of using things that you have learned from other people. The College definition of plagiarism is given in the Student Guide (Section 3.2) as follows.

“Plagiarism is the use or presentation of the work of another person, including another student, as your own work (or as part of your own work) without acknowledging the source. This includes submitting the work of someone else as your own, and extensive copying from someone else’s work without proper referencing. Copying from the internet without acknowledging the source is also plagiarism. You may use brief quotes from the published or unpublished work of other persons, but you must always show that they are quotations by putting them inside quotation marks, giving the source (for example, in a footnote), and listing the work in the bibliography at the end of your piece of work. It is also plagiarism to summarise another person’s ideas or judgements without reference to the source.”

Students are advised that failure to observe any of the provisions of this policy or of approved departmental guidelines constitutes an examination offence under College and University Regulations. Examination offences will normally be treated as cheating under the regulations covering Examination Offences. Under these regulations students found to have committed an offence may have all their assessments for a whole academic year cancelled and so have to resit all their examinations, or be expelled from the College.

Here are some guidelines specifically for Mathematical Sciences students.

Computer coursework: You can use programs that the lecturer has given you or pointed out to you in textbooks. However, anything else that you type into the computer must be in your own words. Of course you can discuss the assignment with other students, but make sure that anything you copy down in your discussions is ideas not text.

Essays: As above, you can use other people’s ideas, but if you use their actual phrases or sentences (even the lecturer’s), you must put them between quotation marks, say where they came from, and include the source in your bibliography at the end of the essay. Your bibliography should also include any sources you have used such as books or articles. If you copy any material from the Internet, reference the URL of the web page in your essay, making clear whether you are using the actual text from the web page or just ideas and information. Include the date when you last accessed the URL.

Mathematical coursework: You should write everything in your own words. If you discuss the coursework with friends, you can make a note of the ideas that you reach together, but do not write them up for your coursework until you are alone. Copying in coursework is hard for the markers to control, so if they find two coursework submissions that are largely identical, they may just give zero to both without checking who copied from whom. Therefore, do not lend your finished coursework to other people until after it has been marked, and always submit your coursework yourself.

Group projects: If you are involved in a group project, for example in computer science, you will be expected to share some ideas and maybe some data with other members of your group. You must make sure that your lecturer explains what kinds of joint work will be acceptable.

Don’t cheat – it won’t be worth it!

When must I not talk or use my mobile phone?

There has been a rapid rise in the student population over the last few years and it has resulted in some problems. In a large class,
students talking can be very disruptive to others trying to work, even when the noise is not of a level to disrupt or even be readily noticed by the lecturer. If there are twenty students all speaking quietly, but sitting between you and the lecturer, it can easily blot out the lecturer's voice.

Similar problems have arisen in the library. If you want to talk to your friends about your academic work, there are special group study areas in the library. In all other parts of the library people have the right to be able to concentrate on their work in a quiet environment, and not be disturbed by noise from others.

Students persistently talking in class or in the library may well be reported to the College disciplinary authorities, who take a serious view of behaviour that prevents other students from working.

Mobile phones must be switched off during all lectures, classes, tutorials, tests and examinations, and in the library, computing laboratories and staff offices. Any student whose mobile phone rings in a lecture or a laboratory may be asked to leave. Allowing your mobile phone to ring during a test or an examination is a disciplinary offence, and will normally lead to failure in the test or examination with a mark of 0, with more severe penalties for a second offence.

**How can I provide feedback or complain?**

**What is the Student-Staff Liaison Committee?**

The School of Mathematical Sciences undergraduate Student-Staff Liaison Committee (SSLC) meets at least once a term. It discusses matters of interest to undergraduates, including the curriculum and student welfare and facilities, and can advise the Head of School. Two student representatives are normally elected from each year; their photographs and names are displayed in the first-floor corridor of the Mathematical Sciences Building opposite the staff photographs. Please raise any matters of concern with one of the student representatives.

The School takes suggestions from the SSLC very seriously. The committee is chaired by Dr L Rass and includes the Director of Undergraduate Studies and the Senior Tutor. Details of the SSLC are available on the web at [www.maths.qmul.ac.uk/undergraduate/liaison](http://www.maths.qmul.ac.uk/undergraduate/liaison), from where minutes of the meetings are also available (but only from within the Queen Mary network).

**How do I make a complaint?**

We hope you will not need to make any complaints, but if you do feel that there are issues you would like to raise, either as an individual or as a group, please follow the guidelines below.

Complaints about a lecture module – the lectures, classes, coursework or tests – should normally be addressed to the module organiser first. (This includes modules taught by other departments.) If this does not solve the problem, talk to your adviser. If he or she can't help and you want to make a formal complaint, do it in writing (preferably by email) to the Director of Undergraduate Studies; it is his job to log all such complaints and follow them up, and to keep you informed in writing of the outcome.

Complaints about matters of student welfare and advisers should go to the Senior Tutor, though it would usually be sensible to discuss the problem with your adviser first if you can.

Complaints about other matters in the School of Mathematical Sciences should go to the Director of Undergraduate Studies, if a discussion with your adviser does not resolve them first.

You should initially discuss any complaints about examination board decisions with your adviser or the SEB Chair. If you are not satisfied then you can make a formal complaint in writing to the Deputy Academic Secretary, Council Secretariat. But note that exams will not be remarked because they have already been marked by two internal examiners and moderated by an external examiner from another university. However, we can check that administrative errors have not been made in addition or transcription.

If you want to make a serious complaint about the College, such as a complaint that the School of Mathematical Sciences has not properly handled a complaint you have made, see [www.studentadmin.qmul.ac.uk/students/complaints.pdf](http://www.studentadmin.qmul.ac.uk/students/complaints.pdf).

Remember also that there are elected student representatives on the Student-Staff Liaison Committee. They are not a part of the College's complaints procedures, but they may have useful experience and advice, and if
you think your complaint is a matter of general interest you may take it to the Student-Staff Liaison Committee.

The School of Mathematical Sciences undertakes that no student will be disadvantaged as a result of making a complaint in good faith. The School also understands and respects the fact that some complaints need to be made in confidence.

Are there any relevant interdisciplinary or intercollegiate final-year modules?

The following modules are potential third-year electives, provided they fit in with the constraints of your study programme.

**PHY333 Entrepreneurship and innovation**

This is a level-3 elective module organised by Physics (hence the code) but taught by SIMFONEC, an enterprise of CASS Business School, on the Queen Mary Mile End campus. It should be relevant to you if you are considering going into business after you graduate. For details see the module web site at [www.ph.qmul.ac.uk/phy333](http://www.ph.qmul.ac.uk/phy333) and/or the Queen Mary Course Directory (which is available on the web at [www.qmul.ac.uk/courses/coursedirectory](http://www.qmul.ac.uk/courses/coursedirectory)).

**I24001 Mathematical education for physical and mathematical sciences**

The aim of this level-3 elective module is to introduce you to central ideas of mathematical education. It should be relevant to you if you are considering going into teaching after you graduate and it will also be relevant to you as a learner of mathematics. The module will be taught at the Institute of Education [www.ioe.ac.uk](http://www.ioe.ac.uk) (IoE) at 20, Bedford Way, seven minutes walk from Euston Square tube station. Lectures take place during Semester A on Tuesdays and Thursdays at 3:45–5:15 pm, starting on Tuesday 2 October and finishing on Thursday 13 December, with the week beginning 5 November a reading week. The assessment is 50% coursework essay (to be submitted towards the end of Semester B) and 50% final exam (to be sat in May 2008). Individual tutorials will be arranged during Semester B to help with essay writing, and revision session(s) will be held late April / early May to help prepare for the exam.

For an outline of the module see [mathsed.mst-online.org](http://mathsed.mst-online.org) where a more detailed syllabus will be posted in mid-September.

To be allowed to register for this module you must:

- have a second-year mean mark of at least 50%;
- email the Director of Undergraduate Studies, Dr F. J. Wright (see “All undergraduate teaching, advising and administrative staff” on page 5), to express your interest before Monday 24 September 2007, giving your full name and student number;
- attend the introductory meeting, provisionally on Thursday 27 September 2007 at Queen Mary in Maths 103 at 3:00 – 4:00 pm. Details will be confirmed to your qmul.ac.uk email address and/or posted in the Mathematical Sciences building.

At the introductory meeting the module organiser and lecturer, Dr Melissa Rodd, will describe the module and then interested (and acceptable) students may register. Please bring a passport-sized photo with you to accompany the registration documents.

When considering your timetable, you should allow 45 minutes travel time from Queen Mary to the Institute of Education. Because this module starts a week later than Queen Mary modules, you should register for 8 modules not including this one and then withdraw from one first-semester module later.

This module is valued by Queen Mary at 1 course unit and will be counted as an MAS module for purposes of meeting study programme requirements. Note that the Queen Mary (intercollegiate) code for this module is I24001 (although its IoE code is completely different).
Changes from Last Year

This list is a brief summary of the main changes from last year; for full details please see the rest of this handbook.

Changes to modules

We have revised some of the modules that we offer, especially in the second year. We have also revised our study programmes, in particular FG31, to take account of the changes to modules. If you feel that the changes cause you difficulties then please seek advice from your adviser and, if necessary, your programme director. Here are the main changes.

Second year

- MAS111 Convergence and Continuity is offered in semester 3.
- MAS113 Fundamentals of Statistics I, which is offered in semester 2, will also be offered in semester 3 with code MAS113X for students who were unable to take it in their first year.
- MAS204 Calculus III has changes in syllabus.
- MAS205 Complex Variables has moved to semester 4.
- MAS210 Graph Theory has been replaced by MAS236 Algorithmic Graph Theory, at least for this year; MAS210 is not offered in 2007–8. The two modules overlap and students who have taken MAS210 cannot take MAS236.
- MAS212 Linear Algebra I has changes in syllabus and teaching style.
- MAS217 Quantum Theory has been replaced by MAS348 From Classical Dynamics to Quantum Theory. The two modules overlap and students who have taken MAS217 cannot take MAS348.
- MAS226 Dynamics of Physical Systems has changes in syllabus.
- MAS228 Probability II has changes in prerequisites.
- MAS229 Oscillations, Waves and Patterns has changes in syllabus, prerequisites and overlaps.
- MAS233 Logic I: Mathematical Writing has become MAS237 Mathematical Writing. The two modules overlap and students who have taken MAS233 cannot take MAS237.
- MAS234 Sampling, Surveys and Simulation has changes in assessment rules.

Third year

- MAS313 Cosmology has become MAS347 Mathematical Aspects of Cosmology. The two modules overlap and students who have taken MAS313 cannot take MAS347.
- (MAS322 Relativity will have changes in prerequisites from 2008–9.)
- MAS349 Fluid Dynamics is a new level-3 module in semester 6.

Essential Mathematical Skills

If you do not pass Essential Mathematical Skills by the exam in January then you must drop one level-1 module in semester 2 and take MAS010 Essential Mathematical Skills as a formal course unit instead. We now recommend which module you should drop, which depends on your study programme; see Part 5: Study Programmes.

Advice for third and final year students

You should generally follow the current study programmes as far as possible. However, we will not enforce any programme requirements that were not stated on the version of your study programme in effect when you formally began that programme. In particular, we will waive any core module requirements introduced in 2006–7 that relate to developmental years of your study programme before 2006–7. Please consult the programme director for a definitive ruling on the requirements for a particular study programme.
**MAS111 Convergence and Continuity**
MAS111 Convergence and Continuity is shown as a second-year core module in several study programmes but was not offered in 2006–7. Because this module was moved from the first to the second year in 2006–7, third and final year students following study programmes with MAS111 as a core module should have taken it in their first year. However, it is offered again this year, so students who planned to take MAS111 in 2006–7 will be able to take it this year instead. We expect that this module will continue to be offered at level 2 in future.

**G3N2 Statistics with Business Management**
This programme is being phased out and has no new students. Any continuing students on this programme should follow the last published version, but see also the current programme for G1N1 Mathematics with Business Management.
Study Programmes

What happens if I do not follow my study programme?

Normally, your degree title will be the title of your study programme. If you fail to meet any of the specific requirements of your study programme then we may give you a different degree title. A changed degree title is usually based on your study programme title, but if you are a long way from the requirements of any study programme then we may give you the degree title Mathematical Sciences. Failure to pass specific modules will affect only the title and not the class of your degree. However, if you are on a degree-class borderline then we may take account of the number of level-3 modules you have passed.

What happens if I fail Essential Mathematical Skills?

Unlike most modules, if you fail Essential Mathematical Skills then you will not be allowed to progress to your second year. If you do not pass Essential Mathematical Skills by the exam in January then you must drop one level-1 module in semester 2 and take MAS010 Essential Mathematical Skills as a formal course unit instead. Since all first-year modules in your study programme are core, you must take later the module you drop.

Guidance on the module to drop and when to take it is given below, but in most cases the module to drop is MAS113 Fundamentals of Statistics I, which in 2007–8 and 2008–9 we are offering again in semester 3 (with code MAS113X) so that you can catch up. The autumn and spring versions, MAS113 and MAS113X, will have the same specification and exam paper.

The advice below depends on your study programme. You may want to discuss it with your adviser.

G100, G1N1, GG14: drop MAS113 Fundamentals of Statistics I and take it later; when will depend on your module choices in later years.


G300, GG31: drop either MAS117 Introduction to Algebra or MAS118 Differential Equations and take it later; when will depend on your module choices in later years.

FG31: drop MAS113 Fundamentals of Statistics I and take it in your final year.

G102: transfer to G100 and follow the advice for that programme.

G1G3: transfer to GG31 or G300 and follow the advice for that programme.
Can I take Economics modules?
You can take Economics (ECN) modules only if you are registered for the GL11 study programme or the modules are shown as core for your study programme. If you register for any modules that you are not allowed to take then you will be deregistered later and you may have difficulty finding replacements.

Can I take Business Management modules?
The School of Business and Management strictly limits the availability of Business Management (BUS) elective modules. (This does not apply if you are following either of the joint programmes G1N1 or GN13 and the Business Management modules are listed as core.) The Business Management modules available to Mathematical Sciences students are shown in the following table (provided by the School of Business and Management on 18 July 2007). Details of these modules can be found in the Queen Mary Course Directory (which is available on the web at www.qmul.ac.uk/courses/coursedirectory). There will be limits on the numbers of places available and any Business Management elective modules must be validated by the School of Business and Management during the enrolment period (see www.maths.qmul.ac.uk/undergraduate/induction).

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Available to Joint Programme Students and:</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 1 modules</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BUS017</td>
<td>Economics for Business</td>
<td>Any other 1st or 2nd years</td>
<td>None</td>
</tr>
<tr>
<td>BUS001</td>
<td>Fundamentals of Management</td>
<td>Any other 1st or 2nd years</td>
<td>None</td>
</tr>
<tr>
<td><strong>Level 2 modules</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BUS206</td>
<td>Coordination &amp; Social Dynamics</td>
<td>No others</td>
<td>BUS001 Fundamentals of Management</td>
</tr>
<tr>
<td>BUS201</td>
<td>Financial Accounting</td>
<td>Any other 2nd or 3rd years. NOT 1st Years</td>
<td>None</td>
</tr>
<tr>
<td>BUS022</td>
<td>Managerial Accounting</td>
<td>Any other 2nd or 3rd years. NOT 1st Years</td>
<td>BUS021 Financial Accounting</td>
</tr>
<tr>
<td><strong>Level 3 modules</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BUS306</td>
<td>Financial Management</td>
<td>Any other 3rd years. NOT 1st or 2nd Years</td>
<td>BUS022 Managerial Accounting</td>
</tr>
<tr>
<td>BUS014</td>
<td>Human Resource Management</td>
<td>Any other 3rd years. NOT 1st or 2nd Years</td>
<td>BUS001 Fundamentals of Management &amp; BUS103 Organisational Behaviour</td>
</tr>
<tr>
<td>BUS011</td>
<td>Marketing</td>
<td>Any other 3rd years. NOT 1st or 2nd Years</td>
<td>BUS001 Fundamentals of Management</td>
</tr>
<tr>
<td>BUS208</td>
<td>Microeconomics for Managers</td>
<td>No others</td>
<td>BUS001 Fundamentals of Management &amp; BUS017 Economics for Business</td>
</tr>
<tr>
<td>BUS316</td>
<td>Social and Political Marketing</td>
<td>No others</td>
<td>BUS011 Marketing</td>
</tr>
<tr>
<td>BUS311</td>
<td>Social Networks (Max 60)</td>
<td>No others except Maths, Economics &amp; Computer Science</td>
<td>None</td>
</tr>
<tr>
<td>BUS204</td>
<td>Strategy</td>
<td>Any other 3rd years. NOT 1st or 2nd Years</td>
<td>BUS001 Fundamentals of Management</td>
</tr>
<tr>
<td>BUS312</td>
<td>The Market &amp; Social Order</td>
<td>No others</td>
<td>BUS001 Fundamentals of Management</td>
</tr>
</tbody>
</table>
Are there any non-UCAS study programme codes?

The following conversion table relates the study programme codes used by the Queen Mary Student Record System (QM Code) to the corresponding UCAS course codes in the cases where they differ. This difference is necessary to avoid ambiguity because UCAS changed its course codes a few years ago and some of the new codes clash with old ones. The QM codes appear in place of the UCAS codes on a few College documents, such as course registration forms.

<table>
<thead>
<tr>
<th>QM Code</th>
<th>UCAS Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GG1E</td>
<td>GG14</td>
<td>Mathematics and Computing</td>
</tr>
<tr>
<td>GG4B</td>
<td>GG41</td>
<td>Computer Science and Mathematics</td>
</tr>
<tr>
<td>GR1C</td>
<td>GR12</td>
<td>German and Mathematics</td>
</tr>
<tr>
<td>GR1E</td>
<td>GR14</td>
<td>Hispanic Studies and Mathematics</td>
</tr>
<tr>
<td>G11A</td>
<td>G110</td>
<td>Pure Mathematics</td>
</tr>
</tbody>
</table>

Will there be future changes to study programmes?

Students starting their courses in 2007 should be aware that, because of changes to regulations from September 2007, there will be changes to the study programmes currently listed that will affect mainly the third and fourth years of study.
G100 BSc in Mathematics
Programme director: Prof. L H Soicher

Degree requirements
1. Pass at least 18 course units, no more than two of which shall be at level zero (*).
2. Take all core modules and the required number of core options shown in the outline programme.
3. At least 3/4 of the course units passed should be MAS course units.
4. Pass Essential Mathematical Skills. Students who have not passed this test are not eligible to enter the second year of this programme (**).

(*) To be eligible for the award of Honours, 18 course units at level 1 or higher are required and an overall weighted College mark of normally not less than 45%. Special regulations apply for students who have taken a year abroad.

(**) Students who have not passed Essential Mathematical Skills by week 2 in Semester 2 will be required to drop one level-1 module in Semester 2 and take MAS010 Essential Mathematical Skills instead; see “What happens if I fail Essential Mathematical Skills?” on page 1. This module is level 0 with the exam mark pegged at 40%.

Outline programme
Modules in bold are core and must normally be taken in the year shown. Exceptionally, some core modules may be taken outside the year shown subject to prerequisites. Students are required to take modules to the value of 8 course units in each developmental year.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAS115 Calculus I</td>
<td>MAS125 Calculus II</td>
<td></td>
</tr>
<tr>
<td>MAS108 Probability I</td>
<td>MAS113 Fundamentals of Statistics I</td>
<td></td>
</tr>
<tr>
<td>MAS114 Geometry I</td>
<td>MAS118 Differential Equations</td>
<td></td>
</tr>
<tr>
<td>MAS116 Intro. to Mathematical Computing</td>
<td>MAS117 Introduction to Algebra</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAS212 Linear Algebra I</td>
<td>Take at least three of:</td>
<td></td>
</tr>
<tr>
<td>Take at least two of:</td>
<td>MAS201 Algebraic Structures I</td>
<td></td>
</tr>
<tr>
<td>MAS111 Convergence and Continuity</td>
<td>MAS205 Complex Variables</td>
<td></td>
</tr>
</tbody>
</table>
| MAS204 Calculus III | MAS210 Graph Theory and Applications (***)
| MAS226 Dynamics of Physical Systems | MAS221 Differential and Integral Analysis |
| MAS228 Probability II | MAS229 Oscillations, Waves and Patterns |
| MAS237 Mathematical Writing | MAS230 Fundamentals of Statistics II |
| | MAS231 Geometry II |
| | MAS232 Statistical Modelling I |
| | MAS236 Algorithmic Graph Theory |

<table>
<thead>
<tr>
<th>Year 3</th>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take at least four MAS course units at level 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(*** Not given in 2007–8)
G110 BSc in Pure Mathematics
Programme director: Prof. L H Soicher
QM code: G11A

Degree requirements
1. Pass at least 18 course units, no more than two of which shall be at level zero (*)
2. Take all core modules and the required number of core options shown in the outline programme
3. At least 3/4 of the course units passed should be MAS course units
4. Pass Essential Mathematical Skills. Students who have not passed this test are not eligible to enter the second year of this programme (**)

(*) To be eligible for the award of Honours, 18 course units at level 1 or higher are required and an overall weighted College mark of normally not less than 45%. Special regulations apply for students who have taken a year abroad.

(**) Students who have not passed Essential Mathematical Skills by week 2 in Semester 2 will be required to drop one level-1 module in Semester 2 and take MAS010 Essential Mathematical Skills instead; see “What happens if I fail Essential Mathematical Skills?” on page 1. This module is level 0 with the exam mark pegged at 40%.

Outline programme
Modules in bold are core and must normally be taken in the year shown. Exceptionally, some core modules may be taken outside the year shown subject to prerequisites. Students are required to take modules to the value of 8 course units in each developmental year.

Year 1

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAS115 Calculus I</td>
<td>MAS125 Calculus II</td>
</tr>
<tr>
<td>MAS108 Probability I</td>
<td>MAS113 Fundamentals of Statistics I</td>
</tr>
<tr>
<td>MAS114 Geometry I</td>
<td>MAS118 Differential Equations</td>
</tr>
<tr>
<td>MAS116 Intro. to Mathematical Computing</td>
<td>MAS117 Introduction to Algebra</td>
</tr>
</tbody>
</table>

Year 2

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAS111 Convergence and Continuity</td>
<td>MAS201 Algebraic Structures I</td>
</tr>
<tr>
<td>MAS212 Linear Algebra I</td>
<td>MAS205 Complex Variables</td>
</tr>
<tr>
<td></td>
<td>MAS221 Differential and Integral Analysis</td>
</tr>
<tr>
<td>Take at least one course unit from the lists below:</td>
<td></td>
</tr>
</tbody>
</table>
| MAS228 Probability II        | MAS210 Graph Theory and Applications (***)
| MAS237 Mathematical Writing  | MAS231 Geometry II          |
|                              | MAS236 Algorithmic Graph Theory |

Year 3

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take at least four course units from the lists below:</td>
<td></td>
</tr>
<tr>
<td>MAS219 Combinatorics</td>
<td>MAS309 Coding Theory</td>
</tr>
<tr>
<td>MAS305 Algebraic Structures II</td>
<td>MAS310 Complex Functions</td>
</tr>
<tr>
<td>MAS308 Chaos and Fractals</td>
<td>MAS335 Cryptography</td>
</tr>
<tr>
<td>MAS317 Linear Algebra II</td>
<td></td>
</tr>
<tr>
<td>MAS329 Topology</td>
<td></td>
</tr>
</tbody>
</table>

(*** Not given in 2007–8)
G300 BSc in Statistics
Programme director: Dr B Bogacka (Semester A) / Dr H Grossman (Semester B)

Degree requirements
1. Pass at least 18 course units, no more than two of which shall be at level zero (*).
2. Take all core modules and the required number of core options shown in the outline programme.
3. At least 3/4 of the course units passed should be MAS course units.
4. Pass Essential Mathematical Skills. Students who have not passed this test are not eligible to enter the second year of this programme (**).

(*) To be eligible for the award of Honours, 18 course units at level 1 or higher are required and an overall weighted College mark of normally not less than 45%. Special regulations apply for students who have taken a year abroad.

(**) Students who have not passed Essential Mathematical Skills by week 2 in Semester 2 will be required to drop one level-1 module in Semester 2 and take MAS010 Essential Mathematical Skills instead; see "What happens if I fail Essential Mathematical Skills?" on page 1. This module is level 0 with the exam mark pegged at 40%.

Outline programme
Modules in bold are core and must normally be taken in the year shown. Exceptionally, some core modules may be taken outside the year shown subject to prerequisites. Students are required to take modules to the value of 8 course units in each developmental year.

Year 1

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAS115 Calculus I</td>
<td>MAS125 Calculus II</td>
</tr>
<tr>
<td>MAS108 Probability I</td>
<td>MAS113 Fundamentals of Statistics I</td>
</tr>
<tr>
<td>MAS114 Geometry I</td>
<td>MAS118 Differential Equations</td>
</tr>
<tr>
<td>MAS116 Intro. to Mathematical Computing</td>
<td>MAS117 Introduction to Algebra</td>
</tr>
</tbody>
</table>

Year 2

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAS212 Linear Algebra I</td>
<td>MAS230 Fundamentals of Statistics II</td>
</tr>
<tr>
<td>MAS228 Probability II</td>
<td>MAS232 Statistical Modelling I</td>
</tr>
<tr>
<td>MAS234 Sampling, Surveys and Simulation</td>
<td></td>
</tr>
</tbody>
</table>

Year 3

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take at least five course units from the lists below:</td>
<td></td>
</tr>
<tr>
<td>MAS338 Probability III</td>
<td>MAS314 Design of Experiments</td>
</tr>
<tr>
<td>MAS328 Time Series</td>
<td>MAS340 Statistical Modelling III</td>
</tr>
</tbody>
</table>
| MAS339 Statistical Modelling II | MAS344 Computational Statistics (***)
| MAS332 Advanced Statistics Project (2 course units over both semesters) |

(**) Not given in 2007–8
GG31 BSc in Mathematics and Statistics
Programme director: Dr B Bogacka (Semester A) / Dr H Grossman (Semester B)

Degree requirements
1. Pass at least 18 course units, no more than two of which shall be at level zero (*).
2. Take all core modules and the required number of core options shown in the outline programme.
3. At least 3/4 of the course units passed should be MAS course units.
4. Pass Essential Mathematical Skills. Students who have not passed this test are not eligible to enter the second year of this programme (**).

(*) To be eligible for the award of Honours, 18 course units at level 1 or higher are required and an overall weighted College mark of normally not less than 45%. Special regulations apply for students who have taken a year abroad.

(**) Students who have not passed Essential Mathematical Skills by week 2 in Semester 2 will be required to drop one level-1 module in Semester 2 and take MAS010 Essential Mathematical Skills instead; see “What happens if I fail Essential Mathematical Skills?” on page 1. This module is level 0 with the exam mark pegged at 40%.

Outline programme
Modules in **bold** are core and must normally be taken in the year shown. Exceptionally, some core modules may be taken outside the year shown subject to prerequisites. Students are required to take modules to the value of 8 course units in each developmental year.

Year 1

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAS115 Calculus I</td>
<td>MAS125 Calculus II</td>
</tr>
<tr>
<td>MAS108 Probability I</td>
<td>MAS113 Fundamentals of Statistics I</td>
</tr>
<tr>
<td>MAS114 Geometry I</td>
<td>MAS118 Differential Equations</td>
</tr>
<tr>
<td>MAS116 Intro. to Mathematical Computing</td>
<td>MAS117 Introduction to Algebra</td>
</tr>
</tbody>
</table>

Year 2

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAS212 Linear Algebra I</td>
<td>MAS230 Fundamentals of Statistics II</td>
</tr>
<tr>
<td>MAS228 Probability II</td>
<td>MAS232 Statistical Modelling I</td>
</tr>
</tbody>
</table>

**Take at least two course units from the lists below:**

| MAS111 Convergence and Continuity    | MAS201 Algebraic Structures I       |
| MAS204 Calculus III                 | MAS205 Complex Variables            |
| MAS226 Dynamics of Physical Systems  | MAS210 Graph Theory and Applications (**) |
| MAS237 Mathematical Writing         | MAS221 Differential and Integral Analysis |
|                                     | MAS229 Oscillations, Waves and Patterns |
|                                     | MAS231 Geometry II                  |
|                                     | MAS236 Algorithmic Graph Theory      |

Year 3

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take at least four MAS course units at level 3, of which at least three should be from the lists below:</td>
<td></td>
</tr>
<tr>
<td>MAS338 Probability III</td>
<td>MAS314 Design of Experiments</td>
</tr>
<tr>
<td>MAS328 Time Series</td>
<td>MAS340 Statistical Modelling III</td>
</tr>
<tr>
<td>MAS339 Statistical Modelling II</td>
<td>MAS344 Computational Statistics (**)</td>
</tr>
</tbody>
</table>

(****) Not given in 2007–8
G1N1 BSc in Mathematics with Business Management
Programme director: Dr B Bogacka (Semester A) / Dr H Grossman (Semester B)

Degree requirements
1. Pass at least 18 course units, no more than two of which shall be at level zero (*).
2. Take all core modules and the required number of core options shown in the outline programme.
3. At least 1/2 of the course units passed should be MAS course units and at least 1/4 of the course units passed should be BUS course units.
4. Pass Essential Mathematical Skills. Students who have not passed this test are not eligible to enter the second year of this programme (**) .

(*) To be eligible for the award of Honours, 18 course units at level 1 or higher are required and an overall weighted College mark of normally not less than 45%. Special regulations apply for students who have taken a year abroad.

(**) Students who have not passed Essential Mathematical Skills by week 2 in Semester 2 will be required to drop one level-1 module in Semester 2 and take MAS010 Essential Mathematical Skills instead; see “What happens if I fail Essential Mathematical Skills?” on page 1. This module is level 0 with the exam mark pegged at 40%.

Outline programme
Modules in bold are core and must normally be taken in the year shown. Exceptionally, some core modules may be taken outside the year shown subject to prerequisites. Students are required to take modules to the value of 8 course units in each developmental year.

Year 1

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAS115 Calculus I</td>
<td>MAS125 Calculus II</td>
</tr>
<tr>
<td>MAS108 Probability I</td>
<td>MAS113 Fundamentals of Statistics I</td>
</tr>
<tr>
<td>MAS114 Geometry I</td>
<td>MAS118 Differential Equations</td>
</tr>
<tr>
<td>BUS001 Fundamentals of Management</td>
<td>BUS017 Economics for Business</td>
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</tbody>
</table>

Year 2

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAS212 Linear Algebra I</td>
<td>BUS011 Marketing</td>
</tr>
<tr>
<td>BUS021 Financial Accounting</td>
<td></td>
</tr>
<tr>
<td><strong>Take at least three course units from the lists below:</strong></td>
<td></td>
</tr>
<tr>
<td>MAS204 Calculus III</td>
<td>MAS117 Introduction to Algebra</td>
</tr>
<tr>
<td>MAS226 Dynamics of Physical Systems</td>
<td>MAS205 Complex Variables</td>
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<td>MAS229 Oscillations, Waves and Patterns</td>
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<td>MAS230 Fundamentals of Statistics II</td>
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<tr>
<td></td>
<td>MAS231 Geometry II</td>
</tr>
<tr>
<td></td>
<td>MAS232 Statistical Modelling I</td>
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Year 3

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUS204 Strategy</td>
<td>BUS014 Human Resource Management</td>
</tr>
<tr>
<td><strong>Take at least three MAS course units at level 3</strong></td>
<td></td>
</tr>
</tbody>
</table>
GN13 BSc in Mathematics, Business Management and Finance

Programme director: Dr L Rass

Degree requirements

1. Pass at least 18 course units, no more than two of which shall be at level zero (*).
2. Take all core modules and the required number of core options shown in the outline programme.
3. At least 1/3 of the course units passed should be MAS course units, at least 1/3 of the course units passed should be BUS or ECN course units, and no more than 1/4 of the course units passed should be in subjects not related to Mathematics, Statistics, Business Management or Finance.
4. Pass Essential Mathematical Skills. Students who have not passed this test are not eligible to enter the second year of this programme (**).

(*) To be eligible for the award of Honours, 18 course units at level 1 or higher are required and an overall weighted College mark of normally not less than 45%. Special regulations apply for students who have taken a year abroad.

(**) Students who have not passed Essential Mathematical Skills by week 2 in Semester 2 will be required to drop one level-1 module in Semester 2 and take MAS010 Essential Mathematical Skills instead; see “What happens if I fail Essential Mathematical Skills?” on page 1. This module is level 0 with the exam mark pegged at 40%.

Outline programme

Modules in bold are core and must normally be taken in the year shown. Exceptionally, some core modules may be taken outside the year shown subject to prerequisites. Students are required to take modules to the value of 8 course units in each developmental year.

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<td>ECN106 Macroeconomics I</td>
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Year 2

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<th>Semester 3</th>
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<tbody>
<tr>
<td>MAS212 Linear Algebra I</td>
<td>MAS232 Statistical Modelling I</td>
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<tr>
<td>MAS228 Probability II</td>
<td>ECN222 Financial Markets and Institutions</td>
</tr>
<tr>
<td>BUS021 Financial Accounting</td>
<td>BUS011 Marketing</td>
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</tbody>
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Year 3

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECN314 Investment Analysis</td>
<td>ECN358 Futures and Options</td>
</tr>
<tr>
<td>BUS204 Strategy</td>
<td>BUS014 Human Resource Management</td>
</tr>
</tbody>
</table>

Take two of:

- MAS328 Time Series
- MAS338 Probability III
- MAS339 Statistical Modelling II
- MAS343 Introduction to Mathematical Finance
GL11 BSc in Mathematics, Statistics and Financial Economics

Programme director: Dr L Rass

Degree requirements

1. Pass at least 18 course units, no more than two of which shall be at level zero (*).
2. Take all core modules and the required number of core options shown in the outline programme.
3. At least 1/3 of the course units passed should be MAS course units, at least 1/3 of the course units passed should be ECN course units, and no more than 1/4 of the course units passed should be in subjects not related to Mathematics, Statistics, or Financial Economics.
4. Pass Essential Mathematical Skills. Students who have not passed this test are not eligible to enter the second year of this programme (**).

(*) To be eligible for the award of Honours, 18 course units at level 1 or higher are required and an overall weighted College mark of normally not less than 45%. Special regulations apply for students who have taken a year abroad.

(**) Students who have not passed Essential Mathematical Skills by week 2 in Semester 2 will be required to drop one level-1 module in Semester 2 and take MAS010 Essential Mathematical Skills instead; see “What happens if I fail Essential Mathematical Skills?” on page 1. This module is level 0 with the exam mark pegged at 40%.

Outline programme

Modules in bold are core and must normally be taken in the year shown. Exceptionally, some core modules may be taken outside the year shown subject to prerequisites. Students are required to take modules to the value of 8 course units in each developmental year.

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<td>ECN106 Macroeconomics I</td>
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<tr>
<td>ECN113 Principles of Economics</td>
<td>ECN111 Microeconomics I</td>
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**Year 2**

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<td>MAS212 Linear Algebra I</td>
<td>MAS230 Fundamentals of Statistics II</td>
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<td>MAS228 Probability II</td>
<td>MAS232 Statistical Modelling I</td>
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<tr>
<td>ECN214 Games and Strategies</td>
<td>ECN211 Microeconomics II</td>
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<td>ECN222 Financial Markets and Institutions</td>
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<td>ECN314 Investment Analysis</td>
<td>Take at least one of:</td>
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<td></td>
<td>ECN320 Corporate Finance</td>
</tr>
<tr>
<td></td>
<td>ECN358 Futures and Options</td>
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<tr>
<td></td>
<td>Take at least one further ECN course unit.</td>
</tr>
<tr>
<td></td>
<td>Take at least two course units from the lists below:</td>
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<td>MAS328 Time Series</td>
<td>MAS314 Design of Experiments</td>
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<tr>
<td>MAS338 Probability III</td>
<td>MAS340 Statistical Modelling III</td>
</tr>
<tr>
<td>MAS339 Statistical Modelling II</td>
<td>MAS344 Computational Statistics (***)</td>
</tr>
</tbody>
</table>

(**) Not given in 2007–8
G1L1 BSc in Mathematics and Statistics with Finance
Programme director: Dr L Rass

Degree requirements:
1. Pass at least 18 course units, no more than two of which shall be at level zero (*).
2. Take all core modules and the required number of core options shown in the outline programme.
3. At least 1/2 of the course units passed should be MAS course units and at least 1/4 of the course units passed should be ECN and BUS course units.
4. Pass Essential Mathematical Skills. Students who have not passed this test are not eligible to enter the second year of this programme (**).

(*) To be eligible for the award of Honours, 18 course units at level 1 or higher are required and an overall weighted College mark of normally not less than 45%. Special regulations apply for students who have taken a year abroad.

(**) Students who have not passed Essential Mathematical Skills by week 2 in Semester 2 will be required to drop one level-1 module in Semester 2 and take MAS010 Essential Mathematical Skills instead; see “What happens if I fail Essential Mathematical Skills?” on page 1. This module is level 0 with the exam mark pegged at 40%.

Outline programme
Modules in bold are core and must normally be taken in the year shown. Exceptionally, some core modules may be taken outside the year shown subject to prerequisites. Students are required to take modules to the value of 8 course units in each developmental year.

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<tbody>
<tr>
<td>MAS212 Linear Algebra I</td>
<td>MAS224 Actuarial Mathematics</td>
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<tr>
<td>MAS228 Probability II</td>
<td>MAS230 Fundamentals of Statistics II</td>
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<tr>
<td>BUS021 Financial Accounting</td>
<td>MAS232 Statistical Modelling I</td>
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<td>ECN222 Financial Markets and Institutions</td>
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<tbody>
<tr>
<td>ECN314 Investment Analysis</td>
<td>ECN358 Futures and Options</td>
</tr>
</tbody>
</table>

Take at least four MAS course units, of which at least two should be from the lists below:

- MAS232 Time Series
- MAS338 Probability III
- MAS339 Statistical Modelling II
- MAS343 Introduction to Mathematical Finance
- MAS314 Design of Experiments
- MAS340 Statistical Modelling III
- MAS344 Computational Statistics (***)
- MAS345 Further Topics in Math. Finance

(***) Not given in 2007–8
GG14 BSc in Mathematics and Computing
Programme director: Prof. L H Soicher
QM code: GG1E

Degree requirements
1. Pass at least 18 course units, no more than two of which shall be at level zero (*).
2. Take all core modules and the required number of core options shown in the outline programme.
3. At least 1/3 of the course units passed should be MAS course units, and at least an additional 1/3 of the course units passed should be DCS course units or MAS course units approved by the programme director to have sufficient computing content. No more than 1/4 of the course units passed should be in subjects not related to mathematics or computing.
4. Pass Essential Mathematical Skills. Students who have not passed this test are not eligible to enter the second year of this programme (**).

(*) To be eligible for the award of Honours, 18 course units at level 1 or higher are required and an overall weighted College mark of normally not less than 45%. Special regulations apply for students who have taken a year abroad.

(**) Students who have not passed Essential Mathematical Skills by week 2 in Semester 2 will be required to drop one level-1 module in Semester 2 and take MAS010 Essential Mathematical Skills instead; see “What happens if I fail Essential Mathematical Skills?” on page 1. This module is level 0 with the exam mark pegged at 40%.

Outline programme
Modules in bold are core and must normally be taken in the year shown. Exceptionally, some core modules may be taken outside the year shown subject to prerequisites. Students are required to take modules to the value of 8 course units in each developmental year.

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<td>MAS113 Fundamentals of Statistics I</td>
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<tr>
<td>MAS114 Geometry I</td>
<td>MAS117 Introduction to Algebra</td>
</tr>
<tr>
<td>DCS100 Procedural Programming</td>
<td>DCS104 Object Oriented Programming</td>
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</table>

Year 2

<table>
<thead>
<tr>
<th>Semester 3</th>
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<tbody>
<tr>
<td>MAS116 Intro. to Mathematical Computing</td>
<td>MAS235 Intro. to Numerical Computing</td>
</tr>
<tr>
<td>MAS212 Linear Algebra I</td>
<td>DCS103 Language and Communication</td>
</tr>
<tr>
<td>DCS210 Algorithms and Data</td>
<td></td>
</tr>
</tbody>
</table>

Take at least two course units from the lists below:

| MAS204 Calculus III                             |
| MAS228 Probability II                           |
| MAS237 Mathematical Writing                     |
| MAS118 Differential Equations                   |
| MAS201 Algebraic Structures I                    |
| MAS205 Complex Variables                        |
| MAS210 Graph Theory and Applications (***))      |
| MAS230 Fundamentals of Statistics II            |
| MAS232 Statistical Modelling I                   |
| MAS236 Algorithmic Graph Theory                 |

Year 3

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take at least three MAS course units at level 3.</td>
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</tr>
<tr>
<td>Take at least two DCS course units at level 2 or higher. (Approval from the Department of Computer Science may be required for some DCS modules.)</td>
<td></td>
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</tbody>
</table>

(***) Not given in 2007–8
FG31 BSc in Mathematics and Physics
Programme director: Dr T Prellberg

Degree requirements
1. Pass at least 18 course units, no more than two of which shall be at level zero (*).
2. Take all core modules and the required number of core options shown in the outline programme.
3. At least 1/3 of the course units passed should be MAS course units, and at least an additional 1/3 of the course units passed should be PHY course units or MAS course units approved by the programme director to have sufficient physics content. No more than 1/4 of the course units passed should be in subjects not related to mathematics or physics.
4. Pass Essential Mathematical Skills. Students who have not passed this test are not eligible to enter the second year of this programme (**).

(*) To be eligible for the award of Honours, 18 course units at level 1 or higher are required and an overall weighted College mark of normally not less than 45%. Special regulations apply for students who have taken a year abroad.

(**) Students who have not passed Essential Mathematical Skills by week 2 in Semester 2 will be required to drop one level-1 module in Semester 2 and take MAS010 Essential Mathematical Skills instead; see “What happens if I fail Essential Mathematical Skills?” on page 1. This module is level 0 with the exam mark pegged at 40%.

Outline programme
Modules in bold are core and must normally be taken in the year shown. Exceptionally, some core modules may be taken outside the year shown subject to prerequisites. Students are required to take modules to the value of 8 course units in each developmental year.

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<td>MAS113 Fundamentals of Statistics I</td>
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<td>MAS114 Geometry I</td>
<td>MAS118 Differential Equations</td>
</tr>
<tr>
<td>PHY116 From Newton to Einstein</td>
<td>PHY215 Quantum Physics</td>
</tr>
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</table>

Year 2

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<tbody>
<tr>
<td>MAS204 Calculus III</td>
<td>MAS229 Oscillations, Waves and Patterns</td>
</tr>
<tr>
<td>MAS212 Linear Algebra I</td>
<td>PHY210 Electric and Magnetic Fields</td>
</tr>
<tr>
<td>MAS226 Dynamics of Physical Systems</td>
<td>PHY304 Physical Dynamics</td>
</tr>
<tr>
<td>PHY214 Thermal and Kinetic Physics</td>
<td>PHY319 Quantum Mechanics A</td>
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Year 3

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Take at least four MAS/PHY course units at level 3, including those shown below:</td>
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<tr>
<td></td>
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<tr>
<td>Take exactly one of:</td>
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<tr>
<td>PHY403 Statistical Physics</td>
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<tr>
<td>MAS333 Advanced Mathematics Computing Project (2 cu)</td>
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<tr>
<td>MAS334 Mathematics Computing Project (1 cu)</td>
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</tr>
<tr>
<td>MAS342 Third Year Project (1 cu)</td>
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<tr>
<td>PHY709 Independent Project (1 cu)</td>
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<tr>
<td>PHY776 Extended Independent Project (2 cu)</td>
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</tbody>
</table>
G102 MSci in Mathematics
Programme director: Prof. L H Soicher

Degree requirements
1. Pass at least 28 MAS course units at level 1 or higher, or other approved course units.
2. Pass MAS410 MSci Project and at least two other MAS course units at level 4 or approved MSc modules at Queen Mary or other colleges of the University of London.
3. Pass Essential Mathematical Skills. Students who have not passed this test are not eligible to enter the second year of this programme (*).

(*) Students who have not passed Essential Mathematical Skills by week 2 in Semester 2 will be required to drop one level-1 module in Semester 2 and take MAS010 Essential Mathematical Skills instead; see “What happens if I fail Essential Mathematical Skills?” on page 1. This module is level 0 with the exam mark pegged at 40%.

Outline programme
Modules in bold are core and must normally be taken in the year shown. Exceptionally, some core modules may be taken outside the year shown subject to prerequisites. Students are required to take modules to the value of 8 course units in each developmental year.

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<td>MAS114 Geometry I</td>
<td>MAS118 Differential Equations</td>
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<td>MAS116 Intro. to Mathematical Computing</td>
<td>MAS117 Introduction to Algebra</td>
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Year 2

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<tr>
<td>MAS111 Convergence and Continuity</td>
<td>MAS201 Algebraic Structures I</td>
</tr>
<tr>
<td>MAS212 Linear Algebra I</td>
<td>MAS221 Differential and Integral Analysis</td>
</tr>
<tr>
<td>Take at least two course units from the lists below:</td>
<td></td>
</tr>
<tr>
<td>MAS204 Calculus III</td>
<td>MAS205 Complex Variables</td>
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<tr>
<td>MAS226 Dynamics of Physical Systems</td>
<td>MAS210 Graph Theory and Applications (**)</td>
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<tr>
<td>MAS228 Probability II</td>
<td>MAS229 Oscillations, Waves and Patterns</td>
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<tr>
<td>MAS237 Mathematical Writing</td>
<td>MAS231 Geometry II</td>
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<tr>
<td></td>
<td>MAS235 Introduction to Numerical Computing</td>
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<tr>
<td>Take at least four course units from the lists below:</td>
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<tr>
<td>MAS219 Combinatorics</td>
<td>MAS309 Coding Theory</td>
</tr>
<tr>
<td>MAS305 Algebraic Structures II</td>
<td>MAS310 Complex Functions</td>
</tr>
<tr>
<td>MAS308 Chaos and Fractals</td>
<td>MAS323 Solving PDEs (**)</td>
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<tr>
<td>MAS317 Linear Algebra II</td>
<td>MAS335 Cryptography</td>
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<td>MAS322 Relativity</td>
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<td>MAS329 Topology</td>
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Year 4

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<tbody>
<tr>
<td>MAS410 MSci Project</td>
<td></td>
</tr>
<tr>
<td>Take at least four other MAS course units at level 3 or 4, or other approved units, of which at least two should be at level 4.</td>
<td></td>
</tr>
</tbody>
</table>
G1G3 MSci in Mathematics with Statistics
Programme director: Dr B Bogacka (Semester A) / Dr H Grossman (Semester B)

Degree requirements
1. Pass at least 28 MAS course units at level 1 or higher, or other approved course units.
2. Pass MAS410 MSci Project and at least two other MAS course units at level 4 or approved MSc modules at Queen Mary or other colleges of the University of London.
3. Pass Essential Mathematical Skills. Students who have not passed this test are not eligible to enter the second year of this programme (*).

(*) Students who have not passed Essential Mathematical Skills by week 2 in Semester 2 will be required to drop one level-1 module in Semester 2 and take MAS010 Essential Mathematical Skills instead; see "What happens if I fail Essential Mathematical Skills?" on page 1. This module is level 0 with the exam mark pegged at 40%.

Outline programme
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</tr>
<tr>
<td>MAS228 Probability II</td>
<td>MAS230 Fundamentals of Statistics II</td>
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<td>MAS232 Statistical Modelling I</td>
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</tbody>
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Year 3

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
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<tbody>
<tr>
<td>Take at least three course units from the lists below:</td>
<td>Take at least three course units from the lists below:</td>
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<tr>
<td>MAS305 Algebraic Structures II</td>
<td>MAS309 Coding Theory</td>
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<tr>
<td>MAS308 Chaos and Fractals</td>
<td>MAS335 Cryptography</td>
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<tr>
<td>MAS317 Linear Algebra II</td>
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<tr>
<td>MAS329 Topology</td>
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<td>Take at least three course units from the lists below:</td>
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<tr>
<td>MAS328 Time Series</td>
<td>MAS314 Design of Experiments</td>
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<tr>
<td>MAS338 Probability III</td>
<td>MAS340 Statistical Modelling III</td>
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<td>MAS339 Statistical Modelling II</td>
<td>MAS344 Computational Statistics (**)</td>
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Year 4

<table>
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<tr>
<th>Semester 7</th>
<th>Semester 8</th>
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<tr>
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<td>MAS410 MSci Project</td>
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<tr>
<td>Take at least four other MAS course units at level 3 or 4, or other approved units, of which at least two should be at level 4.</td>
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</tbody>
</table>

(**) Not given in 2007–8
Algebra and Discrete Mathematics

Semesters 1,3,5

Geom I

Math Writing

Linear Algebra I

Combin'rics

Linear Algebra II

Algebraic Structures I

Cryptog'phy

Algebraic Structures II

Coding Theory

Algo Graph Theory

Number Theory

Semesters 2,4,6

Intro Alg

Algo Graph Theory

Galois Theory

Graphs Colourings and Design

ASPBD

Perm'tation Groups

Level 4 and MSc modules, Semesters 7 and 8

Advanced Algo Math

Group Theory

Enum & Asympt Combin'rics

Projective and Polar Spaces

Rings and Modules

Graphs Colourings and Design

ASPBD

Perm'tation Groups
Intro Math Comp

Geom I

Calc I

Diff Eqs

Calc II

Linear Algebra I

Dynamics Phys Sys

Calc III

Oscillations Waves Patterns

Intro Num Computing

Relativity

Linear Operators & Diff Eqs

From Class Dynamics to Quant Theory

Math Aspects of Cosmology

Fluid Dynamics

Solving PDEs (not offered in 2007-8)

Level 4 and MSc modules, Semesters 7 and 8

Advanced Cosmology

Stellar Structure & Evolution

The Galaxy

Intro Dynamical Systems

Astrophys Fluid Dynamics

Relativity & Gravitation

Topics in Stat Mech (not offered in 2007-8)

Solar System
Module Details

For further information on these modules, including full descriptions, learning objectives and links to module organisers’ web pages (where available), see the departmental website. The times given are provisional and subject to change dependent upon room availability. Please check the student notice board and departmental website for up to date times and rooms.

MAS010, Essential Mathematical Skills

Organiser: Sem 1 Prof M Jerrum, Sem 2 Prof BJ Carr
Level: 0
Course units: 1
Semester: 1 and 2
Timetable:
- Semester 1 Lec 49 Tut 18, 31, 44, 48
- Semester 2 Lec 49 Tut 43, 44
Assessment: 100% multiple choice test
Prerequisites: None

Syllabus
1. Decompose an integer as a product of prime numbers
2. Calculate the GCD and LCM of a pair of integers
3. Compute quotient and remainder of integer division
4. Simplify arithmetical expressions involving fractions
5. Convert between fractions and decimal numbers
6. Multiply and divide polynomials in one indeterminate
7. Simplify rational expressions in one indeterminate
8. Simplify expressions involving square roots
9. Perform algebraic substitutions
10. Solve linear and quadratic equations and inequalities
11. Perform simple estimations

Books
Main Text:
- Essential Mathematics http://www.maths.qmul.ac.uk/~fv/teaching/em/embook.html
  (web-book)

MAS108, Probability I

Organiser: Dr J R Johnson
Level: 1
Course units: 1
Semester: 1
Timetable:
- 34, 45, 52 (46, 53, 54)
Assessment: 10% coursework, 10% in-course test, 80% final exam
Prerequisites: MAS115 Calculus I, or its equivalent, is co-requisite

Syllabus
1. Probability: frequentist vs modelling vs subjective. Finite sample spaces (equiprobable or not); events as subsets. Sets, subsets, membership, set notation, union, intersection, complement, setminus. Commutative, distributive, and de Morgans laws. Ordered and unordered pairs and higher products.
2. Functions, including domain, codomain, composition of functions, one-to-one, onto, bijections, inverse functions. Sequences: suffix notation, summation notation, change of suffix, manipulating sums.
3. Elementary ideas of probability theory; Kolmogorov axioms; additivity of probabilities of disjoint events. Sigma notation with suffix \( i \). Simple proofs from the axioms. Inclusion-exclusion. Propositions, logical operations, negation, and, or, converse, equivalent, ideas of proof.
5. Independent events: definition, examples. Multiplication law. Three or more events.

\[
P(E_1 \cap E_2 \cap \cdots \cap E_n) = P(E_1) \times P(E_2 \mid E_1) \times \cdots \times P(E_n \mid E_1 \cap \cdots \cap E_{n-1})
\]

Theorem of Total Probability.
7. Bayes’ Theorem and its use to calculate ‘inverse’ probabilities like conditional probability of having disease D given that test for D is positive. Discrete random variables as functions from sample space to \( \mathbb{R} \).

8. Probability mass function, mean, Variance. Sigma notation with suffix \( x \). Manipulation with sigma notation. Mean and variance of \( aX + b \).

9. Important probability distributions (including pmf, mean, variance, what they are used to model): Bernoulli, binomial, geometric, hypergeometric, Poisson. Cumulative distribution function for discrete random variables. Informal introduction to continuous random variables. Cumulative distribution function, probability density function. Mean, variance. \( E(g(X)) \). Median and quartiles.


**Books**

**Main texts**
- Lindley/Scott, New Cambridge Elementary Statistical Tables (CUP).

**Other texts**
- JA Rice, Mathematical Statistics & Data Analysis (Wadsworth).

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**MAS111, Convergence and Continuity**

**Organiser** Prof I Goldsheid

**Level** 1  **Course units** 1  **Semester** 3

**Timetable** 45,51,58 (14, 16)

**Assessment** 10% coursework, 10% in-course test, 80% final exam

**Prerequisites** MAS115 Calculus I or equivalent

**Syllabus**

1. Real numbers: Algebraic and order properties of the real numbers, upper and lower bounds, completeness axiom.

2. Logical statements: Implication and equivalence, converse, negation and quantifiers.


4. Series: Convergent series, geometric series, harmonic series. Alternating series, comparison and ratio tests. Absolutely convergent series. Power series, radius of convergence. Examples, including \( \sin(x) \), \( \cos(x) \) and \( \exp(x) \).

5. Real functions: Definition of limit, properties of limits.

6. Continuous functions: Definition of continuity and its use in specific examples, sum of continuous functions, composites of continuous functions (proofs), products/quotients of continuous functions (stated). Briefly, the Intermediate Value Theorem, application to roots of polynomials, boundedness of continuous functions on closed bounded intervals.

**Books**

**Main text**

**Other texts**
- K Hirst, Numbers, Sequences & Series (E. Arnold).
- KG Binmore, Mathematical Analysis, a Straightforward Approach (CUP).
MAS113, Fundamentals of Statistics I

Organiser: Prof RA Bailey (Sem 2) and Prof SG Gilmour (Sem 3)
Level: 1
Course units: 1
Semester: 2 and 3

Timetable:
- Sem 2: Lec 12, 45, 52, Tut 16-18
- Sem 3: Lec 26, 45, 54, Tut 55

Assessment:
- 10% coursework, 10% in-course test, 80% exam

Prerequisites: MAS108 Probability I

Overlaps: ECN104 Introductory Statistics for Economics and Business

Syllabus

1. Ideas of statistical modelling, populations and samples, simple plots, mean and median.
2. Five figure summary, box plots. Sample variance, inter-quartile range, skewness. Effect of linear transformations on summary statistics. Scatterplots and marginal plots. Sample correlation and proof that $-1 < r < 1$.
3. Revision of discrete RV's. Goodness of fit tests for discrete RVs, basic ideas, p-values, fixed significance level tests, estimation of parameters, grouping classes. Revision of continuous RVs.
6. Random samples, sampling distribution of sample mean and variance. Point estimates, unbiasedness, calculation of bias. Distribution of sample total.
8. Test on the variance. Test of a proportion. Confidence intervals general ideas, example for mean and variance.
9. Confidence intervals for a Poisson mean. F test, 2-sample t test and corresponding confidence intervals.
10. Approximate 2-sample test when variances are unequal. Matched pairs t test, discussion about design and blocking and when to use which test.
11. Test of 2 proportions and relationship to contingency tables. Introduction to joint distribution of 2 continuous random variables.

Books

Main Text: A book which suits YOU best to learn statistics is best (for you). You are encouraged to use it, whether it is one from the list below or another one.


You should already have a copy of

MAS114, Geometry I
Organiser Dr L H Soicher
Level 1 Course units 1 Semester 1
Timetable 13, 24, 43 (17, 22, 23,33)
Assessment 10% coursework, 10% in-course test, 80% final exam.
Prerequisites A-Level Mathematics or equivalent
Overlaps MAS106 Matrices and Geometry
Syllabus
1. Phrasebook up to $\mathbb{R}^3$.
2. Vectors in 2-space and 3-space, expressed as $x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ or as row or column vectors. Addition of vectors. Length of vectors.
3. Vector and cartesian equations of a straight line in $\mathbb{R}^2$ and $\mathbb{R}^3$.
4. Scalar multiple and scalar product of vectors in $\mathbb{R}^2$ and $\mathbb{R}^3$. Cartesian equation of a plane in $\mathbb{R}^3$. Intersections of two or three planes. Solution of families of linear equations in $x, y, z$ by reduction to echelon form.
6. Linear transformations in $\mathbb{R}^2$, expressed by matrices with respect to the standard basis $\mathbf{i}, \mathbf{j}$. Examples: rotations, reflections, dilations, shears; their matrices.
7. In $\mathbb{R}^2$, characteristic equation, eigenvalues and eigenvectors, trace. Application to the examples in (6) (e.g. rotations with integer trace and the crystallographic restriction).
8. Extension of (6), (7) to $\mathbb{R}^3$.
9. Addition and multiplication of $2 \times 2$ and $3 \times 3$ matrices. Their interpretation as addition and composition of linear transformations. Inversion of matrices in $\mathbb{R}^2$ and in $\mathbb{R}^3$. (Examples and exercises may include $2 \times 2$ and $3 \times 2$ matrices.)
10. Cartesian equations of ellipse, parabola, hyperbola; calculation of eccentricity, directrix, foci, asymptotes.
11. Review echelon form of sets of linear equations in $x, y, z$ using matrices and elementary matrix operations. Row rank and linear dependence of rows.

Books
Main Text
• A.E. Hirst, Vectors in 2 or 3 dimensions, Elsevier 1995.

Other texts
• In addition, Prof. Chiswell’s notes on Matrices and Geometry will be helpful for some parts of the course, and will be available online.

MAS115, Calculus I
Organiser Dr T Prellberg
Level 1 Course units 1 Semester 1
Timetable 21, 55, 58 (32 or 33)
Assessment 20% coursework and in-term tests, 80% final exam
Prerequisites A-Level Mathematics or equivalent
Syllabus
1. Real numbers and the real line. Manipulation of algebraic equations and inequalities involving the square root. Manipulation of trigonometric identities
3. Limits and continuity.
4. Differentiation: derivatives as the instantaneous rate of change and basic rules of differentiation, technical dexterity of finding derivatives to be checked using test assessments.
5. Application of derivatives: graph sketching, extreme values, monotone functions, indeterminate forms and L’Hospital’s Rule.
6. The indefinite integral and basic rules of integration (technical dexterity of integration skills to be checked using test assessments). Separable and first order linear differential equations.


8. Polar coordinates. Graph sketching in polar coordinates.

Books

Main text

MAS115 Calculus I and MAS125 Calculus II follow Thomas’ Calculus and make use of an interactive maths web site MyMathLab which is tied up to the book. Buying this book in advance is not advisable. We hope to be able to offer the book and access code to MyMathLab at a discounted price in September.

MAS116, Introduction to Mathematical Computing

Organiser
Prof R P Nelson

Level 1
Course units 1
Semester 1

Timetable
12, 19, 25 (15, 16, 22, 23, 26, 27, 28)

Assessment
10% coursework, 10% in-course test, 80% final exam

Prerequisites
A-Level Mathematics or equivalent

Overlaps
MAS103 Computational Mathematics I, MAS104 Computational Mathematics II

Syllabus Part I Interactive Mathematical Computing

1. Introduction to Maple: The Maple worksheet; online help; execution groups and text regions; basic computational number systems (integer, rational, float); simple arithmetic operations; factorial (!) and big numbers; Pi and numerical approximation using evalf; %; comma operator and expression sequences; command completion.

2. Continuous Mathematics: Variables, assignment and automatic evaluation; indeterminates and (univariate) polynomials; simple polynomial algebra; expand, factor, simplify; sqrt, exp, log and trigonometric functions; substitution and evaluation using eval; equations and inequalities; solve and fsolve; diff; int and evalf(Int ); limit; series and taylor.

3. Discrete Mathematics: Integer arithmetic, divisibility and prime numbers: irem, iquo, igcd, ifactor, isprime; structured data: sequences, lists and sets; seq; nops; indexing using op and [ ]; index ranges; set operations; map; add, mul, sum.

4. Vectors, Matrices and Multivariate Algebra: Inputting row/column vectors and matrices; Vector and Matrix; vector and matrix algebra; scalar and vector product; exact and approximate eigenvalues and eigenvectors. Multivariate expressions; solving coupled multivariate equations.

5. Plotting and Tabulating lotting univariate expressions; multiple plots; using the graphical user interface to read off intersections; lists of points; bivariate expressions as surfaces; 2D curves and 3D surfaces defined implicitly and parametrically; vectors; linear transformations; ellipses, ellipsoids and eigenvectors. Introduction to spreadsheets.

Part II Mathematical Programming

6. Boolean Logic: Boolean constants (true, false); relational operators, evalb, is; use of evalf; Boolean operators (and, or, not); truth tables (using spreadsheets); Boolean algebra; analogy with set theory.

7. User-defined Functions: Arrow syntax; anonymous and named functions; polynomial and elementary transcendental examples; use with map; predicates (Boolean-valued functions); select and remove.

8. Repeated Execution: do end do; for to; while; for in; applications such as recursive sequences and iterative approximation, e.g. Iterative method for solving univariate equations, power method for largest eigenvalue; single/double loops over vector/matrix elements.

9. Conditional Execution: if then end if; else; elif; applications within loops (e.g. finding the maximum value in a list, vector or matrix and convergence of iterations); piecewise-defined functions; characteristic functions on sets; use with add.

10. Procedures: proc end proc; variable scope; local; global; return value versus side effects; return; error; print; applications such as base conversion, simple statistics.

11. Procedural Programming: The use of procedures for structuring programs; converting algorithms into programs; program design; debugging.

Books

You may find the following books useful
• F. Vivaldi, Experimental Mathematics with Maple, Chapman & Hall, CRC Press 2001

MAS117, Introduction to Algebra
Organiser Dr I Tomasic
Level 1 Course units 1 Semester 2
Timetable 15, 25, 41, (26, 33)
Assessment 10% coursework, 10% in-course test, 80% final exam
Prerequisites MAS114 Geometry I
Overlaps MAS105 Discrete Mathematics

Syllabus
1. Mathematical basics: proofs, necessary and sufficient conditions, proofs and counterexamples, definitions, existence and uniqueness.
3. Sets, subsets, functions, relations. One-to-one and onto functions. Equivalence relations and partitions.
5. Rings and fields, ideals, factor rings.
6. Groups, subgroups, cyclic groups, Lagrange’s Theorem.

Books
Reading List

MAS118, Differential Equations
Organiser Dr W Just
Level 1 Course units 1 Semester 2
Timetable 13, 18, 27 (32, 47)
Assessment 10% coursework, 10% in-course test, 80% final exam
Prerequisites MAS115 Calculus I, MAS114 Geometry I
Overlaps MAS112 Modelling Dynamical Systems

Syllabus
1. Revision of geometrical meaning of derivative, anti-derivative. Differentiation of combined and composed functions. Verification of solution of differential equation by substitution. Particular and general solutions. The role of initial or boundary conditions. Solution of simplest ODEs by direct integration. Separation of variables for first order differential equations, implicitly defined solutions.
2. First order linear differential equation (integrating factors), homogeneous and inhomogeneous equations.
4. Interpretation of first order differential equation in terms of direction fields, the initial value problem, solution by geometric method.
5. Linear second order differential equations with constant coefficients, homogeneous equations, superposition, characteristic equations, real roots (incl. degenerate equal roots case), complex roots.
6. Inhomogeneous equations with constant coefficients, method of undetermined coefficients, variation of constants formula, forced oscillations and visualization.
7. Matrices, eigenvalues and eigenvectors (2 dimensional).
8. Linear systems in two dimensions, reduction of linear second order ordinary differential equation to a linear system in two variables. Various types of solution in terms of exponential functions.
10. The Linearization Theorem and examples. Linearization breakdown by examples.

Books
Course text

MAS125, Calculus II
Organiser Prof C Murray
Level 1 Course units 1 Semester 2
Timetable 48, 51, 55 (34, 42, 44, 46, 56)
Assessment 10% coursework, 10% in-course test, 80% final exam
Prerequisites MAS115 Calculus I

Syllabus
1. Complex numbers.
4. Limits and continuity in the xy-plane.
7. Extreme points and saddle points. Lagrange multipliers.

Books
Main text
The course follows Thomas’ Calculus and makes use of an interactive maths web site MyMathLab which is tied up to the book. Buying this book in advance is not advisable. We hope to be able to offer the book and access code to MyMathLab at a discounted price in September.

MAS201, Algebraic Structures I
Organiser Prof S Majid
Level 2 Course units 1 Semester 4
Timetable 21, 32, 51 (33, 52)
Assessment 10% coursework, 10% in-course test, 80% final exam
Prerequisites Either MAS117 Introduction to Algebra or MAS105 Discrete Mathematics

Syllabus
1. Revision of sets, functions, operations, relations, equivalence relations.

Books
Reading List
- PJ Cameron, Introduction to Algebra (Oxford).
MAS204, Calculus III
Organiser      Prof. M A H MacCallum
Level 2 Course units 1 Semester 3
Timetable      11, 46, 53 (16 or 17)
Assessment     10% coursework, 10% in-course test, 80% final exam
Prerequisites   MAS125 Calculus II and MAS114 Geometry I

Syllabus
1. Vector fields, line, surface and volume integrals.
2. Grad, div and curl operators in Cartesian coordinates. Grad, div, and curl of products etc. Vector and scalar forms of divergence and Stokes’s theorems. Conservative fields: equivalence to curl-free and existence of scalar potential. Green’s theorem in the plane.
3. Index notation and the Summation Convention; summation over repeated indices; Kronecker delta and \( \epsilon_{ijk} \); formula for \( \epsilon_{ijk}\epsilon_{klm} \).
4. Orthogonal curvilinear coordinates; length of line element; grad, div and curl in curvilinear coordinates; spherical and cylindrical polar coordinates as examples.
5. Series solution of ODEs. Introduction to special functions, e.g., Legendre, Bessel, and Hermite functions; orthogonality of special functions.

Books
Main text
• Thomas’ Calculus, 11th Edition (Addison Wesley)

Other texts
• S. Simons, Vector Analysis for Mathematicians, Scientists & Engineers (Pergamon Press).

MAS205, Complex Variables
Organiser      Dr K Malik
Level 2 Course units 1 Semester 4
Timetable      12, 42, 55 (27, 47)
Assessment     10% cwk, 10% in-course test, 80% final exam
Prerequisites   MAS125 Calculus II

Syllabus
1. Complex numbers, functions, limits and continuity.
3. Sequences and series, Taylor’s and Laurent’s series, singularities and residues.
4. Complex integration, Cauchy’s theorem and consequences, Cauchy’s integral formulae and related theorems.
5. The residue theorem and applications to evaluation of integrals and summation of series.
6. Conformal transformations.

Books
Main text

Other texts
• M.R. Spiegel, Complex Variables (Schaum Outline).
• H.A. Priestley, Introduction to Complex analysis (OUP).
• I.N.Stewart and D.O.Tall, Complex Analysis (Cambridge University Press)
• Tristan Needham, Visual Complex Analysis (Oxford University Press)
MAS212, Linear Algebra I
Organiser Dr O Bandtlow
Level 2 Course units 1 Semester 3
Timetable 43, 57, 59 (18, 23, 44)
Assessment 10% coursework, 10% in-course test, 80% final exam
Prerequisites MAS114 Geometry I

Syllabus
2. Matrix algebra: Revision of matrix addition and multiplication from Geometry I. \(A \mathbf{x}\) as a linear combination of the columns of \(A\). Matrix inverse. Special types of square matrices. Linear systems in matrix notation. Elementary matrices and row operations. Reduced row echelon form for square matrices, conditions for non-singularity, matrix inverses by Gaussian elimination.
5. Linear Transformations: Definition and examples. Matrix representations of linear transformations. The law of change of matrix representation under the change of basis. The Rank-Nullity Theorem.
8. Eigenvalues and Eigenvectors: The equation \(A \mathbf{x} = \lambda \mathbf{x}\). The characteristic polynomial, algebraic multiplicity. Eigenspaces, geometric multiplicity. Examples. Eigenvalues and eigenvectors of special classes of matrices. Real symmetric matrices: orthogonal diagonalization. Similarity: distinct eigenvalues and diagonalization.

Books
Main text
- S J Leon: Linear Algebra with Applications. 7th Ed. (Pearson)

MAS219, Combinatorics
Organiser Prof P J Cameron
Level 3 Course units 1 Semester 5
Timetable 25, 31, 51 (34, 35)
Assessment 10% in-course, 90% final exam
Prerequisites MAS212 Linear Algebra I

Syllabus
1. Counting, binomial coefficients, recurrence relations, generating functions, partitions and permutations, finite fields, Gaussian coefficients.
2. Steiner triple systems, necessary conditions, direct and recursive constructions, structural properties and characterisations.
3. Ramsey’s theorem, illustrations, proof and applications.
4. Transversal theory, Latin squares, Hall’s theorem, upper and lower bounds.

Books
Main text
- PJ Cameron, Combinatorics (CUP).
Other texts

- JH Van Lint, RM Wilson, A Course in Combinatorics (CUP).
- I Anderson, A first course in combinatorial theory (OUP).

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**MAS221, Differential and Integral Analysis**

**Organiser** Dr M Walters

**Level** 2  **Course units** 1  **Semester** 4

**Timetable** 13, 43, 56 (44)

**Assessment** 10% coursework, 10% in-course test, 80% final exam

**Prerequisites** MAS111 Convergence and Continuity

**Syllabus**

3. Integration: Darboux definition of Riemann integral, simple properties, Fundamental Theorem of the calculus, integral form of Mean Value Theorem and of the remainder in Taylor’s Theorem; applications to some well known series (log, arctan, binomial). Improper integrals. Indefinite integrals of arbitrary rational functions, of arbitrary rational functions of trigonometric (resp. hyperbolic) functions and of rational functions involving square root of quadratic functions.

**Books**

**Main text**

- R. Haggerty, Fundamentals of Mathematical Analysis (Addison-Wesley)

**Other texts**

- C. Clark, Elementary Mathematical Analysis (Wadsworth, 1982).

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**MAS224, Actuarial Mathematics**

**Organiser** Dr L Rass

**Level** 2  **Course units** 1  **Semester** 4

**Timetable** 19, 42, 55 (43 or 58)

**Assessment** 10% coursework, 10% in-course test, 80% final exam

**Prerequisites** MAS108 Probability I, MAS115 Calculus I, MAS125 Calculus II

**Syllabus**

1. Compound interest: discounting, force of interest, nominal values (APR); annuities certain: accumulated amount; schedule of principal and interest; perpetuities.
2. Life tables (LT): LT fnns.; the LT as model of cohort experience or stationary distn.; survival probs. in terms of LT’s. Ref. to actual pops: tables of annuitants and assured lives. Select LT’s.
3. Valuation: monetary functions; values of endowments, annuities and assurances.
4. Calculation of premiums; policy and surrender values; paid up policies.
5. Population models.

**Books**

**Reading List**

- McCutcheon & Scott, An Introduction to the Mathematics of Finance. (Heinemann)
- A Neill, Life Contigencies. (Heinemann.)
- Bowers, Gerber, Hickman et al., Actuarial mathematics (SoA).
- Pollard, Mathematical Models for the Growth of Human Populations (CUP).
MAS226, Dynamics of Physical Systems
Organiser Dr J Cho
Level 2 Course units 1 Semester 3
Timetable 21, 42, 52 (22, 28)
Assessment 10% coursework, 10% in-course test, 80% final exam
Prerequisites MAS125 Calculus II, MAS118 Differential Equations

Syllabus
- Review of motion in space: displacement, velocity and acceleration using vectors; equation of motion; concept of constants of motion, energy and potentials; circular motion (plane polar coordinates).
- Mathematical modelling skills; from statement of problem to mathematical model; testing and evaluating a mathematical model.
- Newton’s laws of motion. Examples of different types of motion due to forces and force fields, including resistive forces, and restoring forces: springs, ice hockey and parachutists.
- Newtonian model of gravity; sphere theorem; projectile motion and escape speed; variable mass: footballs, rockets and black holes.
- Central forces; (eg gravity and Coulomb electrostatic forces); Conditions for conservative force; potentials and conservation of angular momentum; orbit theory: polar equation of motion, types of orbit, Kepler’s Laws: planets, asteroids and impact hazards.

Books
- Phil Dyke & Roger Whitworth, Guide 2 Mechanics (Palgrave Mathematical Guides).

MAS228, Probability II
Organiser Dr L Rass
Level 2 Course units 1 Semester 3
Timetable 28, 29, 41, (14, 17, 27)
Assessment 10% coursework, 10% in-course test, 80% final exam
Prerequisites MAS108 Probability I, MAS125 Calculus II

Syllabus Part A Discrete Probability
1. Probability generating function and its use (factorial moments, sums of independent random variables).

Part B. Continuous probability
2. Transformation of random variables (technique and simple examples of its use). t- and F-distributions.

Part C. Limit theorems
1. Chebyshev’s inequality. The weak law of large numbers.
2. Central limit theorem (by the way of moment generating function).
Books
Main Text
- S. Ross: A First Course in probability

MAS229, Oscillations, Waves and Patterns
Organiser  Prof R Tavakol
Level 2  Course units 1  Semester 4
Timetable  18, 25, 34(19, 22)
Assessment  10% Coursework, 10% in-term test, 80% final exam
Prerequisites  MAS204 Calculus III, MAS226 Dynamics of Physical Systems
Overlaps  PHY217 Vibrations and Waves

Syllabus
1. Oscillations: Review of restoring forces and SHM; damped oscillations, strong, weak and critical
damping; forced damped oscillations, transient and steady state solutions; resonance.
2. Coupled oscillators: normal coordinates, normal modes of vibrations, derivation of wave equation as
the limit of many coupled oscillators.
3. Waves: derivation of classical wave equation for string; D’Alembert’s solution; travelling plane wave
solutions; transverse vibrations on a string: harmonic waves, normal modes for string fixed at ends,
solution by separation of variables; initial conditions and Fourier sine series; examples, such as vibra-
tions and musical sounds.
4. Waves in fluids: linear surface waves on deep and shallow water; dispersion relation, phase and group
velocities; waves on inclined beds, tsunamis.
5. Patterns: circular membranes (drums): modes of oscillation and their patterns; nonlinear waves and
solitons; qualitative introduction to waves and pattern formation in other systems, e.g., biological and
chemical systems.

Books
Contact the course organiser.

MAS230, Fundamentals of Statistics II
Organiser  Dr D S Coad
Level 2  Course units 1  Semester 4
Timetable  14, 46, 57 (15, 56)
Assessment  10% coursework, 10% in-course test, 80% final exam
Prerequisites  MAS113 Fundamentals of Statistics I, MAS228 Probability II

Syllabus The theory developed will be used to justify the methods introduced in MAS113 and will be used
to analyse data from a variety of applications.
2. Methods of estimation: method of moments, maximum likelihood, least squares, properties of estim-
ators obtained from these methods, asymptotic properties of MLEs.
3. Confidence intervals: methods of obtaining CIs using pivots, likelihood CIs.
4. Testing: power, simple and composite hypotheses, Neyman-Pearson Lemma, uniformly most powerful
tests, likelihood ratio tests, Wilks’ Theorem.

Books
Main Text

Other texts
University Press.

MAS231, Geometry II: Knots and Surfaces

Organiser Dr. D Stark
Level 2 Course units 1 Semester 4
Timetable 16, 26, 51 (23, 54)
Assessment 10% coursework, 10% in-course test, 80% final exam
Prerequisites MAS114 Geometry I, MAS125 Calculus II

Syllabus

1. Knots and the unsolved problem of their classification. Reidemeister moves, Jones polynomial. Examples including trefoil, figure-eight.
2. Parametrized regular curves, their curvature and torsion defined by vector cross and dot products. Unit speed parametrization and arc length.
3. Principal normal, co-normal and theorem that torsion and curvature can be prescribed up to rigid motions of $\mathbb{R}^3$.
4. Planar curves, signed curvature and the winding number theorem.
5. Surfaces, doughnuts and pretzels (classification by number of holes). Surface patches of smooth surfaces.
6. Orientability of a surface and unit normal. Examples of orientable and non orientable surfaces such as M"obius band.
7. Studying curves lying in surfaces. First fundamental form and area, second fundamental form, geodesic and normal curvatures.
8. Principal, mean and Gauss curvature of a surface. Elliptic, hyperbolic and parabolic points. Principal vectors and Euler's theorem.
10. Gauss-Bonnet theorem for integral of geodesic curvature in terms of integral of Gauss curvature in the interior, for simple closed curves and for curvilinear n-gons.
11. Discussion on hyperbolic surfaces and/or higher dimensional spaces.

Books

Main Text


MAS232, Statistical Modelling I

Organiser Dr L Pettit
Level 2 Course units 1 Semester 4
Timetable 23, 47, 52 (26, 27, 28)
Assessment 20% coursework, including any in-course tests, 80% final exam.
Prerequisites MAS113 Fundamentals of Stats I, MAS228 Probability II, MAS212 Linear Algebra I

Syllabus

The techniques covered will be applied to data from various areas of business, economics, science and industry.

1. Relationships among variables and basic concepts of statistical modelling, response and explanatory variables.
2. The Normal-linear model: definition, matrix form, simple, multiple and polynomial regression models.
5. Assessing fitted models: analysis of variance, $R^2$, lack of fit, residuals and model checking, outliers.
7. Inference: confidence intervals for parameters and mean response, testing for parameters and mean response.
8. Uses of linear models—prediction, control, optimisation.

Books

Main Text
- W J Krzanowski, An Introduction to Statistical Modelling (Arnold).
- Lindley/Scott, New Cambridge Elementary Statistical Tables (CUP).

Other Texts
- B Abraham and J Ledolter, Introduction to Regression Modeling (Duxbury).
- Sen & Srivastava, Regression Analysis (Springer).

MAS234, Sampling, Surveys, Simulation

Organiser: Dr R A Sugden
Level 2 Course units 1 Semester 3
Timetable: 26, 42, 54 (51, 52, 53)
Assessment: 10% in-course test, 25% questionnaire design, 15% coursework, 50% final exam.
Prerequisites: MAS113 Fundamentals of Statistics I, MAS125 Calculus II

Syllabus
1. Simple, cluster and stratified random sampling - how and why they arise, estimation in infinite population models, finite population corrections.
2. Questionnaire / survey design - length and layout of questionnaire, piloting, confidentiality and ethical issues, question content and wording, questionnaire flow, surveys without questionnaires.
3. Simulation - how to sample from different distributions, simulation of simple stochastic processes, illustrations of theoretical results (sampling distributions, laws of large numbers, central limit theorem).

Books

Main text

Other text

MAS235, Introduction to Numerical Computing

Organiser: Dr H Touchette
Level 2 Course units 1 Semester 4
Timetable: 23, 26, 43 (45)
Assessment: 20% coursework, 80% final exam
Prerequisites: MAS116 Introduction to Mathematical Computing, MAS114 Geometry I, MAS125 Calculus II

Syllabus
This course investigates the use of computer algebra, numerical techniques and computer graphics as tools for developing the understanding and the solution of a number of problems in the mathematical sciences. The computer algebra system used for this course will be MAPLE.

1. Brief revision of MAPLE.
2. Numerical and symbolic operations on matrices: obtaining and examining the properties of eigenvalues and eigenvectors.
4. Integration: overview of numerical techniques, symbolic generation of quadrature rules, comparison of numerical integration using numerical techniques and using symbolic analysis.
6. Time permitting numerical approximation: Taylor series, Padé approximants, Orthogonal polynomials (e.g. Chebyshev), Minimax approximation.

Books

Reading List
• A S Tworkowski, Experimental Mathematics

MAS236, Algorithmic Graph Theory
Organiser Dr P Keevash
Level 2 Course units 1 Semester 4
Timetable 24, 33, 53, (28 or 48)
Assessment 10% coursework, 10% in-course test, 80% final exam
Prerequisites Either MAS108 Probability I or MAS117 Introduction to Algebra
Overlaps MAS210 Graph Theory and Applications

Syllabus
2. Applications of trees: finding connected components, depth and breadth first search, minimum weight spanning trees, shortest path spanning trees, longest path spanning trees in acyclic directed networks.
4. Maximum size and maximum weight matchings in bipartite graphs.
5. Euler tours in graphs and digraphs and the Chinese Postman Problem.

Books
Main text
• A printed detailed course summary will be available from the Bookshop and/or the web.

Other text
• Gibbons, Algorithmic Graph Theory, Cambridge University Press.

MAS237, Mathematical Writing
Organiser Prof F Vivaldi
Level 2 Course units 1 Semester 3
Timetable 12, 13, 47, (27, 56)
Assessment 30% coursework, 70% final exam
Prerequisites passing the first year
Overlaps MAS233 Logic I: Mathematical Writing

Syllabus
1. Basic words and symbols of higher mathematics.
3. Describing the behaviour of functions.
4. Logical structures: the predicate algebra.
5. Basic proof techniques.
7. Natural numbers: inductive arguments.
8. Definitions: what they are for and how to write them.
9. Intellectual property: giving credit, respecting copyright

Books
Main text
• F Vivaldi, Mathematical writing web-book, http://www.maths.qmul.ac.uk/fv/books/mw/

Other texts
• G Chartrand, A Polymeny, and P Zhang, Mathematical proofs, a transition to advanced mathematics, Addison-Wesley (2003).
MAS305, Algebraic Structures II
Organiser Dr J Bray
Level 3 Course units 1 Semester 5
Timetable 23, 26, 32, (16)
Assessment 10% in-course, 90% final exam
Prerequisites MAS201 Algebraic Structures I

Syllabus
1. Review of elements of groups and rings.
2. Group theory: group actions; finite p-groups; Sylow theorems and applications; Jordan-Holder theorem; finite soluble groups.
3. Ring theory: matrix rings; Noetherian rings and Hilbert’s basis theorem.
4. Modules: foundations of module theory; isomorphism theorems; structure of finitely generated modules over Euclidean domains.

Books
Main text
• PJ Cameron, Introduction to Algebra (OUP).
Other text

MAS308, Chaos and Fractals
Organiser Prof S R Bullett
Level 3 Course units 1 Semester 5
Timetable 15, 22, 45 (48)
Assessment 10% in-course, 90% final exam
Prerequisites MAS114 Geometry I and MAS102 Calculus II

Syllabus
1. Continuous-time and discrete-time dynamical systems, Poincaré surface of section.
3. The logistic map, period-doubling scenario, Feigenbaum constants and Feigenbaum-Cvitanovic equation, tangent bifurcation and intermittency.
4. Definition of chaos, Lyapunov exponents, Bernoulli shift, topological conjugacy, symbolic dynamics.
5. Invariant measures and invariant densities, Perron-Frobenius operator, time and ensemble average, ergodicity.
7. Examples of simple fractals, fractal dimension, Renyi dimensions.
8. Complex dynamics, Julia sets and Mandelbrot set, iterated function systems.

Books
Main text
• R. Devaney, An introduction to chaotic dynamical systems (Addison-Wesley).
Other texts
• M. Barnsley, Fractals everywhere (Academic Press).
• Beck/Schloegl, Thermodynamics of Chaotic Systems (CUP).
• D. Gulick, Encounters with Chaos (McGraw Hill).

MAS309, Coding Theory
Organiser Prof M Jerrum
Level 3 Course units 1 Semester 6
Timetable 12, 14, 47 (57)
Assessment 10% in-course, 90% final exam
Prerequisites MAS212 Linear Algebra I

Syllabus
1. Basic concepts of coding theory, encoding and decoding, error probabilities, rate of transmission, minimum distance, complexity, statement of Shannon’s theorem.
2. Finite fields and linear codes, constructions of codes such as Hamming and Reed-Muller codes.

Books
Main text
• R Hill, A First Course in Coding Theory (OUP).

Other text
• JH van Lint, Introduction to coding theory (Springer).

MAS310, Complex Functions
Organiser Prof C Chu
Level 3 Course units 1 Semester 6
Timetable 33 (32
Assessment 100% final written exam
Prerequisites MAS205 Complex Variables, MAS111 Convergence and Continuity - Reading course - see Course Organiser before registering

Syllabus
A rigorous reading course in complex analysis. The first part of the course will be concerned with detailed analysis of topics already seen in the course ‘Complex Variables’:
1. Differentiation and integration.
2. Cauchy’s theorem, Taylor and Laurent series.
3. Conformal mappings and harmonic functions.
4. The residue theorem and the calculus of residues.

The second part of the course will introduce more advanced topics, e.g. some or all of
1. Riemann surfaces.
2. Complex gamma, beta and zeta functions.
3. Elliptic functions.
4. Picard’s theorem.

Books
Reading List
See course organiser before buying any book specifically for this course since we shall be using a number of texts. Possibilities include IN Stewart & DO Tall, Complex Analysis, (CUP); HA Priestley, Introduction to Complex Analysis (OUP)

MAS314, Design of Experiments
Organiser Dr H Grossman
Level 3 Course units 1 Semester 6
Timetable 34, 52, 54 (42-43)
Assessment 20% in-course, 80% final exam
Prerequisites MAS339 Statistical Modelling II

Syllabus
Real life experiments will be discussed from several applications in science, including medicine, business, industry and consumer research.
1. Overview: experimentation, consultancy.
2. Treatment structure: factors, main effects, interaction.
3. Completely randomized designs.
5. Row-column designs.
6. Experiments on people and animals.
7. Nested blocks, split-plot designs.
8. General orthogonal designs.
10. Factorial designs in incomplete blocks.

Several lectures will be replaced by discussion sessions, when students present their solutions to assignments. Solutions are discussed by the whole class because most questions have no single correct answer.

Books

Reading List
- Cochran/Cox, Experimental Design (Wiley).

MAS316, Galois Theory
Organiser Prof T W Muller
Level 3 Course units 1 Semester 6
Timetable 31
Assessment 100% final written exam
Prerequisites MAS201 Algebraic Structures I. Reading course - see Course Organiser before registering

Syllabus
Where useful the characteristic will be restricted to zero to simplify the development.

1. Field theory: prime fields and characteristic, finite field extensions, simple extensions, principal element theorem, degree of an extension, product rule for degree, splitting fields, automorphisms of field extensions, embedding of one field extension into another, separability, normal extensions, fundamental theorem of Galois theory.

2. Applications: Insolubility of equations of degree greater than or equal to 5 by radicals, equivalence with insolubility of the Galois group, specific examples of insoluble equations over the rationals, ruler and compass constructions, symmetric polynomials (are generated by elementary symmetric polynomials).

Books

Main text
- I Stewart, Galois Theory (Chapman & Hall)

MAS317, Linear Algebra II
Organiser Dr S McKay
Level 3 Course units 1 Semester 5
Timetable 27, 46, 56 (54)
Assessment 10% in-course, 90% final exam
Prerequisites MAS212 Linear Algebra I

Syllabus


2. Orthogonality, the Gram-Schmidt orthogonalisation process, orthogonal projections.

3. Revision of vector spaces, subspaces, eigenspaces, linear maps, direct sum, kernel and image, spanning set, linear independence, basis, dimension, Steinitz Exchange Lemma, dimension formula for subspaces, with rigorous proofs.


5. Linear functional, dual spaces, equality of row and column rank of a matrix.


7. Simultaneous diagonalisation, for linear map and positive definite symmetric form, and for two symmetric forms.
Books
Main text
• S. Lipshutz, Linear Algebra (2nd edition) (Schaum Outline Series).

MAS320, Number Theory
Organiser Dr T W Muller
Level 2 Course units 1 Semester 6
Timetable 17, 21, 51 (56)
Assessment 10% in-course, 90% final exam
Prerequisites Either MAS105 Discrete Mathematics or MAS117 Introduction to Algebra

Syllabus
1. Continued fractions: finite and infinite continued fractions, approximation by rationals, order of approximation.
2. Continued fractions of quadratic surds: applications to the solution of Pell’s equation and the sum of two squares.

Books
Main text
Other text
• Allenby & Redfern, Introduction to Number Theory with Computing, Edward Arnold (1989)

MAS322, Relativity
Organiser Prof J E Lidsey
Level 3 Course units 1 Semester 5
Timetable 12, 53, 57 (23)
Assessment 10% in-course, 90% final exam
Prerequisites MAS114 Geometry I, MAS102 Calculus II
(From 2008-9: MAS118 Differential Equations, MAS125 Calculus II and MAS212 Linear Algebra I)

Syllabus
2. Vectors in Special Relativity: 4-vectors and the Lorentz transformation matrix 4-velocity, 4-momentum, 4-acceleration. Relativistic dynamics and collisions. Optics: redshift and aberration.

Books
Main text
• M V Berry, Principle of Cosmology and Gravitation (CUP) [Elementary]
• B F Schutz, A First Course in General Relativity (CUP) [Intermediate]
• W Rindler, Essential Relativity: Special, General and Cosmological (Springer-Verlag) [Intermediate]
• S Weinberg, Gravitation and Cosmology: Principles and Applications of the General Theory of Relativity (Wiley) [Advanced]
• A Einstein, The Principle of Relativity (Dover) [Classical]

MAS326, Theoretical Astronomy Project
Organiser TBA
Level 3 Course units 1 Semester 5
Timetable not timetabled
Assessment Written project and oral examination
Prerequisites See project organiser

Syllabus An essay or report, normally 20–30 typed pages, on a topic agreed with the supervisor. The work will involve weekly meetings with the supervisor. Students must obtain the written agreement of a member of staff to supervise the project, then obtain validation from the project organiser.

MAS328, Time Series
Organiser Dr B Bogacka
Level 3 Course units 1 Semester 5
Timetable 42, 45, 55 (32, 33)
Assessment 20% in-course, 80% final exam
Prerequisites MAS113 Fundamentals of Statistics I, MAS228 Probability II
Overlaps ECN323 Economic Forecasting

Syllabus The course includes time series analysis using Minitab. The methods developed are applied to data arising in applications in economics, business, science and industry.

1. General introduction and motivation.
4. Time series as a stationary stochastic process.
5. Modelling of time series in the time domain. Development of AR(p) and MA(q) models in general and their detailed study for the case of p and q = 1,
6. ARMA models.
7. Model identification using the ACF and PACF.
8. Estimation of parameters by moments, least squares and maximum likelihood methods.
9. Forecasting by least squares and conditional expectations.
10. ARIMA models.

Books
Main texts
• PJ Brockwell and RA Davis, An Introduction to Time Series and Forecasting (Springer).
• C Chatfield, The Analysis of Time Series, an Introduction (Chapman & Hall).

Other texts
• R Shumway & D Stoffer, Time series Analysis and Its Applications (Springer).
• AC Harvey, Time Series Models (Philip Allan).

MAS329, Topology
Organiser Prof I Chiswell
Level 3 Course units 1 Semester 5
Timetable 28, 41, 55 (44)
Assessment 10% in-course, 90% final exam
Prerequisites MAS111 Convergence and Continuity and MAS201 Algebraic Structures I

Syllabus
2. Connected spaces (especially the line and plane), paths and path connectedness.
4. Quotient spaces, especially of a square.
5. The fundamental group, definition and elementary properties. Fundamental group of a circle.

Books
Main text
- B Mendelson, Introduction to topology (Dover Publications).

Other texts
- WA Sutherland, Introduction to metric and topological spaces (CUP).

MAS330, Mathematical Problem Solving
Organiser Prof S Majid and Dr T Prellberg
Level 3 Course units 1 Semester 6
Timetable 26, 55
Assessment Written solutions to questions and oral exam
Prerequisites Places on this modules are limited, see the Course Organiser(s) before registering.

Syllabus The course is concerned with solving problems rather than building up the theory of a particular area of mathematics. The problems cover a wide range, with some emphasis on problems in pure mathematics and on problems which do not require knowledge of other undergraduate courses for their solution. Students are given a selection of problems to work on and are expected to use their own initiative and the library; however hints are provided by the staff at the timetabled sessions.

MAS332, Advanced Statistics Project
Organiser Dr L Rass
Level 3 Course units 2 Semester 5 and 6
Timetable 1 hour per week, see project organiser for details
Assessment Written project and oral examination
Prerequisites Must be taking at least two other Level 3 Statistics units
Overlaps MAS325 Statistics and Operational Research Project

Syllabus The major part of this unit is an individual project on some aspect of probability or statistical theory or applied statistics. There will also be classes, which will cover the following:

1. Introduction to project work; development of a project proposal.
2. Statistical study skills, including use of literature, selection of appropriate methods of data analysis, selection of appropriate computer software.

MAS333, Advanced Mathematics Computing Project
Organiser Dr A S Tworkowski
Level 3 Course units 2 Semester 5 and 6
Timetable not timetabled
Assessment Written project and oral examination
Prerequisites See project organiser
Overlaps MAS300 Advanced Applied Maths Comp Project, MAS301 Advanced Pure Maths Comp Project

Syllabus Develop one or more thoroughly tested and well documented computer programs to solve an advanced mathematical problem. The topic may extend one already covered in a lecture course. Write a project report, which must include a discussion of the underlying mathematics and algorithms and details of the program implementation; it may also include a review of the subject area and a discussion of any new results obtained. The examiners will attach great importance to the quality of the report. The advanced (2 cu) project requires significantly more depth and breadth than the regular (1 cu) project.
MAS334, Mathematics Computing Project
Organiser Dr A S Tworkowski
Level 3 Course units 1 Semester 6
Timetable not timetabled
Assessment Written project and oral examination
Prerequisites See project organiser
Syllabus Develop one or more thoroughly tested and well documented computer programs to solve an advanced mathematical problem. The topic may extend one already covered in a lecture course. Write a project report, which must include a discussion of the underlying mathematics and algorithms and details of the program implementation; it may also include a review of the subject area and a discussion of any new results obtained. The examiners will attach great importance to the quality of the report.

MAS335, Cryptography
Organiser Prof R A Wilson and Dr Keevash
Level 3 Course units 1 Semester 6
Timetable 11, 13, 25 (16, 27)
Assessment 30% coursework, 70% final exam
Prerequisites MAS212 Linear Algebra I
Syllabus
1. History and basic concepts (Substitution and other traditional ciphers; Plaintext, ciphertext, key; Statistical attack on ciphers).
2. One-time pad and stream ciphers (Shannon’s Theorem; One-time pad; Simulating a one-time pad; stream ciphers, shift registers).
3. Public-key cryptography (Basic principles (including brief discussion of complexity issues); Knapsack cipher; RSA cipher; Digital signatures).
Optional topics which may be included: secret sharing, quantum cryptography, the Enigma cipher, for example.
Books
Reading List
• Dominic Welsh, ‘Codes and Cryptography’, Oxford University Press.
• Paul Garrett, ‘Making, Breaking Codes: An Introduction to Cryptography.’

MAS338, Probability III
Organiser Prof I Goldsheid
Level 3 Course units 1 Semester 5
Timetable 16, 23, 46 (15)
Assessment 10% in-course, 90% final exam
Prerequisites MAS228 Probability II
Syllabus
2. Markov chains with absorbing states (probability of absorption in a given state, expected time to absorption).
5. Poisson distribution as the law of rare events. Definition and basic properties of the Poisson process. Waiting and sojourn times. Relation to the uniform distribution. Computing expectations of additive functionals of waiting times.
The following may be included if time permits: Renewal processes and/or Brownian motion.

**Books**

**Course text**
- N.M. Taylor and S. Karlin, An Introduction to Stochastic Modeling

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**MAS339, Statistical Modelling II**

**Organiser** Dr D S Coad  
**Level 3 Course units 1 Semester 5**  
**Timetable** 18, 43, 53 (57, 58)  
**Assessment** 20% in-course, 80% final exam  
**Prerequisites** MAS232 Statistical Modelling I

**Syllabus** Extended use of the comprehensive statistical packages GenStat is developed as it is required in the course. The methods introduced are applied to data from various applications in business, economics, science and industry.

1. Qualitative explanatory variables—models, factors, main effects and interactions.  
2. Indicator variables—representation as linear regression models.  
3. Parameterisations and constraints— intrinsic and extrinsic aliasing.  
5. Nested, crossed and general structures.  
6. Random effects—variance components, mixed models.

**Books**

**Main Text**

**Other texts**

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**MAS340, Statistical Modelling III**

**Organiser** Dr R A Sugden  
**Level 3 Course units 1 Semester 6**  
**Timetable** 16, 24, 41(42, 43, 44)  
**Assessment** 20% in-course, 80% final exam  
**Prerequisites** MAS339 Statistical Modelling II, MAS230 Fundamentals of Statistics II

**Syllabus** GenStat is used as it is required in the course. The methods developed are applied to data arising in various areas of business, science and medicine.

1. Nonlinear least squares—examples, estimation, numerical methods, approximate inference.  
2. Generalized linear models—models for discrete responses, definition of GLM, maximum likelihood estimation, confidence intervals and tests.  
4. Polytomous data—ordinal and nominal scales.  
7. Overdispersion—how it arises, modelling, quasi-likelihood.  
8. Time to event data—hazard function, censoring, Exponential and Weibull models.

**Books**

**Main Text**
- W.J. Krzanowski, An Introduction to Statistical Modelling (Arnold).

**Other texts**
• (Introductory only) Dobson, An Introduction to Statistical Modelling Organisational Information (Chapman & Hall)

MAS342, Third Year Project
Organiser Dr M Walters
Level 3 Course units 1 Semester 5
Timetable
Assessment Project and Oral
Prerequisites See project organiser
Overlaps Students will not normally be allowed to take this option together with another project module.
Syllabus Any of the MSci projects listed on the School website, reduced to a 1-unit form, provided that the supervisor of the MSci project is willing to make this reduction.

MAS343, Introduction to Mathematical Finance
Organiser Dr D Stark
Level 3 Course units 1 Semester 5
Timetable 12, 28, 34 (17, 32)
Assessment 10% in-course, 90% exam
Prerequisites MAS108 Probability I and MAS102 Calculus II
Overlaps
Syllabus
1. Pointers/revision of probability concepts: probability and events, conditional probability, random variables and expected values, covariance and correlation. Normal random variables and their properties, central limit theorem.
3. Interest rates and Present Value Analysis - including rate of return and continuously varying interest rates.
4. Pricing contracts via arbitrage - options pricing and examples.
5. The arbitrage theorem - proof and interpretation.
7. A derivation of the Black-Scholes formula.

Books
Main Text

MAS345, Further Topics in Mathematical Finance
Organiser Prof C Beck
Level 3 Course units 1 Semester 6
Timetable 23, 28, 48 (26)
Assessment 10% in-course, 90% exam
Prerequisites AS343 Introduction to Mathematical Finance, MAS228 Probability II
Overlaps
Syllabus
1. Revision of: geometric Brownian motion; Interest rates and present value analysis; the arbitrage theorem; the Black-Scholes Formula; properties of the Black-Scholes option cost; arbitrage strategy.
2. Additional results on option.
3. Valuing by expected utility.
4. Deterministic and probabilistic optimization models
5. Exotic options.
6. Some examples beyond geometric Brownian motion models.
7. Autoregressive models and mean reversion

**Books**

**Main Text** Sheldon M. Ross An elementary introduction to Mathematical Finance: Options and other topics, Cambridge University Press (ISBN 0-521-81429-4)

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**MAS346, Linear Operators and Differential Equations**

<table>
<thead>
<tr>
<th><strong>Organiser</strong></th>
<th>Prof Cho-Ho Chu</th>
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<tbody>
<tr>
<td><strong>Level</strong></td>
<td>3</td>
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<tr>
<td><strong>Course units</strong></td>
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<td><strong>Semester</strong></td>
<td>5</td>
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<tr>
<td><strong>Timetable</strong></td>
<td>11, 13, 25 (54)</td>
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<tr>
<td><strong>Assessment</strong></td>
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<tr>
<td><strong>Prerequisites</strong></td>
<td>MAS102 Calculus II, MAS212 Linear Algebra I</td>
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<td><strong>Overlaps</strong></td>
<td>MAS214</td>
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**Syllabus**

2. Techniques: Existence and uniqueness of solutions of $Lf = g$. Inversion of operators, examples. Inverting a degenerate operator; applications to matrices and integral operators.

**Books**

- Matthews & Walker, Mathematical Methods of Physics (Benjamin).
- Friedman, Principles of Applied Mathematics (Dover).
- Krieder/Kuller/Ostberg/Perkins, An Introduction to Linear Analysis (Addison-Wesley).
- Goertzel & Trali, Some Mathematical Methods of Physics (McGraw-Hill).

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**MAS347, Mathematical Aspects of Cosmology**

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<thead>
<tr>
<th><strong>Organiser</strong></th>
<th>Dr A G Polnarev</th>
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<td><strong>Level</strong></td>
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<td><strong>Semester</strong></td>
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<td><strong>Timetable</strong></td>
<td>23, 42, 44 (27)</td>
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<td><strong>Assessment</strong></td>
<td>10% in-course, 90% final exam</td>
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<tr>
<td><strong>Prerequisites</strong></td>
<td>MAS204 Calculus III and MAS226 Dynamics of Physical Systems in UG Mathematics Programme or PHY122 Math Techniques and PHY116 From Newton to Einstein in UG Physics Programme.</td>
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<tr>
<td><strong>Overlaps</strong></td>
<td>MAS313 Cosmology</td>
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</table>

**Syllabus**

1. Cosmography of the Universe: qualitative description of the contents of the Universe, including galaxies, large-scale structure, matter, radiation; cosmological principle, cosmic expansion and Hubble law.
2. Cosmic Microwave Background: its spectrum, anisotropy and polarization.
4. Relativistic Cosmological Models: Derivation of relativistic evolution equations (deceleration and Friedmann equations); determination of scale factor as function of time and key relationships between fundamental cosmological parameters.
5. A Brief History of the Universe: The age of the Universe; the dynamical role of matter, radiation, dark energy and curvature in the evolution of the scale factor.
6. Basic ideas of inflationary models and expansion with acceleration.
7. Mathematics of Observational Cosmology: Use of Robertson-Walker metric to study propagation of light-rays, and calculation of distance, surface areas and volumes; significance of particle horizon and cosmological red shift.
8. Origin of Large-scale Structure: Mechanism of gravitational instability; solutions of evolution equation for density perturbations in simple cosmological models.

Books
Main text
- BJ Carr, Cosmology.

Other texts
- M Berry, Principles of Cosmology and Gravitation (CUP).

MAS348, From Classical Dynamics to Quantum Theory
Organiser Dr R Klages
Level 3 Course units 1 Semester 5
Timetable 18, 47, 58 (17)
Assessment 10% in-course, 90% final exam
Prerequisites MAS212 Linear Algebra I and MAS204 Calculus III.
MAS226 Dyn of Phys Sys will be helpful but is not necessary.
Overlaps PHY319 Quantum Mechanics A, PHY413 Quantum Mechanics B, MAS217 Quantum Theory.

Syllabus
1. Classical mechanics: Newton's laws; Hamilton’s equations; conservative systems; Poisson brackets; conserved dynamical variables; angular momentum
2. Rise of quantum mechanics: motivation by experiments like black body radiation, photoelectric effect, double-slit experiment; Bohr’s postulates; Motivation for and definition of the time-dependent Schroedinger equation; quantisation rules; quantum mechanical wave functions and Born’s interpretation; time-independent Schroedinger equation; postulates underlying quantum theory
3. Applications of the Schroedinger equation to motion in one dimension: step potential and quantum mechanical tunnel effect; infinite potential well; harmonic oscillator
4. Mathematical formulation of Quantum Theory: vector spaces; scalar (inner) product; orthogonal and orthonormal basis; properties of linear and Hermitian operators; expectation and dispersion for operators; commutation of operators and their properties;
5. Applications of Quantum Theory: mathematical statement of the uncertainty principle; Ehrenfest’s theorem; angular momentum and its quantisation; Hydrogen atom.

Books
Main texts
- Alastair I. M. Rae, Quantum mechanics (The Institute of Physics, 2002), Chapters 1–5.

MAS349, Fluid Dynamics
Organiser Dr J Cho
Level 3 Course units 1 Semester 6
Timetable 24, 33, 48 (46)
Assessment 10% in-course, 90% final exam
Prerequisites MAS204 Calculus III, MAS226 Dynamics of Physical Systems

Syllabus
1. Introduction
   - Describing a fluid: Lagrangian and Eulerian descriptions, material derivative.
   - Euler and vorticity equations, conservation of mass and momentum, equation of state
2. Viscosity
- Reynolds number, disappearing windows and swimming tadpoles
- Diffusion of vorticity, flow with circular streamlines
- Poiseuille and Hele-Shaw flows, Eckmann spin (tea leaves in a cup)

3. Waves
- Wave dispersion, dispersion relation, phase and group velocity
- Sound, shallow- and deep-water waves: shouting upwind and tsunamis
- Nonlinear behaviour: Method of characteristics, hydraulic jumps and shocks

4. Vortices and vorticity
- Kelvin and Helmholtz theorems, vortex lines, pairs and shedding, flying
- Vortex sheets and Kelvin-Helmholtz instability, billow clouds

5. Advanced topic(s), selected from:
- boundary layers and perturbation theory
- planetary and gravity waves, the weather and the ozone hole
- wave-wave interactions
- computational fluid dynamics

Books
Main text
- Acheson, Elementary Fluid Dynamics (OUP)

MAS400, Advanced Algorithmic Mathematics
Organiser Dr J Bray
Level 4 Course units 1 Semester 8
Timetable 52, 53 (57)
Assessment 100% final exam
Prerequisites MAS201 Algebraic Structures I, MAS212 Linear Algebra I, MAS202 Algorithmic Mathematics, or consult lecturer
Syllabus The Lenstra, Lenstra, Lovasz Algorithm: for calculating an LLL-reduced basis for a lattice contained in $\mathbb{R}^n$. The Buchberger Algorithm: for determining a Gröbner basis of an ideal of a (multivariate) polynomial ring over a field. Applications: to algebra, geometry and number theory. These are two of the most important modern mathematical algorithms. The mathematical background to them will be covered, together with proofs of their correctness and some analysis of their complexity. No background in computation will be assumed and computers will not be used.

Books
Reading List
- J. von zur Gathen & J. Gerhard, Modern Computer Algebra (CUP)

MAS401, Advanced Cosmology (MSci/MSc)
Organiser Dr J E Lidsey
Level 4 Course units 1 Semester 7
Timetable 100% final exam
Prerequisites MAS102 Calculus II and MAS226 Dynamics of Physical Systems or an approximately equivalent course
Syllabus
- Observational basis for cosmological theories.
- Derivation of the Friedmann models and their properties.
- Cosmological tests; the Hubble constant; the age of the universe; the density parameter; luminosity distance and redshift.
- The cosmological constant.
- Physics of the early universe; primordial nucleosynthesis; the cosmic microwave background (CMB); the decoupling era; problems of the Big Bang model.
- Inflationary cosmology.
- Galaxy formation and the growth of fluctuations
• Evidence for dark matter.
• Large and small scale anisotropy in the CMB.

MAS402, Astrophysical Fluid Dynamics
Organiser Dr S Vorontsov
Level 4 Course units 1 Semester 8
Timetable ???
Assessment 100% final exam
Prerequisites MAS204 Calculus III and MAS229 Oscillations, Waves, Patterns; a first course in Fluid Dynamics is helpful.
Syllabus
1. Fluid dynamical model in astrophysics.
2. Gravitational stability, gravitational collapse.
4. Helioseismology.
5. Stellar rotation, structure of rotating stars.
7. Rotationally and tidally distorted planets.

MAS407, Galactic Dynamics and Interstellar Medium
Organiser
Level 4 Course units 1 Semester When offered, 8
Timetable Not offered in 2007–8
Assessment 100% final exam
Prerequisites MAS102 Calculus II and MAS11 Modelling of Dynamical Systems
Syllabus Discussion of relaxation processes in star systems; development of a statistical description of these systems. Models of spherical and disc galaxies in statistical equilibrium developed from Jeans’ theorem; comparison with observations. Collisional evolution of globular clusters; evidence for black holes in the centres of galaxies; shapes of elliptical galaxies.

MAS408, Graphs, Colourings and Design
Organiser Prof A Hilton
Level 4 Course units 1 Semester Semester 8
Timetable To be agreed
Assessment 100% final exam
Prerequisites None
Syllabus The course will cover most of the following topics:
1. König’s and Vizing’s theorems about the chromatic index of graphs; Gupta’s theorem about the cover index of a graph; Petersen’s theorem; equitable and balanced edge-colourings of graphs; de Werra’s theorem.
2. Total colourings of graphs. Choice numbers of graphs and their edge and total analogues. Galvin’s theorem and some analogues of it. Fractional analogues of these.
3. Outline and amalgamated Latin squares; applications to Ryser’s and Cruse’s theorems. Analogues for symmetric Latin squares. Analogues for Hamiltonian decompositions of complete graphs.

MAS409, Measure Theory and Probability
Organiser
Level 4 Course units 1 Semester When offered, 8
Timetable Not offered in 2007–8
Assessment 100% final exam
Prerequisites MAS221 Differential and Integral Analysis and MAS329 Topology
Syllabus This is an introductory course on the Lebesgue theory of measure and integral with application to Probability. Students are expected to know the theory of Riemann integration.

1. Measure in the line and plane, outer measure, measurable sets, Lebesgue measure, non-measurable sets.
2. Sigma-algebras, measures, probability measures, measurable functions, random variables.
4. Absolute continuity and singularity, Radon-Nikodym theorem, probability densities.
5. Possible further topics: product spaces, Fubini’s theorem.

MAS410, MSc Project
Organiser Dr M Walters
Level 4 Course units 2 Semester 7,8
Timetable Not timetabled
Assessment Written project and oral exam
Prerequisites See project organiser

Syllabus The written report must involve the study of some mathematical topic at the 4th year undergraduate level and must be the student’s own work in the sense that it gives an original account of the material, but it need not contain new mathematical results. The length should be the equivalent of between 3,500 and 7,000 words. The report can be written in a single Semester or the work can be spread over two Semesters, depending on the other units taken.

MAS411, Quadratic Forms
Organiser Prof B A F Wehrfritz
Level 4 Course units 1 Semester When offered, 8
Timetable Not offered in 2007–8
Assessment 100% final exam
Prerequisites MAS317 Linear Algebra II

Syllabus Quadratic Spaces: isometry, orthogonality, isotropy, hyperbolic and anisotropic spaces, Witt’s three main theorems (always characteristic not equal to 2). Witt Ring: construction and general structure, made explicit for the fields of complex and real numbers and finite fields. Formally Real Fields: ordered fields, formally real fields, real closure, prime ideals and units of the Witt ring for formally and non-formally real fields. Briefly: behaviour of quadratic forms under ground-field extension; Pfister forms.

MAS412, Relativity and Gravitation
Organiser Dr A G Polnarev
Level 4 Course units 1 Semester 8
Timetable 32, 33
Assessment 100% final exam
Prerequisites MAS322 Relativity or an approximately equivalent course


MAS413, Sets, Logic and Categories
Organiser
Level 4 Course units 1 Semester When offered, 7
Timetable Not offered in 2007–8
Assessment 100% final exam
Prerequisites Previous exposure to abstract maths
Syllabus An introductory course covering set-theoretic axioms, sets & classes, ordinals & cardinals, choice principles, first-order logic, functors, natural transformations, limits & colimits, adjoints, free algebras, additive categories.

MAS414, Solar System Dynamics
Organiser
Level 4 Course units 1 Semester When offered, 8
Timetable Not offered in 2007–8
Assessment 100% final exam
Prerequisites MAS317 Linear Algebra II
Syllabus See MAS243 Solar System

MAS415, Stellar Structure and Evolution
Organiser Prof I P Williams
Level 4 Course units 1 Semester 8
Timetable 26, 27
Assessment 100% final exam
Prerequisites MAS204 Calculus III, MAS229 Oscillations, Waves, Patterns and a first general course in Physics
Syllabus
1. Observational properties of stars, the H-R diagram, the main sequence, giants and white dwarfs.
3. Models of main sequence stars with low, moderate and high mass.
4. Pre- and post-main sequence evolution, models of red giants, and the end state of stars.
The course includes some exposure to simple numerical techniques of stellar structure and evolution; computer codes in Fortran.

MAS417, Association Schemes and Partially Balanced Designs
Organiser
Level 4 Course units 1 Semester When offered, 8
Timetable Not offered in 2007–8
Assessment 100% final exam
Prerequisites MAS108 Probability I, MAS317 Linear Algebra II
Syllabus
2. The Bose-Mesner algebra: minimal idempotents, generalized inverses, eigenvalue calculations, integer conditions for strongly regular graphs.
3. Crossing and nesting of association schemes.
4. Partially balanced incomplete block designs: concurrence matrix, information matrix, variance of a simple contrast, efficiency factors.
5. Sets of mutually orthogonal partitions: the association schemes they define: the Mobius function of their semi-lattice.
6. Partially balanced designs for a set of mutually orthogonal partitions: efficiency factors in each stratum.

MAS418, Abelian Groups
Organiser
Level 4 Course units 1 Semester When offered, 8
Timetable Not offered in 2007–8
Assessment 100% final exam
Prerequisites MAS305 Algebraic Structures II
Syllabus Preliminaries, free groups, divisible groups, reduced groups, pure subgroups, direct sums of cyclic groups, Ulm invariants, basic subgroups and p-groups without elements of infinite heights, countable reduced p-groups, co-torsion groups, tensor products, torsion-free groups of rank 1, indecomposable groups, direct sums of rank 1 groups, locally free groups.

MAS419, Basic Algebra III
Organiser
Level 4 Course units 1 Semester When offered, 7 or 8
Timetable Not offered in 2007–8
Assessment 100% final exam
Prerequisites MAS305 Algebraic Structures II
Syllabus A basic grounding in the general theory of groups at Level 4, including: commutators, solubility and nilpotence, Hirsch-Plotkin Theorem, stability groups; Linear groups, soluble linear groups, residual properties; Free groups, residual properties and linearity, presentations; Polycyclic groups and the maximal condition; Chernikov groups and the minimal condition; additional topics if time allows, free products, locally finite groups.

MAS420, Topics in Probability and Stochastic Processes
Organiser Dr R Harris
Level 4 Course units 1 Semester 8
Timetable 21, 22
Assessment 100% final exam
Prerequisites MAS338 Probability III
Syllabus Topics will be chosen from the following list:
1. Borel-Cantelli lemma, Kolmogorov’s inequalities, strong law of large numbers.
2. Weak convergence of distributions. The Central Limit Theorem.
3. Recurrent events and renewal theory.
4. Further topics in random walks.
5. General theory of Markov chains. Classification of states and ergodic properties.
See course organiser before registering.
Books
Main text

MAS421, Applied Statistics
Organiser Dr B Bogacka
Level 4 Course units 1 Semester 7
Timetable To be agreed with course organiser.
Assessment 3 reports (about 10-15 pages each, on separate topics), 33% each
Prerequisites MAS232 Statistical Modelling I and at least two of MAS311, MAS328, MAS339, MAS340
Syllabus The semester will be divided into three 4-week ‘months’. In each month there is a genuine piece of applied statistics, led by a different lecturer. The lecturer will set it up with at most 2 lectures. At the end of the month the student will hand in a report of 10–15 pages. Statistical techniques and statistical computing packages from previous statistics courses will be needed. The three topics will be chosen from the following list.
1. Designed experiments
2. Medical statistics
3. Time series analysis of spacecraft data
4. Multivariate data from crop research
5. Agricultural statistics
6. Economic statistics
7. Industrial statistics
See course organiser before registering.

MAS422, Ring Theory
Organiser
Level 4 Course units 1 Semester When offered, 8
Timetable Not offered in 2007–8
Assessment 100% final exam
Prerequisites MAS427 Rings and Modules
Syllabus A basic grounding in the general theory of rings, including at least five of the following topics: general chain conditions and radicals; Artinian rings (including one-sided such), Hopkins’ theorem and Artin-Wedderburn theory; rings of quotients; Goldie’s theorem; ranks in Noetherian rings, Small’s theorem and the Artin radical of a Noetherian ring; Group rings, generalized Hilbert basis theorems and polycyclic group rings; Krull dimension.

MAS423, Solar System
Organiser Dr C Agnor
Level 4 Course units 1 Semester 8
Timetable 46, 47
Assessment 100% final exam (up to 10% of final mark can be obtained from the coursework)
Prerequisites MAS102/125 Calculus II, MAS112 Modelling of Dynamical Systems or MAS118 Differential Equations, MAS226 Dynamics of Physical Systems. The following modules are helpful but not required: MAS204 Calculus III, MAS229 Oscillations, Waves, Patterns, or a first course in fluids.
Syllabus The material presented in this module will be chosen from the following:
1. General overview/survey
2. Fundamentals: 2-body problem, continuum equations
3. Terrestrial planets: interiors, atmospheres
4. Giant planets: interiors, atmospheres
5. Satellites: 3-body problem, tides
6. Resonances and rings
7. solar nebula and planet formation
8. Asteroids, comets and impacts

Books
Main text
• I de Peter & JJ Lissauer, Planetary Sciences, (Cambridge University Press)
• CD Murray & SF Dermott, Solar System Dynamics (Cambridge)
Other texts

MAS424, Introduction to Dynamical Systems
Organiser Dr R Klages
Level 4 Course units 1 Semester 7
Timetable 42, 43 (44)
Assessment 100% final exam
Prerequisites MAS308 Chaos and Fractals would be useful but is not essential
MAS425, Quantum Computation
Organiser
Level 4 Course units 1 Semester When offered, 8
Timetable Not offered in 2007–8
Assessment 100% final exam
Prerequisites MAS212 Linear Algebra I

Syllabus

1. Quantum mechanics of two-state systems, and the idea of qubits.
2. Some elementary algorithms: examples where a quantum computer would yield speed gains of 2, or \(N\), or \(2^N\). Quantum circuits (especially fundamental nature of the cnot gate), some ideas for implementation.
4. Decoherence and error correction. (The need for correcting corrupted qubits without actually evaluating them, examples of encoding which would permit this.)

MAS426, Algebraic Topology
Organiser Prof I Chiswell
Level 4 Course units 1 Semester 8
Timetable 33, 34 (32)
Assessment 100% final exam
Prerequisites MAS329 Topology

Syllabus A selection from the following topics: the fundamental group, covering spaces, homotopy theory, singular homology and cohomology, manifolds, duality. See course organiser before registering.

Books

Main text
- Allen Hatcher, Algebraic Topology, CUP (paperback) (mainly material in Chapters 0,1 and 2)

MAS427, Rings and Modules
Organiser Prof I Chiswell
Level 4 Course units 1 Semester 7
Timetable 22, 23 (43)
Assessment 100% final exam
Prerequisites MAS201 Algebraic Structures I; MAS305 Algebraic Structures II will be helpful but not necessary

Syllabus

1. Introduction to module theory, starting from the definition of module: free, flat, projective and injective modules, products, coproducts, tensor products, exactness and the Hom functor will be covered. The notion of a ring will be assumed.
2. Structure theorems: chain conditions on rings and modules, Noetherian rings, Artinian rings, Artin-Wedderburn Theorem and the structure of finitely generated modules over principal ideal domains.

Books

Recommended reading

The following general algebra texts may be useful for consultation:
- P. M. Cohn, Algebra (3 vols), Wiley 1974-77.
MAS428, Group Theory
Organiser  Prof R Wilson
Level 4  Course units 1  Semester 7
Timetable  46, 47
Assessment  100% final exam
Prerequisites  MAS201 Algebraic Structures I and the group theoretic part of MAS305 Algebraic Structures II
Syllabus
1. General group theory: series, soluble groups, nilpotent groups and commutator calculus.
2. Finite group theory: Sylow’s Theorems (briefly), Schur-Zassenhaus Theorem, Hall and Wielandt conjugacy theorems; Hall subgroups, Sylow bases, basis normalizers, projectors, injectors, Carter subgroups, Fischer subgroups of soluble groups; fusion and Alperin’s Fusion Theorem.
See course organiser before registering.

MAS430, The Galaxy
Organiser  Dr B Jones
Level 4  Course units 1  Semester 7
Timetable  26, 27
Assessment  100% final exam
Prerequisites  MAS204 Calculus III
Syllabus
• Introduction: galaxy types, descriptive formation and dynamics.
• Stellar dynamics: virial theorem, dynamical and relaxation times, collisionless Boltzmann equation, orbits, simple distribution functions, Jeans equations.
• The interstellar medium: emission processes from gas and dust (qualitative only), models for chemical enrichment.
• Dark matter - rotation curves: bulge, disk, and halo contributions.
• Dark matter - gravitational lensing: basic lensing theory, microlensing optical depth.
• The Milky Way: mass via the timing argument, solar neighbourhood kinematics, the bulge, the Sgr dwarf.

MAS439, Enumerative and Asymptotic Combinatorics
Organiser  Prof T W Muller
Level 4  Course units 1  Semester 7
Timetable  35, 36(56)
Assessment  100% final exam
Prerequisites  MAS219 Combinatorics
Syllabus
1. Techniques: Inclusion-exclusion, recurrence relations and generating functions.
2. Subsets, partitions, permutations: binomial coefficients; partition, Bell, and Stirling numbers; derangements. q-analogues: Gaussian coefficients, q-binomial theorem.
3. Linear recurrence relations with constant coefficients.
4. Counting up to group action: Orbit-counting lemma, cycle index theorem.
5. Posets and Möbius inversion, Möbius function of projective space.
See course organiser before registering.

MAS440, Functional Analysis
Organiser
Level 4  Course units 1  Semester  When offered, 7
Timetable  not offered in 2007–8
Assessment  100% final exam
Prerequisites  MAS221 Differential and integral analysis. MAS329 Topology previously or concurrently may be helpful.
Mathematical Sciences Undergraduate Handbook 2007–8

Part 7: Module Details


MAS441, Topics in Noncommutative Geometry
Organiser Prof S Majid
Level 4 Course units 1 Semester 8
Timetable TBA
Assessment 100% final exam
Prerequisites MAS317 Linear Algebra II and MAS201 Algebraic Structures I

Syllabus The main part of the course will cover topics chosen from the following: Noncommutative differential forms on algebras. Quantum de Rham complex and its cohomology. Introduction to Hochschild and cyclic cohomology and the Chern-Connes pairing. Hopf algebras (quantum groups). Yang-Baxter equation and braided categories. q-SL(2), q-line and q-plane. Introduction to vector bundles as projective modules and noncommutative principal bundles. q-Sphere and q-monopole. Noncommutative models of spacetime and quantum gravity.

MAS442, Bayesian Statistic
Organiser Dr L Pettit
Level 4 Course units 1 Semester 8
Timetable 56, 57 (24)
Assessment 100% final exam
Prerequisites MAS339 Statistical Modelling II

Syllabus
1. The Bayesian paradigm - likelihood principle, sufficiency and the exponential family, conjugate priors, examples of prior to posterior analysis, mixtures of conjugate priors, non-informative priors, two sample problems, predictive distributions, constraints on parameters, point and interval estimation, hypothesis tests, nuisance parameters.
2. Linear models - use of non-informative priors, normal priors, two and three stage hierarchical models, examples of one way model, exchangeability between regressions, growth curves, outliers and influential observations.
4. Examples - appropriate examples will be discussed throughout the course. Possibilities include epidemiological data, randomized clinical trials, radiocarbon dating.

Books
Reading List
1. Lee, P.M. Bayesian Statistics: An Introduction, (3rd Ed) Edward Arnold

MAS443, Topics in Statistical Mechanics
Organiser
Level 4 Course units 1 Semester When offered, 7 or 8
Timetable Not Offered in 2007–8
Assessment 100% final exam
Prerequisites MAS228 Probability II (or equivalent) and MAS125 Calculus II

Syllabus Topics will be chosen from:


Books

Reading List
1. F Reif, Statistical physics (McGraw-Hill)
2. K Huang, Statistical mechanics (Wiley)
3. R Dorfman, An introduction to chaos in nonequilibrium statistical mechanics (CUP)
5. D Ruelle, Statistical mechanics: rigorous results (Benjamin)
6. R W Zwanzig, Nonequilibrium statistical mechanics (OUP)

MAS444, Extremal Combinatorics

Organiser

Level 4 Course units 1 Semester When offered, 7 or 8

Timetable Not offered in 2007–8

Assessment 100% final exam

Prerequisites None

Syllabus Draft Syllabus


2. The Discrete Cube: Sperners theorem. Shadows and isoperimetric inequalities (LYM inequality, the Kruskal-Katona theorem, Harpers theorem, edge isoperimetric inequality).


4. Other Topics: Other topics of a similar flavour chosen according to class interest and time.

Books

Reading List The lecture notes will be self contained. Examples of books giving background material and further reading are:

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