How to use

This Handbook should be used together with the Academic Regulations and the Student Guide. This Handbook provides information specific to the School of Mathematical Sciences, while the Student Guide gives information common to all students at the College. The Academic Regulations provide detailed information on award requirements and governance.

Nothing in this Handbook overrides the Academic Regulations, which always take precedence.

The School of Mathematical Sciences Undergraduate Handbook is available online at:
www.maths.qmul.ac.uk/undergraduate/current/handbook

You will receive a copy of the Student Guide at the start of the academic year. It is also available online at:
www.studentadmin.qmul.ac.uk/students/studentguide.pdf

The Academic Regulations are available online at:
www.studentadmin.qmul.ac.uk/QA/academicregulations.pdf

Other formats available

This Handbook is available in large print format. If you would like a large print copy, or have other requirements for the Handbook, please visit the Maths Office (room 101 on the first floor or the Mathematical Sciences Building) or telephone 020 7882 5470. Please note that we produce large print and other special formats only on request, which may take up to two weeks.

Disclaimer

The information in this handbook is correct as of August 2008. In the unlikely event of substantial amendments to the material, the School of Mathematical Sciences will attempt to inform you of the changes.

The College cannot accept responsibility for the accuracy or reliability of information given in third party publications or websites referred to in this Handbook.
Dear Student,

Welcome (back) to Queen Mary. This handbook should provide you with the main information that you need to organise your studies during the coming academic year. We have written it primarily for students following undergraduate degree programmes organised by the School of Mathematical Sciences, but it should also be useful to students taking other joint undergraduate programmes involving the School. We will allocate you an academic adviser, and your adviser and other staff in the School will be happy to try to help you overcome any difficulties you may encounter. But please refer to this handbook before approaching your adviser or other School staff.

We have divided this handbook into several distinct parts as listed above. The pages of each part are numbered separately starting from 1 in the form “Part m – Page n”.

Please visit our web page for current undergraduate students at www.maths.qmul.ac.uk/undergraduate/current regularly. It gives important current information and provides links to other online documentation. This handbook is available as PDF files, which you can easily search by computer, and some important parts of the handbook are available as separate web pages, listed in the menu on the left of all the current undergraduate pages. We will correct and update the information on the web as necessary, so the web version may be more accurate than this printed version.

Dr Francis Wright
Director of Undergraduate Studies
August 2008
Module Summary

The new Queen Mary Academic Credit Framework level is the old level plus 3, unless the real academic level of a module has increased. Every module is worth 15 academic credits (1 course unit) unless indicated to the contrary. We have recoded all our undergraduate Mathematical Sciences modules and changed the title of a few, but there is no substantial change to any module unless its real academic level has increased. The comment field below describes any nontrivial changes.

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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

- You can collect your provisional results from the Maths Office after 1:00 pm on Thursday 18th June 2009 or have them sent by post (anywhere you want) by giving a stamped addressed envelope to the Maths Office beforehand. Include your student number on the envelope.
- We do not release results via the web or by phone, but we will send your provisional results by email to your Queen Mary email address (only) by the end of June.
- Queen Mary Student Administration will send official results to your home address by the end of July.

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

- You should register for all you modules and main exams within two weeks of the start of each semester, preferably as early as possible.
- 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 90 credits (6 course units) in total (counting resits but not EMS). Students passing fewer than 75 credits (5 course units) do not progress.
- From second to third year: pass 180 credits (12 course units) in total (counting resits but not EMS). Students passing fewer than 165 credits (11 course units) do not progress.
- Modules at QMACF level 3 (old level 0) do not count for progression.

Certified absences

If you miss an exam for a good reason (usually supported by a medical certificate), we may grant you a first sit. 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.
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Preliminary Information

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 modules in mathematics that forms 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.

What are the key dates?
The three terms of the academic year consist of two 12-week teaching semesters followed by a 6-week examination period. The first semester begins with a three-day induction and enrolment period, during which you should agree your programme for the year with your adviser. Dates for the academic year 2008–09 are as follows.

Semester A
Enrolment: Wednesday 17 – Friday 19 September 2008
Teaching: Monday 22 September – Friday 12 December 2008
Questionnaire week (6): Monday 27 – Friday 31 October 2008
Test, consolidation and reading week (7): Monday 3 – Friday 7 November 2008
Degree ceremonies: Tuesday 9 and Wednesday 10 December 2008
Three-week Christmas vacation

Semester B
Teaching: Monday 5 January – Friday 27 March 2009
Questionnaire week (6): Monday 9 – Friday 13 February 2009
Test, consolidation and reading week (7): Monday 16 – Friday 20 February 2009
Four-week Easter vacation (Easter Day is 12 April 2009)

Examinations
Essential Mathematical Skills exams:
1 October 2008; 29 October 2008; 26 November 2008; 7 January 2009
Main exam period: Monday 27 April – Friday 5 June 2009
Main exam board: Wednesday 17 June 2009
Release of provisional results: Thursday 18 June 2009
Degree ceremonies: Friday 10 – Friday 17 July 2009

Key College dates are available online at www.qmul.ac.uk/about/calendar/.

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 every day.

- Check the student information notice boards in the Mathematical Sciences Building at least twice a week.
- Visit your adviser at the start of each semester (or more often) 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 Registry (in the Queens' Building) of any change in your contact details (home address, term address, landline or 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, 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.

## Departmental Information

### 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 Mile End campus.

The postal address for the School is:

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

For general undergraduate enquires please use the following contact details.

Email: u.g.maths@qmul.ac.uk  
Tel: 020 7882 5470  
Fax: 020 8981 9587

To contact specific staff please see “How do I contact staff?” on page 7.

### Where do I find things and people in Mathematical Sciences?

#### Main noticeboards

The main noticeboards are on the left of the corridor leading from the main entrance to the Mathematical Sciences Building. You should check it frequently. It is for official notices by staff and sometimes carries urgent information such as changes to examination rooms.

#### Maths Office

Your main 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 noticeboard and a box for posting letters to staff outside the Maths Office. Printed copies of this handbook are available from the Maths Office while stocks last.

The Maths Office opening hours are 9:30 am – 12:15 pm and 1:30 pm – 4:45 pm every weekday except Wednesdays afternoons.

The section “How do I contact staff?” on page 7 lists other academic and administrative staff offices.
Coursework collection boxes
There are brightly coloured locked coursework collection boxes located opposite the lifts in the basement and on the ground and second floors of the Mathematical Sciences Building.

Teaching rooms
The Mathematics Lecture Theatre (MLT, formally room G1) spans the ground floor and basement of the Mathematical Sciences Building; the main doors are on the ground floor just inside and to the left of the main entrance to the building.

Room G2 and the Mathematics Seminar Room (MSR) are smaller rooms. The door to G2 is by the main door to the MLT. The MSR (formally room 103) is on the west side of the first floor of the Mathematical Sciences Building. Very small groups occasionally meet in room 513 on the fifth floor or in rooms B11 or B17 in the basement.

Web site
The School of Mathematical Sciences web site is at [www.maths.qmul.ac.uk](http://www.maths.qmul.ac.uk) but the sub-site most relevant to you is at [www.maths.qmul.ac.uk/undergraduate/current](http://www.maths.qmul.ac.uk/undergraduate/current). Please visit this web site frequently. The main page provides an online noticeboard and other transient information, and on the left is a menu of links to other pages, currently Induction, Modules, Timetable, MSci projects, Handbook, Student-Staff Liaison Committee, Study programmes, Forms, Computing facilities, and Careers. The web is likely to be the most up-to-date source of information.

Reporting absence
You are expected and required to attend all elements of your course. If you wish to be absent for more than one day then you must have a good reason and you should ask the Senior Tutor in advance for permission.

If something serious (such as illness) prevents you from attending an assessment (such as an exam or test) or submitting assessed work (such as coursework) then you should report this to us using the appropriate form, which is available either on paper from the Maths Office or online from the Maths web site. If you do so then we may make some allowance for the marks that you would otherwise lose. See "How do I report extenuating circumstances?" on page 10 for details.

Module details
We publish timetable information on the web at [www.maths.qmul.ac.uk/undergraduate/current/timetable](http://www.maths.qmul.ac.uk/undergraduate/current/timetable) and on the noticeboards, but not in the main handbook, because timetable details are subject to change. You can find other module details, such as recommended textbooks, in Part 7 of this handbook and on the web at [www.maths.qmul.ac.uk/undergraduate/current/modules](http://www.maths.qmul.ac.uk/undergraduate/current/modules). The main web page for each module should include a link to the module organiser’s web page, which may provide information such as lecture notes, past exam papers, etc. You can also access past exam papers on the library web site at [www.library.qmul.ac.uk/exams](http://www.library.qmul.ac.uk/exams).

What computing facilities do you provide?
All the software that you need for your course should be available on the Queen Mary Student Service. But you must remember to log in to the Windows XP (not ME) service. As a Queen Mary student you can also buy a copy of Maple, a mathematical computing package, very cheaply to run on your own computer; see [www.maths.qmul.ac.uk/undergraduate/current](http://www.maths.qmul.ac.uk/undergraduate/current).

We also run an experimental server that should provide access to all the software you will need. The software runs on the server and your computer acts as a "remote desktop". The purpose of the Mathematical Sciences software server is primarily to give you the option of working on your coursework from home rather than in College. See the web site [www.maths.qmul.ac.uk/undergraduate/current/computing](http://www.maths.qmul.ac.uk/undergraduate/current/computing) for details of accessing the server.

How will you communicate with me?
Communications from us to you
The College will communicate with you in a variety of ways. It will send you formal correspondence by letter, and it is important that you keep the College up to date with your personal details and address. However, it is most common for the School of Mathematical Sciences and the College to contact you by email. The College assigns you an email address when you enrol and you must check this account daily.

You can access your email account by logging on to a College computer or, if you are not on campus, at [webmail.stu.qmul.ac.uk](http://webmail.stu.qmul.ac.uk).
The School of Mathematical Sciences has developed software that sends your coursework and test marks to your College email addresses on a weekly basis during the semesters. We have also developed software that we will use to send your final module results for the current academic year to your College email addresses towards the end of June. Please note that we do not send any results by email in any other way.

We will keep any paper mail for you in the Maths Office and send you an email inviting you to collect it.

**Communications from you to us**

It is usually best if you contact staff (at least initially) by email. You may also visit staff in their offices or telephone them **but only during their office hours**. There should be a notice on each undergraduate staff member's office door indicating his or her office hours. Staff should allocate at least two hours per week when they will normally be available in their offices to see students. 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.

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**Email etiquette**

When emailing any member of College staff, you must include your **full name** (as registered with the College) and your **student number**. Use standard and correct English; do not use abbreviations or colloquialisms. (Save “txtspk” for friends and family!) If you are replying to an email then please include a copy of that email.

If you follow the above requirements then you can reasonably expect an acknowledgement within about two working days and a full reply within about five working days during the semesters, but replies may take longer during vacations. **If you do not follow the above requirements then we may ignore your email.**

**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.

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**Who's who in Mathematical Sciences?**

**Who are the key staff?**

<table>
<thead>
<tr>
<th>Role</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>Dr O Bandtlow</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>SEB Deputy Chair (Late Summer Resits)</td>
<td>Prof. S Majid</td>
</tr>
<tr>
<td>Subject Examination Board Secretary</td>
<td>Prof. C-H Chu</td>
</tr>
<tr>
<td>Admissions Tutor</td>
<td>Dr D S Coad (Sem A)</td>
</tr>
<tr>
<td>School Administrator</td>
<td>Prof. B Jackson (Sem B)</td>
</tr>
<tr>
<td>Undergraduate Administrative Assistant</td>
<td>Mr W White</td>
</tr>
<tr>
<td></td>
<td>Ms C Griffin</td>
</tr>
</tbody>
</table>

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**Whom should I ask for advice?**

For straightforward administrative enquiries, you should normally ask in the Maths Office first. For general academic advice, you should normally ask your adviser first, who may refer you to the appropriate programme director, the Senior Tutor or the Pastoral Tutor. Their roles are described below.

**What is my adviser’s role?**

The Senior Tutor will assign you an academic adviser to give you information and advice during your undergraduate studies. Your adviser’s principal task is to discuss with you and approve your “module 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; see “How do I contact staff?” on page 7. We post lists allocating students to advisers on the notice boards on the ground floor of the Mathematical Sciences Building at the start of each academic year. If you cannot find your name on this list then 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 study for that semester, and you should visit your adviser at least once again during each semester to discuss your progress. Advisers have online access to all their advisees' coursework and test marks for Mathematical Sciences modules. It is also important that you discuss with your adviser any academic, financial, medical or other problems as soon as they arise. Your adviser can then refer you to the appropriate person within the College to deal with your problem, which you may also need to report to the Pastoral Tutor (see below).

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.

Teaching is not part of an adviser's role, although your adviser may be willing to help you with mathematical problems and should be willing to help you with Essential Mathematical Skills.

What is the Senior Tutor's role?

The Senior Tutor allocates advisers and oversees the academic aspects of advising and student welfare, in particular, attendance and performance in coursework and tests, and deregistering students from examinations. The Senior Tutor advises the Examination Board on students' non-academic difficulties and progression from one year to the next. If you wish, you should submit end-of-year summaries of non-academic difficulties directly to the Senior Tutor.

What is the Pastoral Tutor's role?

The Pastoral Tutor 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. You should report details of missed in-term assessments, missed examinations and non-academic difficulties 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. You should hand in completed forms to the Maths Office, in a sealed envelope if necessary for confidentiality.

What are the Programme Directors' roles?

Each study programme has a director, who decides which modules students must study 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. For full details of current Mathematical Sciences study programmes, see Part 5: Study Programmes or 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.

<table>
<thead>
<tr>
<th>Name</th>
<th>Programme director for</th>
<th>Second adviser for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. L H Soicher</td>
<td>G100, G110, G102, G101, G13</td>
<td>G501, G504</td>
</tr>
<tr>
<td>Dr H Grossmann</td>
<td>G300, GG31, G13</td>
<td>LG11</td>
</tr>
<tr>
<td>Dr L Rass</td>
<td>G1N1, GN13, GL11, G1L1</td>
<td>GG41, F500, FG11</td>
</tr>
<tr>
<td>Prof. M A H MacCallum</td>
<td>GG14, FG31</td>
<td>GR11, GR12, GR14, GR17</td>
</tr>
<tr>
<td>Prof. R A Wilson (Sem A)</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Prof. R A Bailey (Sem B)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
<th>Second adviser for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr G White</td>
<td>Computer Science</td>
<td>GG14</td>
</tr>
<tr>
<td>Dr D Qin</td>
<td>Economics</td>
<td>GL11</td>
</tr>
<tr>
<td>Prof. J M Charap</td>
<td>Physics</td>
<td>FG31</td>
</tr>
</tbody>
</table>

Part 3 – Page 6
How do I contact 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”, which 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 (<a href="mailto:...@qmul.ac.uk">...@qmul.ac.uk</a>)</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr C B Agnor</td>
<td>4766</td>
<td>512</td>
<td>C.B.Agnor</td>
<td>020 7882 7045</td>
</tr>
<tr>
<td>Prof. D K Arrowsmith</td>
<td>4625</td>
<td>116</td>
<td>D.K.Arrowsmith</td>
<td>020 7882 5464</td>
</tr>
<tr>
<td>Prof. R A Bailey</td>
<td>4626</td>
<td>317</td>
<td>R.A.Bailey</td>
<td>020 7882 5517</td>
</tr>
<tr>
<td>Dr O Bandtlow</td>
<td>4759</td>
<td>B16</td>
<td>O.Bandtlow</td>
<td>020 7882 5438</td>
</tr>
<tr>
<td>Prof. C Beck</td>
<td>4628</td>
<td>114</td>
<td>C.Beck</td>
<td>020 7882 3286</td>
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<tr>
<td>Dr B Bogacka</td>
<td>4665</td>
<td>255</td>
<td>B.Bogacka</td>
<td>020 7882 5497</td>
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<tr>
<td>Dr J N Bray</td>
<td>4769</td>
<td>B54</td>
<td>J.N.Bray</td>
<td>020 7882 5482</td>
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<tr>
<td>Prof. S R Bullett</td>
<td>4629</td>
<td>252</td>
<td>S.R.Bullett</td>
<td>020 7882 5474</td>
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<tr>
<td>Prof. D H Burgess</td>
<td>4630</td>
<td>453</td>
<td>D.Burgess</td>
<td>020 7882 5460</td>
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<tr>
<td>Prof. P J Cameron</td>
<td>4631</td>
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<td>P.J.Cameron</td>
<td>020 7882 5477</td>
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<tr>
<td>Prof. B J Carr</td>
<td>4632</td>
<td>311</td>
<td>B.J.Carr</td>
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<tr>
<td>Prof. I M Chiswell</td>
<td>4633</td>
<td>256</td>
<td>I.M.Chiswell</td>
<td>020 7882 5475</td>
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<tr>
<td>Dr J Y Cho</td>
<td>4758</td>
<td>353</td>
<td>J.Cho</td>
<td>020 7882 5498</td>
</tr>
<tr>
<td>Prof. C-H Chu</td>
<td>4708</td>
<td>153</td>
<td>C.Chu</td>
<td>020 7882 5218</td>
</tr>
<tr>
<td>Dr D S Coad</td>
<td>4718</td>
<td>352</td>
<td>D.S.Coad</td>
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<tr>
<td>Dr J R Donnison</td>
<td>4723</td>
<td>515</td>
<td>R.Donnison</td>
<td>020 7882 5149</td>
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<tr>
<td>Prof. J P Emerson</td>
<td>6523</td>
<td>351</td>
<td>J.P.Emerson</td>
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<tr>
<td>Dr M Fayers</td>
<td>4724</td>
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<td>M.Fayers</td>
<td>020 7882 5479</td>
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<tr>
<td>Prof. S G Gilmour</td>
<td>4685</td>
<td>B51</td>
<td>S.G.Gilmour</td>
<td>020 7882 7833</td>
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<tr>
<td>Prof. I Goldsheid</td>
<td>4638</td>
<td>254</td>
<td>I.Goldsheid</td>
<td>020 7882 5473</td>
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<tr>
<td>Ms C M Griffin</td>
<td>—</td>
<td>101</td>
<td>C.M.Griffin</td>
<td>020 7882 5470</td>
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<tr>
<td>Dr H Grossmann</td>
<td>4765</td>
<td>316</td>
<td>H.Grossmann</td>
<td>020 7882 3113</td>
</tr>
<tr>
<td>Dr R Harris</td>
<td>4770</td>
<td>B13</td>
<td>Rosemary.Harris</td>
<td>020 7882 5478</td>
</tr>
<tr>
<td>Prof. B Jackson</td>
<td>4711</td>
<td>253</td>
<td>B.Jackson</td>
<td>020 7882 5476</td>
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<tr>
<td>Prof. O M Jenkinson</td>
<td>4682</td>
<td>B55</td>
<td>O.M.Jenkinson</td>
<td>020 7882 3188</td>
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<tr>
<td>Prof. M Jerrum</td>
<td>4760</td>
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<td>M.Jerrum</td>
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<tr>
<td>Dr J R Johnson</td>
<td>4725</td>
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<td>R.Johnson</td>
<td>020 7882 5480</td>
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<tr>
<td>Dr W Just</td>
<td>4686</td>
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<tr>
<td>Dr P Keevash</td>
<td>4771</td>
<td>B14</td>
<td>P.Keevash</td>
<td>020 7882 3160</td>
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<tr>
<td>Prof. B A Khoruzhenko</td>
<td>4641</td>
<td>111</td>
<td>B.Khoruzhenko</td>
<td>020 7882 5495</td>
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<tr>
<td>Dr R Klages</td>
<td>4719</td>
<td>B12</td>
<td>R.Klages</td>
<td>020 7882 5448</td>
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<tr>
<td>Prof. J E Lidsey</td>
<td>4698</td>
<td>455</td>
<td>J.E.Lidsey</td>
<td>020 7882 5461</td>
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<tr>
<td>Prof. M A H MacCallum</td>
<td>4644</td>
<td>G57</td>
<td>M.A.H.MacCallum</td>
<td>020 7882 5445</td>
</tr>
<tr>
<td>Prof. S Majid</td>
<td>4702</td>
<td>G54</td>
<td>S.Majid</td>
<td>020 7882 5444</td>
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<tr>
<td>Dr K A Malik</td>
<td>4762</td>
<td>454</td>
<td>K.Malik</td>
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<tr>
<td>Prof. T W Müller</td>
<td>4671</td>
<td>155</td>
<td>T.W.Müller</td>
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<tr>
<td>Prof. C D Murray</td>
<td>4647</td>
<td>451</td>
<td>C.D.Murray</td>
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<tr>
<td>Prof. R P Nelson</td>
<td>4687</td>
<td>511</td>
<td>R.P.Nelson</td>
<td>020 7882 5199</td>
</tr>
<tr>
<td>Dr L I Pettit</td>
<td>4710</td>
<td>314</td>
<td>L.Pettit</td>
<td>020 7882 3285</td>
</tr>
<tr>
<td>Dr A G Polnarev</td>
<td>4650</td>
<td>356</td>
<td>A.G.Polnarev</td>
<td>020 7882 5457</td>
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<tr>
<td>Dr T Prellberg</td>
<td>4721</td>
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<td>T.Prellberg</td>
<td>020 7882 5490</td>
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<tr>
<td>Dr L Rass</td>
<td>4652</td>
<td>B57</td>
<td>L.Rass</td>
<td>020 7882 5219</td>
</tr>
<tr>
<td>Prof. L H Soicher</td>
<td>4655</td>
<td>B52</td>
<td>L.H.Soicher</td>
<td>020 7882 5463</td>
</tr>
</tbody>
</table>
How do I complain?

We hope you will not need to complain, but if you would like to raise any issues, either as an individual or as a group, please follow the guidelines below.

You should normally address complaints about a module, e.g. the lectures, classes, coursework or tests, to the module organiser initially. (This includes modules taught by other departments.) If this does not solve the problem, talk to your adviser. If he or she cannot help and you want to make a formal complaint, do it in writing (preferably by email) to the Director of Undergraduate Studies. He will keep a record of all such complaints and follow them up, and try to keep you informed in writing of the outcome. If you do not hear anything within two weeks then please ask for an update.

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. Note that two internal examiners mark all exams and an external examiner from another university moderates the marking, so we will not normally remark them. However, we can check that we have not made any administrative errors 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.

Remember also that there are elected student representatives on the Student-Staff Liaison Committee. They are not 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 not to disadvantage you if you make a complaint in good faith. The School also understands and respects the fact that you may need to complain in confidence.

What are the safety and emergency procedures?

You should familiarise yourself with emergency procedures for all areas in which you work, noting the location of emergency exits, assembly points and equipment. In case of a fire, immediately leave the building by the nearest exit point. Do not use the lifts. Fire action notices are displayed in corridors and by fire escapes.

In an emergency, dial 3333 from any internal phone and clearly state the nature and location of the problem, your name, and the number you are calling from (if known). If no internal phone is available, call 999 and follow the normal procedure. You should ensure that
corridors and doorways are not obstructed
and that fire fighting equipment is not removed
from its station.

First aid assistance for minor accidents can be
obtained by dialling 3333 from an internal
phone or 020 7882 3333 from any other
telephone.

What prizes do you award?
We award one prize each year to the best
first-year undergraduate in Mathematical
Sciences, and the College awards prizes each
year to outstanding second, third and final
year undergraduates. The prizes are all worth
£100 each; 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, we have also been able to
award Institute of Mathematics and its
Applications (IMA) prizes, consisting of a
year’s free subscription, to the best two
students in the final year in Mathematical
Sciences, and a Pfizer Prize in Statistics to
the student with the best final year statistics
results.

Here is a list of the Mathematical Sciences
students who won prizes in summer 2008.

Departmental and College Prizes

Mathematical Sciences Prize (for first year
students):
Mr Pruvil Patel

Westfield Trust Prize (for second year
students):
Ms Fahmida Begum Basith
Ms Inna Polichtchouk
Mr Franciszek Simkievich
Ms Gavriella Symeonidou

Westfield Trust Prize (for third and final
year students):
Mr Andrew Drizen
Mr James Christopher Daniel Gunner
Mr Matthew James Spencer
Mr Karl Michael Vincent Waugh

Institute of Mathematics and its
Applications Prizes
Mr James Christopher Daniel Gunner
Mr Karl Michael Vincent Waugh

Pfizer UK Prize for Statistics
Ms Sundas Javad

What is my College ID card?
You will receive a College photo-ID card upon
enrolment. This card is very important and you
must carry it at all times on campus. If you do
not produce this card upon request and satisfy
staff that it is your card through comparison of
your face and the photograph, College
security staff may remove you from the
building, or from campus.

The card shows your Student Number and
your Examination Number. You must take
your card into all examinations and display it
on your table for inspection. You will need to
copy the Examination Number (only!) onto
your paper.

The card also serves as your library card and
as an access card for certain buildings. Many
buildings have security points at which you
must show your card and others require you
to scan your card to release the doors.

It is vital that you keep your card safe and with
you at all times on campus. If you lose your
card, or if your card is stolen, you should
contact the Registry, who will be able to help
you. A fee may be charged to replace lost
College Cards.

Departmental Procedures

How do I submit coursework?
The module organiser will tell you at the start
of the module how to submit coursework for
that module. Large modules use the brightly
coloured locked coursework collection boxes
located opposite the lifts in the basement and
on the ground and second floors. 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. If you put it in the wrong box
then you have not submitted it. You will
probably lose both the coursework and the
marks.

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.). We may not
accept work that does not meet this
requirement, in which case you will score a
mark of zero.

We try to return all marked coursework but we
cannot guarantee to do so and occasionally it
gets lost. Therefore, you should take a copy of
any coursework that you want to keep before
you submit it. If you have a computer and
scanner, it will cost you nothing to scan all
your coursework before you submit it.

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 student mentors who
have successfully completed the first year.

WE CAN HELP YOU PASS
Student mentors are volunteers who are keen
to share their knowledge and experience to
help you succeed. We train them to run
effective PASS sessions.

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 “How do I contact staff?” on page 7), or
see the PASS posters around the
Mathematical Sciences Building.

Do I need to buy textbooks?
Most module organisers recommend one or
more textbooks, the main ones 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 around £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 happens if I am absent?
We expect you to attend all elements of your
course. If you are absent from College for
more than a day or two then please always let
your adviser know (preferably by email) at the
earliest opportunity; see also “How do I report
extenuating circumstances?” below.

We use submission of coursework as our
primary measure of your attendance and we
expect you to submit all the coursework set. If
you submit less than 75% of the coursework
then we will ask you to explain your lack of
performance. If there is no or very little
improvement, we will ask the College to
terminate your enrolment.

Why might I be deregistered?
If you do not meet module requirements for
attendance or for submission of coursework
then we may deregister you from the module.
You will be given warnings before
deregistration occurs and you will have the
right to represent your case to the School of
Mathematical Sciences.

How do I report extenuating
circumstances?
If you believe that circumstances beyond your
control have affected your performance in a
particular item of assessment or more
generally then you may wish to register an
extenuating circumstances case. Extenuating
circumstances include illness, death of a close
relative, etc. Extenuating circumstances do
not normally include computer problems,
printing problems, misreading your exam
timetable or planned holidays.

Extenuating circumstances forms are
available from the Maths Office and
www.maths.qmul.ac.uk/undergraduate/current
/forms/. If you believe that you have a case for
consideration, you should complete the
appropriate form and supply supporting
documentation (for example medical
certification, death certificate, police report
and crime number, or other written evidence
from a person in authority), and submit the
paperwork to the Maths Office by the specified deadline. We must receive all claims as soon as possible after the event and no later than 24 hours before the relevant Examination Board meeting (Wednesday 17 June 2009). We may not accept claims made late without a good reason. Please note that although we may accept accompanying documentation late, we cannot consider claims without any evidence.

A small subcommittee of the Examination Board considers all cases of extenuating circumstances. All proceedings of the subcommittee are strictly confidential, and will not normally be discussed at the full Examination Board.

It is your own responsibility to make a case for extenuating circumstances, not that of your adviser. Please ensure that if you do have what you believe is a valid case, you complete the submission process in accordance with the guidelines and deadlines.

Normally, only the Pastoral and Senior Tutors see any supporting evidence. We do not distribute it to other staff, but we may disclose it in confidence to relevant College officials. Maths Office staff will process the form itself. Copies will go to your adviser, all the relevant module organisers and your file, and will be available to any staff writing a reference for you.

What if I miss coursework submissions or tests?

If you report that an extenuating circumstance prevented you from submitting coursework and/or attending a test and we accept your reason then we will excuse you. We will normally excuse you from a test only if you have submitted at least half the coursework set so far for the module. We show an excused mark as E.

If you are absent for more than 5 days you must provide supporting documentary evidence such as a letter from your GP.

Module organisers in the School of Mathematical Sciences will state at the start of each module how they will allow for excused coursework and tests. We normally ignore any excused marks when computing your overall average mark. Note that this puts more weight on your other assessed work.

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.

What if I miss examinations?

Do not delay! If you report that an extenuating circumstance prevented you from attending an examination and we accept your reason then we will allow you to sit the examination later without any penalty (unless you graduate anyway).

We normally require 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 period. If you submit the form by post then it is your responsibility to ensure that it arrives in time.

We call a delayed first attempt at an examination a “first sit”. You normally take “first sits” the following May but we may allow you to take those necessary for progression in August. If you are a finalist and you pass enough credits to graduate then we will consider the missed examinations when classifying your degree.

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 it may be best if you do not attend the examination but instead seek medical advice and a medical certificate.

What if my studies are generally disrupted?

If extenuating circumstances either disrupt your studies for a substantial period or have a substantial direct effect on your examination performance (but do not necessarily cause you to miss any assessments) then you should discuss your case with the Senior or Pastoral Tutor before completing a form.

If you wish the department to take account of your extenuating circumstances when determining progression or degree classification then you should support your form with documentary evidence such as a letter from the College Medical Centre, a GP, a hospital or the police. The Examination Board will not consider extenuating circumstances without supporting documentary evidence.
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 appropriate only 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 you have reported. However, if they occurred very recently then you may attach the report form and supporting documentation to the summary.

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

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 Registry, 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 we will not allow you to enter for any examination in which you would be the only candidate.

What if my exams are disrupted?
It is essential that you inform the Senior Tutor in writing well before the end of the examination period of any difficulties that have affected your examination performance. The board cannot take account of difficulties you have not reported. 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.

The Subject Examination Board (SEB) considers medical certificates and similar material. However, even when the board makes allowance for medical or other problems, it cannot always give full compensation. The board will recommend only the degree class it is confident you would have achieved, not what you might have obtained in other circumstances, but the board may be able to make allowance for circumstances that result in you performing worse in some examinations than others.

You should provide the Senior Tutor with a summary on a single A4 sheet of paper that is printed using a font no smaller than 12 points or written neatly and legibly. At the top, 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 time at Queen Mary, one per paragraph. If your academic results are such that your extenuating circumstances might make a difference then the Examination Board will consider your summary.

The summary would normally refer to extenuating circumstances that you have reported. However, if they occurred very recently then you may attach the report form and supporting documentation to the summary.

How do I choose modules?
You should choose or confirm your modules during the enrolment period before the start of teaching in Semester A and confirm your choices at the start of Semester B. Your
adviser will have your module registration form. You discuss your choices with your adviser, your adviser completes the form and then you sign it to confirm that the details are correct. There is no choice in the first year but you still need to sign your module registration form. We will display adviser lists on the student noticeboard.

Advice for continuing students

Please note that your adviser may have changed. If you took late summer examinations then your adviser should be able to tell you the results. If your progression depends on late summer examinations then you will not be able to enrol and your module registration form will not be available until the first week of teaching.

You should register for all the modules that you propose to take during the current academic year. We should have pre-registered you for the compulsory modules shown in your current study programme.

Most modules have prerequisites and some have overlaps; see 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. Note that each module with a new code overlaps with the same module with its old code, even if the title has changed.

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. You can find information about module validation online at www.qmul.ac.uk/courses/modules/registration.php

It is your responsibility to ensure that you satisfy all modules requirements. You must normally have written permission from both the Senior Tutor and the Registry 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.

What if I have failed modules?

Include on your module registration form all additional examinations that you plan to resit or for which we have granted you first sits; we do not register you automatically. This is your responsibility, not your adviser’s!

You may attempt each examination at most three times but you cannot resit any examination you have already passed. Once you have passed enough credits you will normally graduate, after which you cannot resit any modules.

It is possible to retake a complete module, especially if you are retaking a year. But normally your second and third attempts at a module will be resits of the examination alone (without attending any of the teaching for the module) and the maximum overall mark you can obtain will be limited to the minimum pass mark; we say that the mark is “pegged”. You must resit examinations at the first opportunity. A resit examination does not count toward the credits that you take in each academic year. We use the best mark from the original and any resit results to determine your degree classification.

If we discontinue or substantially change a module and no comparable examination paper is being set then we will set a special resit paper for that module, if required, on one occasion and no more. We may not allow you 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 we will handle the continuously assessed component for resit candidates. You must check with the current module organiser for any minor changes to modules that may affect your resit examinations.

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

- You must resit each examination at the first opportunity.
- We normally allow you three attempts at any one module (i.e. two resits).
- When 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 that is comparable to the original one; they cannot take the current year’s paper.
• You must make any request to waive any of these regulations by writing to the SEB chair by
  o 31st January for examinations the following May, or
  o 15th July for examinations the following August.

How many modules can I take?
You may register temporarily for more modules than required while you decide which to take. If you do this, you must cancel the excess registrations for each semester by the Friday of the second teaching week of the semester by completing a module amendment forms, available from the Registry (Queens’ Building, room CB05), and taking it to your adviser. You must also inform the module organisers yourself.

We will assess your degree on 120 credits (8 course units) per year. We will not examine you in more and you should not take fewer. However, with the approval of your adviser, you may attend 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 module registration form). You should inform the organisers of any modules that you are taking for study only and you should not submit coursework or attend tests for these modules.

Can I change my study programme?
Your study programme is initially the same as the course for which Queen Mary accepted you. Part 5 of this handbook gives details of all Mathematical Sciences study programmes, which specify what modules you must take. Provided you meet the programme requirements, you can choose your optional modules, subject to the approval of your adviser.

We may allow you 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 Registry, 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 Registry then you will not have changed your study programme.

How do I change to a new Mathematical Sciences study programme?
1. Complete a Change of Programme of Study form and obtain your adviser's signature (at the bottom of the front of the form; 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):
   o put a tick against all modules passed in previous years; and
   o put a cross against all modules that you propose to take or resit in the current year.

3. Take the completed form and marked study programme to the director of the proposed new programme. If the director accepts the change then leave the form with the director, who will also sign the bottom of the front of the form (by your adviser’s signature) 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).

We will not normally allow you to transfer to G1N1, GN13, GL11 or G1L1 because these programmes are normally full.

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 need approval by the Registry. If you are a candidate for the MSci and you fail to obtain enough credits for the award of the MSci we can consider you for a BSc, although we may delay the award of the BSc until the time when you would have completed the MSci programme.
How do I change to a new Study Programme run by another department?

1. 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.

2. Take the completed form to the Senior Tutor for Mathematical Sciences for approval of your release from the School of Mathematical Sciences and inform your adviser.

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 Registry yourself.

How do I update my personal details?

It is important for the College to have up to date personal details for you. Please ensure that if you change your home or term-time address, name, telephone number or other details you complete and submit a Change of Personal Details Form, available from the Registry. You should also contact the Maths Office to update our departmental records.

Can I study abroad?

The College runs an American Universities exchange programme, co-ordinated by the Study Abroad Adviser, Mr H Gibney, in the Registry. You normally spend the second year of a three-year programme abroad and you need to begin arrangements 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, with at least one university representing each country in the EU. Any student interested in this opportunity should contact Dr P Keevash in Mathematical Sciences (see “How do I contact staff?” on page 7).

What are lectures, exercise classes, etc?

In place of the classroom teaching normally used in schools, we use lectures and exercise classes to teach most of our modules. You also need to spend time on your own studying and attempting exercises. We also run occasional tests.

Lectures

In a lecture, the lecturer stands at the front of the room and talks. The lecturer will normally also 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 the lecturer has taught in the module. You will generally need to copy carefully what is on the board or screen.

You should regularly review and correct your notes, check for 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 each module since mathematical modules tend to refer back to, and rely on, material covered earlier. You should keep your lecture notes for revision.

The module organiser will set problems as exercises. Working through the exercises is essential in order to understand each module. Moreover, we use the handing in of exercise solutions as an "attendance register".

Exercise classes

In a mathematical sciences 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 should try to solve the problems before the class by looking up the meanings of relevant terms in your lecture notes or appropriate textbooks or by searching the web. 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 take place 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”.

Time management
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 (15-credit) module and to 40 hours per week for 30 weeks of the year.

How must I behave?
The College Code of Student Discipline, available at [www.studentadmin.qmul.ac.uk/students/discipline.pdf](http://www.studentadmin.qmul.ac.uk/students/discipline.pdf), covers general student behaviour. Below is more detail of the behaviour required of Mathematical Sciences students.

When must I not talk?
You must not talk (except to members of staff) in lectures, in the library (except in designated group study areas) or in computing laboratories. If you persistently talk in lectures or in the library then the College may take disciplinary action against you; we take a serious view of behaviour that prevents other people from working.

When must I not use my mobile phone?
You must not talk on your mobile phone or allow it to ring audibly during lectures or classes, or in the library, computing laboratories or staff offices. If you do then a member of staff may ask you to leave.

You must switch off your mobile phone in all tests and examinations. Allowing your mobile phone to ring during a test or an examination is a disciplinary offence that will normally lead to failure in the test or examination with a mark of zero, with more severe penalties for a second offence.

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 (unless calculators are explicitly allowed), 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 an invigilator asks you to do. This applies also to tests.

How are students represented?
Your views are important to the School of Mathematical Sciences and to Queen Mary. You can communicate your opinions to us in a variety of ways. At a College level, there are student representatives on committees across Queen Mary, including at Academic Board and Faculty Board.

What is the Student-Staff Liaison Committee?
The School of Mathematical Sciences 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. We normally elect two student representatives from each year and display their photographs and names in the first-floor corridor of the Mathematical Sciences Building opposite the staff photographs. Please raise any matters of concern with one of your student representatives.

The School takes suggestions from the SSLC very seriously. The committee 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/current/liaison](http://www.maths.qmul.ac.uk/undergraduate/current/liaison), from where minutes of the meetings are also available (but only from within the Queen Mary network).

What are module evaluation questionnaires?
In week 6 of each semester, we will ask you to complete a standard one-page questionnaire
for each of the Mathematical Sciences modules that you are taking. We use the results to try to identify any problems and rectify them as quickly as possible.

**How can I provide personal feedback?**
You are welcome to make (polite) informal comments to members of staff, such as your module organisers or adviser, and we will try to pursue any serious suggestions that may lead to improvements in our procedures.

**What is the National Student Survey?**
All final-year students at UK institutions take part in the National Student Survey (NSS). This is your opportunity to share your experiences of Queen Mary with the wider world and future students. Please do complete the NSS, and fill it in honestly. If you are a finalist, the NSS organisers will usually contact you by email in the spring term. The results are important as they are used in compiling university league tables, which can determine national university 'rankings' in the press.

**What are student ambassadors?**
We need students to act as tour guides and talk to prospective students who visit us after we have made them an offer of a place. There are similar opportunities within the College. Look out for emails and notices if you are interested.

### Writing and Assessment

**How will I be assessed?**
The main types of assessment that you will encounter as Mathematical Sciences students are
- coursework
- tests
- written examinations
- project reports and presentations

For most of our modules, we set exercises approximately once a week to illuminate the previous week’s teaching. You must attempt the exercises in your own time, write out neat solutions and submit them for marking as specified by the module organiser. We refer to these exercises as “coursework”. There are normally weekly exercise classes in which you can get help. Higher-level modules may not have assessed coursework or exercise classes. Assessed coursework normally contributes 10% to the overall mark for a module.

Tests are short exams held during the semester, usually near the middle. Tests normally contribute 10% to the overall mark for a module.

Written examinations take place during the main examination period and normally contribute at least 80% to the overall mark for a module.

A project involves writing a report that carries most of the marks and also giving a short presentation that may increase your marks if you do it well.

If you take modules taught by other departments then you may have to write assessed essays, computer programs, or laboratory reports.

**What is plagiarism?**
Plagiarism is the failure to credit the writings or ideas of another person that you have used in your own work. In such cases, you are attempting, deliberately or inadvertently, to pass their work off as your own. Plagiarism is a serious offence and can carry severe consequences, from failure of the module to deregistration from the College. You may also commit plagiarism by failing to reference your own work that you have submitted previously, or by failing to credit the input of other students on group projects.

Look at some published mathematical research papers (available online via the library web site) for examples of how to reference previous work. Different publications use different referencing styles; you should choose one and use it consistently. What is most important is to provide enough information that the reader can find the document you are referencing. You must always include the author and document title, and you must include the publication date of a printed document and the date when you last accessed an online document. We hope to provide detailed online guidance for preparing project reports.

It is your responsibility to ensure that you understand what plagiarism means and how to avoid it. The recommendations below can help you.

- Be sure to record your sources when taking notes, and to cite these if you use
ideas or, especially, quotations from the original source. Be particularly careful if you are cutting and pasting information between two documents, and ensure that references are not lost in the process.

- Be sensible in referencing ideas – commonly held views that are generally accepted do not always require acknowledgment of particular sources. However, it is best to be safe to avoid plagiarism.
- Be particularly careful with quotations and paraphrasing.
- Be aware that technology is now available at Queen Mary and elsewhere that can automatically detect plagiarism.
- Ensure that you reference appropriately all works used in the text of your work and fully credit them in your bibliography.
- If in doubt, ask for further guidance from your module organiser, project supervisor or adviser.

**How are examinations organised?**

**How and when will I get my exam timetable?**

We will invite you by email to collect your individual examination timetable from the Maths Office at the end of Semester B. Please check it and report any errors to the Registry immediately. In particular, check your resit and first sit entries.

**How and when can I get my results?**

- You can collect provisional results not sent by post from the Maths Office after 2:00 pm on Thursday 18th June 2009.
- Your adviser should be available on 18th and 19th June 2009 to discuss future options with you. **Please have your results with you when you visit your adviser.**
- Note that the results are “provisional” because the Degree Examination Board has not yet formally approved them; only the Registry can provide official results. However, no member of the School of Mathematical Sciences can change the results at this stage.
- The Registry will send out official notices of results, approved by the Degree Examination Board, by post to your registered home address by the end of July.
- We release results only to students who are not in debt to the College. We do not give results over the phone or by email on an individual basis.

**Am I eligible for late summer examinations?**

Late summer examinations are currently **not available for finalists.** We will offer late summer **first sits** to non-finalists 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. We will enter you automatically for late summer resits for which you are eligible. You cannot withdraw and if you are absent then it counts as a fail.

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

- Engineering
- Environmental Science
- Geography
- Materials
- Mathematics

The following departments offer late summer examinations to students in their first or second developmental year:

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

We will put the late summer examination timetable and results for Mathematical Sciences modules on the web at www.maths.qmul.ac.uk/undergraduate/current as soon as they are available.

Please note also that academic staff members 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?

How many credits must I pass?
In the following, level-3 modules including Essential Mathematical Skills (EMS) do not contribute to the minimum numbers of credits required either for progression from one year to the next or for obtaining a degree. (However, the marks from level-3 modules do count towards your degree classification.)

You must normally accumulate passes in 270 credits (18 course units) to obtain a BSc degree and 420 credits (28 course units) to obtain an MSci degree. Furthermore, a BSc student must pass EMS and 90 credits (6 course units) to progress into the second year and 180 credits (12 course units) altogether to progress into the final year. An MSci student must pass 105 credits (7 course units) to progress into the second year, 210 credits (14 course units) altogether to progress into the third year and 300 credits (20 course units) altogether to progress into the final year. These numbers include modules passed by resitting examinations failed at an earlier stage.

The Examination Board has the discretion to allow you to progress to the second or final year of a BSc programme if you have passed 75 or 165 credits (5 or 11 course units) and obtained an average of 40% or more in your best 90 or 180 credits (6 or 12 course units) respectively.

You will not normally be entitled to continue studying at College if you fail to pass the required number of credits at the end of any given year (including late summer examinations). However, after a year out of College, you may resit those examinations for which you are eligible.

During a year out, you cannot attend lectures or exercise classes. You may occasionally consult your adviser or seek information from a lecturer, but we can offer only very limited advice and assistance.

How do you grade my degree?

We will grade your degree from best to worst as either first, upper second, lower second or third class, or pass. (All University of London degrees, including pass degrees, are honours degrees.)

If I entered the first year in 2004 or later...

We will base your degree classification 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 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 credits passed, not to the number of calendar years of study. The resulting College mark will be on a percentage scale.

We will base your degree classification on the scale below but if your weighted mark places you at or just below a borderline then we can take account of other relevant information.

<table>
<thead>
<tr>
<th>College mark ≥ 70%</th>
<th>First class honours</th>
</tr>
</thead>
<tbody>
<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 credits 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
o either passed 18 or more course units in total but fewer than 18 at level 1 or above,
o or 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 we may offer you the award of a pass degree. You may opt to either 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 pass the required number of credits 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 not count towards your degree class.
If you have passed enough credits then we will normally classify you for honours. However, you may request postponement of honours, in which case we defer classification for a year, if either:
• 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; or
• your overall performance has been significantly affected by absence from final year examinations for reasons acceptable to the Examination Board. 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 2005–06 or earlier, or to the document Degree_Classification_2003 on the web as www.maths.qmul.ac.uk/undergraduate/current/handbook/Degree_Classification_2003.pdf.

The Student Guide
The Student Guide is a College publication that you will receive at the start of the academic year. You should use the Guide together with this handbook for general information on your time at Queen Mary.
Changes from Last Year

Many interrelated changes come into play for this academic year (2008–09). Here is a brief summary for the benefit of continuing students; for full details please see the rest of this handbook.

The Queen Mary Academic Credit Framework (QMACF)

The College has introduced an academic credit framework to bring it into line with other higher education institutions. What was previously an academic value of one course unit is now 15 academic credit points (credits). Because we already used a modular system, the new academic credit framework makes little difference beyond multiplying all academic values by 15. However, the QMACF also re-labels undergraduate academic levels by adding 3 to them, to be consistent with the National Qualifications Framework in which, for example, A-levels are level 3. The College is phasing out the term “course” because it is ambiguous (it might mean either degree programme or module) and hence the term “course unit”, although this edition of the handbook retains it for the benefit of continuing students.

From now on, Queen Mary regulations express quantity of study in terms of academic credit points, which occur only in multiples of 15, and difficulty of study in terms of an academic level ranging from 3 to 7. Most of this handbook uses only the new QMACF levels. The current academic regulations, which apply to students entering in September 2008, are expressed in terms of the QMACF, and the study programmes in part 5 of this handbook follow the new regulations.

Real changes of academic levels

The College changed its regulations for students entering in September 2007 to require them to take a specified minimum number of course units at the level of their award, which made the significance of the level of a module different from how we had previously interpreted levels within the School of Mathematical Sciences. In order to make it feasible for Mathematical Sciences students to comply with the new regulations we have revised our interpretation of academic level and hence increased the levels of a number of our modules. (These real increases are in addition to the re-labelling implied by the introduction of the QMACF and mean that the level has increased by 4 rather than 3.) This does not imply any substantial increase in the difficulty of those modules, but rather a re-labelling to make the levels of all our modules consistent. The modules that have had their real levels increased were the more difficult modules at their old levels and, in most cases, there has been a small modification to their syllabuses and/or assessment details to justify formally increasing their level.

Students entering in September 2006 or before are not required to follow the regulations introduced in September 2007 and in particular do not have to satisfy the new requirements on levels of modules. See Part 5: Study Programmes for further details.

There is no longer such a strong link between level and year of study as there was previously. Increase in the levels of your modules indicates progression through a branch of mathematics, but the year in which you study a module is determined by other factors, especially whether you are following a single or joint honours programme. Therefore, we now sort the Module Summary (part I of this handbook) by academic level rather than year, and the College Directory of Modules shows two semesters (e.g. semester 4 or 6) for several of our modules. We encourage you to take at least one level-6 module in your second year (and at least one level-7 module in your third year if you are following an MSci programme), so that you do not need to take so many modules at level 6 (or 7) in your final year.

Changes of module codes and titles

When the real level of a module is changed, it has to have a new code. By September 2009, the College will have to recode all modules to transfer them into the new College database. In order to avoid recoding some of our modules twice, we are one of the few departments to have recoded all our undergraduate modules for September 2008.
Our new module codes all begin with "MTH" instead of "MAS" to avoid any ambiguity and to bring them in line with MSc Mathematics modules; in general, the numeric parts of the codes are different as well. The first digit in the module code after MTH now always represents the (new QMACF) level, which was not uniformly true before. Hence, all level-n modules have codes of the form either MTHnxxx or MTH7xxU, where x is a digit; the latter indicates a level-7 module that is an undergraduate version of an MSc module.

We have also taken this opportunity to revise the titles of some modules. The Module Summary (part I of this handbook) shows changes of module codes and titles, and indicates any other significant changes.

Naturally, a module with a new code and possibly a new title formally overlaps with the same module under its old code and title. You cannot take the same module twice even if the two versions have different codes and possibly different titles, so please check either the Module Details (part 7 of this handbook) or the College Directory of Modules (www.qmul.ac.uk/courses/modules) carefully for overlaps.

**Student Administration**

The College will in future refer to the Student Administration Office, room CB05 in the Queens’ Building, as the (Academic) Registry. See the College Student Guide for further details. (This reverses a change of name made a few years ago.)
Study Programmes

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Disclaimer
This handbook attempts to provide advice but please see the Queen Mary Academic Regulations for definitive information. Nothing in this handbook overrides the Academic Regulations, which always take precedence, and are available online at www.studentadmin.qmul.ac.uk/QA/academicregulations.pdf.

Which study programme applies to me?
If you began your undergraduate course in September 2007 or later then you must follow the study programme for your degree that follows in this handbook. The 2007–08 handbook advised students starting their courses in 2007 that, because of changes to regulations from September 2007, there would be changes to study programmes that would affect mainly the third and final years of study. The current study programmes reflects those changes.

If you began your undergraduate course in September 2006 or earlier then you may follow the study programme for your degree that we published in the 2007–08 handbook, subject to the modules listed in that study programme still being available and appropriate. The appropriate study programmes will be available on the web.
When might the general regulations not apply?
We can suspend the regulations, as outlined in the following study programmes, if necessary in special cases.

If you change study programme we will allow you to take more than 150 credits (10 course units) at level 4 if this is necessary to meet the requirements of your new programme and you have written agreement from the programme director for the new programme.

If you take a year abroad, we will not require you to pass the full number of Queen Mary credits, although we may require you to meet an equivalent requirement from your year abroad.

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 the degree title "Mathematical Studies". Failure to pass specific modules will affect only the title and not the class of your degree.

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 code appears in place of the UCAS code on a few College documents, such as module 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>

Guidance for students in the first year

What is Essential Mathematical Skills?
Essential Mathematical Skills is a progression hurdle, which you must pass in order to progress from the first to the second year of any Mathematical Sciences degree programme, i.e. those listed in the rest of this part of the handbook. It does not contribute to your progression or degree classification in any other way although it will appear on your results transcript. If you are in your first year then you must register for Essential Mathematical Skills in addition to the other eight modules shown on your study programme. (In fact, we should automatically pre-register you for all nine modules.)

We will allow you seven attempts at the Essential Mathematical Skills exam during your first year. As soon as you pass, you can stop attending the module and you will not need to take the exam again. You will have three attempts during the first semester and one attempt towards the end of January. These all count as first attempts and if you pass, your transcript will show a mark of 100% and an A grade. If you pass later, your transcript will show a mark of 40% (a bare pass) and an E grade. Hence, your transcript will look better if you pass Essential Mathematical Skills before the end of January.

Note that you should take Essential Mathematical Skills only if your home department is the School of Mathematical Sciences, i.e. if you are registered for one of the study programmes G100, G110, GG31, G1N1, GN13, GL11, G1L1, GG14, FG31, G102 or G1G3. In particular, you should not take Essential Mathematical Skills if you are registered for one of the study programmes LG11 or GG41. Students who have progressed from the SEFP and already passed Essential Foundation Mathematics must still pass Essential Mathematical Skills, which covers different, although similar, material.
Guidance for students in the second and later years

Can I take modules not listed in my study programme?
The study programmes list only the modules that you must take. In principle, you can take any additional modules you choose to make up 60 credits (4 course units) per semester provided:

- the department teaching the module will allow you to take it (see below);
- you satisfy the prerequisites;
- it does not overlap with any module you have already taken, are taking or must take later;
- your adviser agrees.

If you want to take an intercollegiate module then (except for I24001) you also require the approval of the Senior Tutor and Registry.

Can I take Business Management modules?
You can take Business Management (BUS) modules only if your study programme is G1N1, GN13 or G1L1 and it shows the modules as compulsory. The Business Management modules in our study programmes are all compulsory and there are no Business Management options or electives. 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 Economics modules?
You can take Economics (ECN) modules only if either your study programme is GL11, or your study programme is GN13 or G1L1 and the current version for you shows the modules as compulsory. 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.

How are credits, course units and modules related?
The Queen Mary Academic Credit Framework comes into effect for students entering Queen Mary in September 2008 and defines academic credit in such a way that 15 academic credit points (credits) are equivalent to 1 course unit. Queen Mary is phasing out the term “course unit”, but we have retained it temporarily in this handbook for the benefit of continuing students. We now call the smallest unit of teaching a module. All modules offered by the School of Mathematical Sciences are worth 15 credits except for the Advanced Statistics Project and the MSci Project, which are “double modules” and carry 30 credits.

How have levels changed?
The Queen Mary Academic Credit Framework (QMACF) redefines the academic level of a module to be the old level plus 3. We use new levels in the following study programmes and show the level of each module explicitly in square brackets between the module code and title. There are requirements on the numbers of credits (course units) that you must take at various levels, which we have incorporated into the current study programmes.

Can I take level-4 (old level-1) modules in my final year?
Yes, provided you satisfy the requirements of your study programme (see above). However, you are less likely to benefit from the exam board’s discretion to push you up if you end up close to a degree class borderline than if you take only modules at level 5 or higher. If you began your undergraduate course in September 2007 or later then you cannot take more than 150 credits (10 course units) overall at level 3 or 4, which means at most 30 credits (2 course units) after your first year. If you began your undergraduate course in September 2006 or earlier then you are not subject to this restriction.
G100 BSc in Mathematics

Programme director: Professor L H Soicher

To obtain a BSc degree:

- You must take 360 credits (24 course units of 15 credits each) including no more than 30 credits (2 course units) at level 3, no more than 150 credits (10 course units) at level 3 or 4, and no fewer than 90 credits (6 course units) at level 6 or higher.
- You must pass at least 270 credits (18 course units) at level 4 or higher. Special regulations apply if you take a year abroad.

To obtain a BSc in Mathematics:

- You must pass Essential Mathematical Skills, which is a 0-credit level-3 core module, to progress from the first to the second year of this programme.
- You must take all compulsory modules and the required number of compulsory options shown in the outline programme.
- At least ¾ of the credits you pass must be from MTH modules.

If you graduate but fail to meet these requirements then your degree title may be "Mathematical Studies".

Outline programme

Modules in bold are compulsory and must normally be taken in the year shown. Exceptionally, you may take some compulsory modules outside the year shown subject to prerequisites. You are required to take modules to the value of 120 credits (8 course units) in each developmental year. The value of each module is 15 credits (1 course unit) unless otherwise indicated. Levels are shown in square brackets.

Year 1 – take the following modules:

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
</table>

Year 2 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTH5112 [5] Linear Algebra I</td>
<td>Take at least two of:</td>
</tr>
<tr>
<td>Take at least two of:</td>
<td>MTH5100 [5] Algebraic Structures I</td>
</tr>
<tr>
<td></td>
<td>Take at least one of:</td>
</tr>
<tr>
<td></td>
<td>MTH6105 [6] Algorithmic Graph Theory</td>
</tr>
<tr>
<td></td>
<td>MTH6128 [6] Number Theory</td>
</tr>
<tr>
<td></td>
<td>MTH6129 [6] Oscillations, Waves &amp; Patterns</td>
</tr>
</tbody>
</table>

Year 3 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take enough MTH modules at level 6 or 7 to have at least 90 credits (6 course units) overall in the degree programme.</td>
<td></td>
</tr>
</tbody>
</table>
**G110 BSc in Pure Mathematics**

Programme director: Professor L H Soicher  
QM code: G11A

### To obtain a BSc degree:
- You must take 360 credits (24 course units of 15 credits each) including no more than 30 credits (2 course units) at level 3, no more than 150 credits (10 course units) at level 3 or 4, and no fewer than 90 credits (6 course units) at level 6 or higher.
- You must pass at least 270 credits (18 course units) at level 4 or higher. Special regulations apply if you take a year abroad.

### To obtain a BSc in Pure Mathematics:
- You must pass Essential Mathematical Skills, which is a 0-credit level-3 core module, to progress from the first to the second year of this programme.
- You must take all compulsory modules and the required number of compulsory options shown in the outline programme.
- At least ¾ of the credits you pass must be from MTH modules.

If you graduate but fail to meet these requirements then your degree title may be “Mathematical Studies”.

### Outline programme

Modules in **bold** are compulsory and must normally be taken in the year shown. Exceptionally, you may take some compulsory modules outside the year shown subject to prerequisites. You are required to take modules to the value of 120 credits (8 course units) in each developmental year.

The value of each module is 15 credits (1 course unit) unless otherwise indicated. Levels are shown in square brackets.

#### Year 1 – take the following modules:

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MTH3100 [3]</strong> Essential Mathematical Skills (core)</td>
<td><strong>MTH4101 [4]</strong> Calculus II</td>
</tr>
<tr>
<td><strong>MTH4100 [4]</strong> Calculus I</td>
<td><strong>MTH4106 [4]</strong> Introduction to Statistics</td>
</tr>
<tr>
<td><strong>MTH4108 [4]</strong> Probability I</td>
<td><strong>MTH4102 [4]</strong> Differential Equations</td>
</tr>
<tr>
<td><strong>MTH4103 [4]</strong> Geometry I</td>
<td><strong>MTH4104 [4]</strong> Introduction to Algebra</td>
</tr>
<tr>
<td><strong>MTH4105 [4]</strong> Intro. to Math. Computing</td>
<td></td>
</tr>
</tbody>
</table>

#### Year 2 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MTH5104 [5]</strong> Convergence &amp; Continuity</td>
<td><strong>MTH5100 [5]</strong> Algebraic Structures I</td>
</tr>
<tr>
<td><strong>MTH5112 [5]</strong> Linear Algebra I</td>
<td><strong>MTH5103 [5]</strong> Complex Variables</td>
</tr>
<tr>
<td><strong>MTH5117 [5]</strong> Mathematical Writing</td>
<td><strong>MTH5105 [5]</strong> Differential &amp; Integral Analysis</td>
</tr>
<tr>
<td></td>
<td>Take one of:</td>
</tr>
<tr>
<td></td>
<td><strong>MTH6105 [6]</strong> Algorithmic Graph Theory</td>
</tr>
<tr>
<td></td>
<td><strong>MTH6128 [6]</strong> Number Theory</td>
</tr>
</tbody>
</table>

#### Year 3 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Take enough MTH modules at level 6 or 7 to have at least 90 credits (6 course units) overall in the degree programme, including at least three from the lists below:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>MTH6109 [6]</strong> Combinatorics</td>
<td><strong>MTH6108 [6]</strong> Coding Theory</td>
</tr>
<tr>
<td><strong>MTH6104 [6]</strong> Algebraic Structures II</td>
<td><strong>MTH6115 [6]</strong> Cryptography</td>
</tr>
<tr>
<td><strong>MTH6107 [6]</strong> Chaos &amp; Fractals</td>
<td><strong>MTH6111 [6]</strong> Complex Analysis (not offered 2008-09)</td>
</tr>
<tr>
<td><strong>MTH6140 [6]</strong> Linear Algebra II</td>
<td><strong>MTH733U [7]</strong> Fields and Galois Theory (not offered 2008-09)</td>
</tr>
<tr>
<td><strong>MTH6126 [6]</strong> Metric Spaces</td>
<td></td>
</tr>
</tbody>
</table>
G300 BSc in Statistics
(for continuing students entering in 2007–08 or earlier)

Programme director: Dr H Grossmann

To obtain a BSc degree:

• You must take 360 credits (24 course units of 15 credits each) including no more than 30 credits (2 course units) at level 3, no more than 150 credits (10 course units) at level 3 or 4, and no fewer than 90 credits (6 course units) at level 6 or higher.

• You must pass at least 270 credits (18 course units) at level 4 or higher. Special regulations apply if you take a year abroad.

To obtain a BSc in Statistics:

• You must pass Essential Mathematical Skills, which is a 0-credit level-3 core module, to progress from the first to the second year of this programme.

• You must take all compulsory modules and the required number of compulsory options shown in the outline programme.

• At least ¾ of the credits you pass must be from MTH modules.

If you graduate but fail to meet these requirements then your degree title may be “Mathematical Studies”.

Outline programme

Modules in bold are compulsory and must normally be taken in the year shown. Exceptionally, you may take some compulsory modules outside the year shown subject to prerequisites. You are required to take modules to the value of 120 credits (8 course units) in each developmental year. The value of each module is 15 credits (1 course unit) unless otherwise indicated. Levels are shown in square brackets.

Year 2 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTH5119 [5] Sampling, Surveys &amp; Simulation</td>
<td></td>
</tr>
</tbody>
</table>

Year 3 – take modules worth 120 credits (8 course units) in total including the following:

Take at least five course units from the lists below:

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTH6131U [7] Computational Statistics</td>
<td>(not offered 2008-09)</td>
</tr>
<tr>
<td>MTH709U [7] Bayesian Statistics</td>
<td></td>
</tr>
<tr>
<td>MTH6103 [6] Advanced Statistics Project (30 credits) (2 course units over both semesters)</td>
<td></td>
</tr>
</tbody>
</table>
GG31 BSc in Mathematics and Statistics

Programme director: Dr H Grossmann

To obtain a BSc degree:
- You must take 360 credits (24 course units of 15 credits each) including no more than 30 credits (2 course units) at level 3, no more than 150 credits (10 course units) at level 3 or 4, and no fewer than 90 credits (6 course units) at level 6 or higher.
- You must pass at least 270 credits (18 course units) at level 4 or higher. Special regulations apply if you take a year abroad.

To obtain a BSc in Mathematics and Statistics:
- You must pass Essential Mathematical Skills, which is a 0-credit level-3 core module, to progress from the first to the second year of this programme.
- You must take all compulsory modules and the required number of compulsory options shown in the outline programme.
- At least ¾ of the credits you pass must be from MTH modules.
  If you graduate but fail to meet these requirements then your degree title may be “Mathematical Studies”.

Outline programme

Modules in bold are compulsory and must normally be taken in the year shown. Exceptionally, you may take some compulsory modules outside the year shown subject to prerequisites. You are required to take modules to the value of 120 credits (8 course units) in each developmental year. The value of each module is 15 credits (1 course unit) unless otherwise indicated. Levels are shown in square brackets.

Year 1 – take the following modules:

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
</table>

Year 2 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
</table>

Take at least two modules from the lists below:

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MTH6105 [6] Algorithmic Graph Theory</td>
</tr>
</tbody>
</table>

Year 3 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Take enough modules at level 6 or 7 to have at least 90 credits (6 course units) overall in the degree programme, of which at least 60 credits must be from MTH modules including at least three from the lists below:

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MTH731U [7] Computational Statistics</td>
</tr>
<tr>
<td></td>
<td>MTH709U [7] Bayesian Statistics</td>
</tr>
</tbody>
</table>
G1N1 BSc in Mathematics with Business Management

Programme director: Dr L Rass

To obtain a BSc degree:
- You must take 360 credits (24 course units of 15 credits each) including no more than 30 credits (2 course units) at level 3, no more than 150 credits (10 course units) at level 3 or 4, and no fewer than 90 credits (6 course units) at level 6 or higher.
- You must pass at least 270 credits (18 course units) at level 4 or higher. Special regulations apply if you take a year abroad.

To obtain a BSc in Mathematics with Business Management:
- You must pass Essential Mathematical Skills, which is a 0-credit level-3 core module, to progress from the first to the second year of this programme.
- You must take all compulsory modules and the required number of compulsory options shown in the outline programme.
- At least ½ of the credits you pass must be from MTH modules and at least ¼ of the credits you pass must be from BUS modules.

If you graduate but fail to meet these requirements then your degree title may be “Mathematical Studies”.

Outline programme

Modules in bold are compulsory and must normally be taken in the year shown. Exceptionally, you may take some compulsory modules outside the year shown subject to prerequisites. You are required to take modules to the value of 120 credits (8 course units) in each developmental year. The value of each module is 15 credits (1 course unit) unless otherwise indicated. Levels are shown in square brackets.

Year 1 – take the following modules:

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
</table>

Year 2 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Take at least three modules from the lists below:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MTH6129 [6] Oscillations, Waves &amp; Patterns</td>
</tr>
</tbody>
</table>

Year 3 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take enough modules at level 6 or 7 to have at least 90 credits (6 course units) overall in the degree programme, of which at least 60 credits (4 course units) must be from MTH modules.</td>
<td></td>
</tr>
</tbody>
</table>
GN13 BSc in Mathematics, Business Management and Finance (for new students entering in 2008–09 or later)

Programme director: Dr L Rass

To obtain a BSc degree:

- You must take 360 credits (24 course units of 15 credits each) including no more than 30 credits (2 course units) at level 3, no more than 150 credits (10 course units) at level 3 or 4, and no fewer than 90 credits (6 course units) at level 6 or higher.
- You must pass at least 270 credits (18 course units) at level 4 or higher. Special regulations apply if you take a year abroad.

To obtain a BSc in Mathematics, Business Management and Finance:

- You must pass Essential Mathematical Skills, which is a 0-credit level-3 core module, to progress from the first to the second year of this programme.
- You must take all compulsory modules and the required number of compulsory options shown in the outline programme.
- At least \( \frac{1}{3} \) of the credits you pass must be from MTH modules, at least \( \frac{2}{3} \) of the credits you pass must be from BUS modules, and no more than \( \frac{1}{4} \) of the credits you pass may have module codes other than MTH or BUS.

If you graduate but fail to meet these requirements then your degree title may be “Mathematical Studies”.

Outline programme

Modules in **bold** are compulsory and must normally be taken in the year shown. Exceptionally, you may take some compulsory modules outside the year shown subject to prerequisites. You are required to take modules to the value of 120 credits (8 course units) in each developmental year. The value of each module is 15 credits (1 course unit) unless otherwise indicated. Levels are shown in square brackets.

**Year 1** – take the following modules:

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
</table>

**Year 2** – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUS022 [5] Managerial Accounting</td>
<td></td>
</tr>
</tbody>
</table>

**Year 3** – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUS306 [6] Financial Management</td>
<td>Take at least one from:</td>
</tr>
</tbody>
</table>

Take enough modules at level 6 or 7 to have at least 90 credits (6 course units) overall in the degree programme, of which at least 60 credits (4 course units) must be from MTH modules including at least one from the lists below:

- MTH6134 [6] Statistical Modelling II
GN13 BSc in Mathematics, Business Management and Finance (for continuing students entering in 2007–08 or earlier)

Programme director: Dr L Rass

To obtain a BSc degree:
- You must take 360 credits (24 course units of 15 credits each) including no more than 30 credits (2 course units) at level 3, no more than 150 credits (10 course units) at level 3 or 4, and no fewer than 90 credits (6 course units) at level 6 or higher.
- You must pass at least 270 credits (18 course units) at level 4 or higher. Special regulations apply if you take a year abroad.

To obtain a BSc in Mathematics, Business Management and Finance:
- You must pass Essential Mathematical Skills, which is a 0-credit level-3 core module, to progress from the first to the second year of this programme.
- You must take all compulsory modules and the required number of compulsory options shown in the outline programme.
- At least ⅔ of the credits you pass must be from MTH modules, at least ⅔ of the credits you pass must be from BUS or ECN modules, and no more than ¼ of the credits you pass may have module codes other than MTH/ECN/BUS.

If you graduate but fail to meet these requirements then your degree title may be “Mathematical Studies”.

Outline programme

Modules in bold are compulsory and must normally be taken in the year shown. Exceptionally, you may take some compulsory modules outside the year shown subject to prerequisites. You are required to take modules to the value of 120 credits (8 course units) in each developmental year. The value of each module is 15 credits (1 course unit) unless otherwise indicated. Levels are shown in square brackets.

Year 2 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
</table>

Year 3 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take enough modules at level 6 or 7 to have at least 90 credits (6 course units) overall in the degree programme, of which at least 60 credits must be from MTH modules including at least two from the lists below:</td>
<td></td>
</tr>
</tbody>
</table>
GL11 BSc in Mathematics, Statistics and Financial Economics

Programme director: Dr L Rass

To obtain a BSc degree:

- You must take 360 credits (24 course units of 15 credits each) including no more than 30 credits (2 course units) at level 3, no more than 150 credits (10 course units) at level 3 or 4, and no fewer than 90 credits (6 course units) at level 6 or higher.
- You must pass at least 270 credits (18 course units) at level 4 or higher. Special regulations apply if you take a year abroad.

To obtain a BSc in Mathematics, Statistics and Financial Economics:

- You must pass Essential Mathematical Skills, which is a 0-credit level-3 core module, to progress from the first to the second year of this programme.
- You must take all compulsory modules and the required number of compulsory options shown in the outline programme.
- At least ½ of the credits you pass must be from MTH modules, at least ⅔ of the credits you pass must be from ECN modules, and no more than ¼ of the credits you pass may be in subjects not related to mathematics, statistics, or financial economics.

If you graduate but fail to meet these requirements then your degree title may be “Mathematical Studies”.

Outline programme

Modules in bold are compulsory and must normally be taken in the year shown. Exceptionally, you may take some compulsory modules outside the year shown subject to prerequisites. You are required to take modules to the value of 120 credits (8 course units) in each developmental year. The value of each module is 15 credits (1 course unit) unless otherwise indicated. Levels are shown in square brackets.

Year 1 – take the following modules:

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
</table>

Year 2 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
</table>

Year 3 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECN314 [6] Investment Analysis</td>
<td>Take at least one of:</td>
</tr>
<tr>
<td></td>
<td>ECN210 [5] Corporate Finance</td>
</tr>
<tr>
<td></td>
<td>ECN358 [6] Futures and Options</td>
</tr>
<tr>
<td></td>
<td>Take at least a further 15 ECN credits (1 course unit) at level 6.</td>
</tr>
<tr>
<td></td>
<td>Take at least two modules from the lists below:</td>
</tr>
<tr>
<td></td>
<td>MTH731U [7] Computational Statistics</td>
</tr>
</tbody>
</table>

(not offered 2008-09)
G1L1 BSc in Mathematics and Statistics with Finance
(for new students entering in 2008–09 or later)

(Also offered as G1N4 Mathematics with Finance and Accounting from 2009–10 entry)
Programme director: Dr L Rass

To obtain a BSc degree:

- You must take 360 credits (24 course units of 15 credits each) including no more than 30 credits (2 course units) at level 3, no more than 150 credits (10 course units) at level 3 or 4, and no fewer than 90 credits (6 course units) at level 6 or higher.
- You must pass at least 270 credits (18 course units) at level 4 or higher. Special regulations apply if you take a year abroad.

To obtain a BSc in Mathematics and Statistics with Finance:

- You must pass Essential Mathematical Skills, which is a 0-credit level-3 core module, to progress from the first to the second year of this programme.
- You must take all compulsory modules and the required number of compulsory options shown in the outline programme.
- At least ½ of the credits you pass must be from MTH modules and at least ¼ of the credits you pass must be from BUS modules.

If you graduate but fail to meet these requirements then your degree title may be “Mathematical Studies”.

Outline programme
Modules in bold are compulsory and must normally be taken in the year shown. Exceptionally, you may take some compulsory modules outside the year shown subject to prerequisites. You are required to take modules to the value of 120 credits (8 course units) in each developmental year. The value of each module is 15 credits (1 course unit) unless otherwise indicated. Levels are shown in square brackets.

Year 1 – take the following modules:

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
</table>

Year 2 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
</table>

Year 3 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
</table>

Take enough modules at level 6 or 7 to have at least 90 credits (6 course units) overall in the degree programme, of which at least 60 credits (4 course units) must be from MTH modules including at least two from the lists below:

- MTH6134 [6] Statistical Modelling II
- MTH6130 [6] Probability III
- **MTH6116 [6] Design of Experiments**
- **MTH6130 [6] Probability III**
G1L1 BSc in Mathematics and Statistics with Finance (for continuing students entering in 2007–08 or earlier)

Programme director: Dr L Rass

To obtain a BSc degree:
- You must take 360 credits (24 course units of 15 credits each) including no more than 30 credits (2 course units) at level 3, no more than 150 credits (10 course units) at level 3 or 4, and no fewer than 90 credits (6 course units) at level 6 or higher.
- You must pass at least 270 credits (18 course units) at level 4 or higher. Special regulations apply if you take a year abroad.

To obtain a BSc in Mathematics and Statistics with Finance:
- You must pass Essential Mathematical Skills, which is a 0-credit level-3 core module, to progress from the first to the second year of this programme.
- You must take all compulsory modules and the required number of compulsory options shown in the outline programme.
- At least ½ of the credits you pass must be from MTH modules and at least ¼ of the credits you pass must be from ECN and BUS modules.

If you graduate but fail to meet these requirements then your degree title may be “Mathematical Studies”.

Outline programme
Modules in bold are compulsory and must normally be taken in the year shown. Exceptionally, you may take some compulsory modules outside the year shown subject to prerequisites. You are required to take modules to the value of 120 credits (8 course units) in each developmental year. The value of each module is 15 credits (1 course unit) unless otherwise indicated. Levels are shown in square brackets.

Year 2 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
</table>

Year 3 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
</table>

Take enough modules at level 6 or 7 to have at least 90 credits (6 course units) overall in the degree programme, of which at least 60 credits (4 course units) must be from MTH modules including at least two from the lists below:

|-------------------------|---------------------------------|
GG14 BSc in Mathematics and Computing

Programme director: Professor M A H MacCallum  
QM code: GG1E

To obtain a BSc degree:

- You must take 360 credits (24 course units of 15 credits each) including no more than 30 credits (2 course units) at level 3, no more than 150 credits (10 course units) at level 3 or 4, and no fewer than 90 credits (6 course units) at level 6 or higher.
- You must pass at least 270 credits (18 course units) at level 4 or higher. Special regulations apply if you take a year abroad.

To obtain a BSc in Mathematics and Computing:

- You must pass Essential Mathematical Skills, which is a 0-credit level-3 core module, to progress from the first to the second year of this programme.
- You must take all compulsory modules and the required number of compulsory options shown in the outline programme.
- At least \( \frac{3}{5} \) of the credits you pass must be from MTH modules, at least \( \frac{2}{5} \) of the credits you pass must be from DCS modules or MTH modules approved by the programme director to have sufficient computing content, and no more than \( \frac{1}{4} \) of the credits you pass may be in subjects not related to mathematics or computing.

If you graduate but fail to meet these requirements then your degree title may be “Mathematical Studies”.

Outline programme

Modules in **bold** are compulsory and must normally be taken in the year shown. Exceptionally, you may take some compulsory modules outside the year shown subject to prerequisites. You are required to take modules to the value of 120 credits (8 course units) in each developmental year. The value of each module is 15 credits (1 course unit) unless otherwise indicated. Levels are shown in square brackets.

**Year 1** – take the following modules:

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCS100 [4] Procedural Programming</td>
<td>Take one of:</td>
</tr>
<tr>
<td></td>
<td>MTH4106 [4] Introduction to Statistics</td>
</tr>
</tbody>
</table>

**Year 2** – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCS210 [5] Algorithms and Data</td>
<td>Take at least one module from the lists below:</td>
</tr>
<tr>
<td></td>
<td>MTH5102 [5] Calculus III</td>
</tr>
<tr>
<td></td>
<td>MTH5118 [5] Probability II</td>
</tr>
<tr>
<td></td>
<td>MTH5103 [5] Complex Variables</td>
</tr>
<tr>
<td></td>
<td>In addition, take at least one of:</td>
</tr>
<tr>
<td></td>
<td>MTH6105 [6] Algorithmic Graph Theory</td>
</tr>
<tr>
<td></td>
<td>MTH6128 [6] Number Theory</td>
</tr>
</tbody>
</table>

**Year 3** – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take enough MTH modules at level 6 or 7 to have at least 75 credits (5 course units) overall in the degree programme. Take enough DCS modules to have at least 15 credits (1 course unit) at level 5 or higher together with at least 15 credits (1 course unit) at level 6 or higher. (Approval from the Department of Computer Science may be required for some DCS modules.)</td>
<td></td>
</tr>
</tbody>
</table>
FG31 BSc in Mathematics and Physics

Programme director: Professor M A H MacCallum

To obtain a BSc degree:
- You must take 360 credits (24 course units of 15 credits each) including no more than 30 credits (2 course units) at level 3, no more than 150 credits (10 course units) at level 3 or 4, and no fewer than 90 credits (6 course units) at level 6 or higher.
- You must pass at least 270 credits (18 course units) at level 4 or higher. Special regulations apply if you take a year abroad.

To obtain a BSc in Mathematics and Physics:
- You must pass Essential Mathematical Skills, which is a 0-credit level-3 core module, to progress from the first to the second year of this programme.
- You must take all compulsory modules and the required number of compulsory options shown in the outline programme.
- At least \( \frac{1}{2} \) of the credits you pass must be from MTH modules, at least \( \frac{1}{2} \) of the credits you pass must be from PHY modules or MTH modules approved by the programme director to have sufficient physics content, and no more than \( \frac{1}{4} \) of the credits you pass may be in subjects not related to mathematics or physics.

If you graduate but fail to meet these requirements then your degree title may be “Mathematical Studies”.

Outline programme

Modules in bold are compulsory and must normally be taken in the year shown. Exceptionally, you may take some compulsory modules outside the year shown subject to prerequisites. You are required to take modules to the value of 120 credits (8 course units) in each developmental year. The value of each module is 15 credits (1 course unit) unless otherwise indicated. Levels are shown in square brackets.

Year 1 – take the following modules:

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
</table>

Year 2 – take the following modules:

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
</table>

Year 3 – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take enough MTH/PHY modules at level 6 or 7 to have at least 90 credits (6 course units) overall in the degree programme, including those shown below: PHY403 [6] Statistical Physics</td>
<td>Take exactly one of:</td>
</tr>
<tr>
<td>PHY776 [6] Extended Independent Project (30 credits, 2 course units)</td>
<td></td>
</tr>
</tbody>
</table>
# G102 MSci in Mathematics

Programme director: Professor L H Soicher

## Degree requirements

- You must take 480 credits (32 course units of 15 credits each) including no more than 30 credits (2 course units) at level 3, no more than 150 credits (10 course units) at level 3 or 4, and no fewer than 90 credits (6 course units) at level 7.
- You must pass Essential Mathematical Skills, which is a 0-credit level-3 core module, to progress from the first to the second year of this programme.
- You must pass at least 420 MTH credits (28 course units) at level 4 or higher or other approved modules, and comply with the outline programme.
- You must pass the MSci Project and in addition at least 60 MTH credits (4 course units) at level 7 or approved MSc modules at Queen Mary or other colleges of the University of London.

If you graduate but fail to meet these requirements then your degree title may be "Mathematical Studies".

## Outline programme

Modules in **bold** are compulsory and must normally be taken in the year shown. Exceptionally, you may take some compulsory modules outside the year shown subject to prerequisites. You are required to take modules to the value of 120 credits (8 course units) in each developmental year. The value of each module is 15 credits (1 course unit) unless otherwise indicated. Levels are shown in square brackets.

**Year 1** – take the following modules:

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MTH3100 [3]</strong> Essential Mathematical Skills (core)</td>
<td><strong>MTH4101 [4]</strong> Calculus II</td>
</tr>
<tr>
<td><strong>MTH4100 [4]</strong> Calculus I</td>
<td><strong>MTH4106 [4]</strong> Introduction to Statistics</td>
</tr>
<tr>
<td><strong>MTH4108 [4]</strong> Probability I</td>
<td><strong>MTH4102 [4]</strong> Differential Equations</td>
</tr>
<tr>
<td><strong>MTH4103 [4]</strong> Geometry I</td>
<td><strong>MTH4104 [4]</strong> Introduction to Algebra</td>
</tr>
<tr>
<td><strong>MTH4105 [4]</strong> Intro. to Math. Computing</td>
<td></td>
</tr>
</tbody>
</table>

**Year 2** – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MTH5104 [5]</strong> Convergence &amp; Continuity</td>
<td><strong>MTH5100 [5]</strong> Algebraic Structures I</td>
</tr>
<tr>
<td><strong>MTH5112 [5]</strong> Linear Algebra I</td>
<td><strong>MTH5105 [5]</strong> Differential &amp; Integral Analysis</td>
</tr>
<tr>
<td><strong>MTH5117 [5]</strong> Mathematical Writing</td>
<td></td>
</tr>
</tbody>
</table>

Take at least **two** modules from the lists below:

- **MTH5102 [5]** Calculus III
- **MTH5106 [5]** Dynamics of Physical Systems
- **MTH5118 [5]** Probability II
- **MTH5103 [5]** Complex Variables
- **MTH5109 [5]** Geometry II: Knots and Surfaces
- **MTH5120 [5]** Statistical Modelling I
- **MTH5110 [5]** Intro. to Numerical Computing
- **MTH6129 [6]** Oscillations, Waves & Patterns
- **MTH6136 [6]** Statistical Theory
- **MTH6108 [6]** Coding Theory
- **MTH6111 [6]** Complex Analysis *(not offered 2008-09)*
- **MTH6115 [6]** Cryptography
- **MTH6130 [6]** Probability III
- **MTH6123 [6]** Math. Aspects of Cosmology
- **MTH6119 [6]** Fluid Dynamics
- **MTH6122 [6]** Linear Ops. & Diff. Equations
- **MTH6128 [6]** Number Theory
- **MTH6109 [6]** Combinatorics
- **MTH6140 [6]** Linear Algebra II
- **MTH6123 [6]** Math. Aspects of Cosmology
- **MTH6132 [6]** Relativity
- **MTH6126 [6]** Metric Spaces
- **MTH6130 [6]** Probability III
- **MTH6129 [6]** Oscillations, Waves & Patterns
- **MTH6136 [6]** Statistical Theory
- **MTH6105 [6]** Algorithmic Graph Theory
- **MTH6111 [6]** Complex Analysis *(not offered 2008-09)*
- **MTH6115 [6]** Cryptography
- **MTH6130 [6]** Probability III
- **MTH6123 [6]** Math. Aspects of Cosmology
- **MTH6128 [6]** Number Theory
- **MTH6109 [6]** Combinatorics
- **MTH6140 [6]** Linear Algebra II
- **MTH6123 [6]** Math. Aspects of Cosmology
- **MTH6132 [6]** Relativity
- **MTH6126 [6]** Metric Spaces
- **MTH733U [7]** Fields and Galois Theory *(not offered 2008-09)*

**Year 3** – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MTH6109 [6]</strong> Combinatorics</td>
<td><strong>MTH6108 [6]</strong> Coding Theory</td>
</tr>
<tr>
<td><strong>MTH6104 [6]</strong> Algebraic Structures II</td>
<td><strong>MTH6111 [6]</strong> Complex Analysis <em>(not offered 2008-09)</em></td>
</tr>
<tr>
<td><strong>MTH6107 [6]</strong> Chaos &amp; Fractals</td>
<td><strong>MTH6115 [6]</strong> Cryptography</td>
</tr>
<tr>
<td><strong>MTH6140 [6]</strong> Linear Algebra II</td>
<td><strong>MTH6130 [6]</strong> Probability III</td>
</tr>
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<td><strong>MTH6132 [6]</strong> Relativity</td>
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<td><strong>MTH6122 [6]</strong> Linear Ops. &amp; Diff. Equations</td>
<td><strong>MTH6119 [6]</strong> Fluid Dynamics</td>
</tr>
<tr>
<td><strong>MTH6126 [6]</strong> Metric Spaces</td>
<td><strong>MTH733U [7]</strong> Fields and Galois Theory <em>(not offered 2008-09)</em></td>
</tr>
</tbody>
</table>

**Year 4** – take modules worth 120 credits (8 course units) in total including the following:

<table>
<thead>
<tr>
<th>Semester 7</th>
<th>Semester 8</th>
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</thead>
<tbody>
<tr>
<td><strong>MTH7109 [7]</strong> Advanced Combinatorics</td>
<td><strong>MTH7108 [7]</strong> Advanced Coding Theory</td>
</tr>
<tr>
<td><strong>MTH7104 [7]</strong> Advanced Algebraic Structures II</td>
<td><strong>MTH7111 [7]</strong> Advanced Complex Analysis <em>(not offered 2008-09)</em></td>
</tr>
<tr>
<td><strong>MTH7107 [7]</strong> Advanced Chaos &amp; Fractals</td>
<td><strong>MTH7115 [7]</strong> Advanced Cryptography</td>
</tr>
<tr>
<td><strong>MTH7140 [7]</strong> Advanced Linear Algebra II</td>
<td><strong>MTH7130 [7]</strong> Advanced Probability III</td>
</tr>
<tr>
<td><strong>MTH7132 [7]</strong> Advanced Relativity</td>
<td><strong>MTH7123 [7]</strong> Advanced Math. Aspects of Cosmology</td>
</tr>
<tr>
<td><strong>MTH7122 [7]</strong> Advanced Linear Ops. &amp; Diff. Equations</td>
<td><strong>MTH7119 [7]</strong> Advanced Fluid Dynamics</td>
</tr>
<tr>
<td><strong>MTH7126 [7]</strong> Advanced Metric Spaces</td>
<td><strong>MTH733U [7]</strong> Advanced Fields and Galois Theory <em>(not offered 2008-09)</em></td>
</tr>
</tbody>
</table>
Year 4 – take modules worth 120 credits (8 course units) in total including the following:

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<tr>
<th>Semester 7</th>
<th>Semester 8</th>
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</thead>
<tbody>
<tr>
<td>MTH717U [7] MSci Project (30 credits, 2 course units)</td>
<td></td>
</tr>
<tr>
<td>Take enough MTH modules at level 6 or 7 to have at least 210 credits (14 course units) overall in the degree programme, of which at least 90 credits (6 course units) must be at level 7 (including the MSci Project).</td>
<td></td>
</tr>
</tbody>
</table>
G1G3 MSci in Mathematics with Statistics

Programme director: Dr H Grossmann

Degree requirements

- You must take 480 credits (32 course units of 15 credits each) including no more than 30 credits (2 course units) at level 3, no more than 150 credits (10 course units) at level 3 or 4, and no fewer than 90 credits (6 course units) at level 7.
- You must pass Essential Mathematical Skills, which is a 0-credit level-3 core module, to progress from the first to the second year of this programme.
- You must pass at least 420 MTH credits (28 course units) at level 4 or higher or other approved modules, and comply with the outline programme.
- You must pass the MSci Project and in addition at least 60 MTH credits (4 course units) at level 7 or approved MSc modules at Queen Mary or other colleges of the University of London.

If you graduate but fail to meet these requirements then your degree title may be "Mathematical Studies".

Outline programme

Modules in bold are compulsory and must normally be taken in the year shown. Exceptionally, you may take some compulsory modules outside the year shown subject to prerequisites. You are required to take modules to the value of 120 credits (8 course units) in each developmental year. The value of each module is 15 credits (1 course unit) unless otherwise indicated. Levels are shown in square brackets.

Year 1 – take the following modules:

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<tr>
<th>Semester 1</th>
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Year 2 – take modules worth 120 credits (8 course units) in total including the following:

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<th>Semester 3</th>
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Year 3 – take modules worth 120 credits (8 course units) in total including the following:

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<tr>
<th>Semester 5</th>
<th>Semester 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Take at least two modules from the lists below:</td>
</tr>
<tr>
<td>MTH6140 [6] Linear Algebra II</td>
<td></td>
</tr>
</tbody>
</table>

|                                                 | Take at least three modules from the lists below: |
|                                                 | (not offered 2008-09)                           |
|                                                 | MTH731U [7] Computational Statistics            |
|                                                 | MTH709U [7] Bayesian Statistics                 |

Year 4 – take modules worth 120 credits (8 course units) in total including the following:

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<th>Semester 7</th>
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<tbody>
<tr>
<td>MTH717U [7] MSci Project (30 credits, 2 course units)</td>
<td>Take enough MTH modules at level 6 or 7 to have at least 210 credits (14 course units) overall in the degree programme, of which at least 90 credits (6 course units) must be at level 7 (including the MSci Project).</td>
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</table>
Applied Mathematics

**Level 4**
- Geometry I
- Calculus I
- Calculus II
- Differential Equations

**Level 5**
- Linear Algebra I
- Dynamics of Physical Systems
- Calculus III
- Introduction to Numerical Computing

**Level 6**
- Relativity
- Linear Operators & Differential Equations
- Mathematical Aspects of Cosmology
- Fluid Dynamics

**Level 7**
- Advanced Cosmology
- Introduction to Dynamical Systems
- The Galaxy
- Astrophysical Fluid Dynamics
- Relativity & Gravitation
- Solar System
- Stellar Structure & Evolution
- Oscillations Waves Patterns
Module Details

Modules are listed alphabetically by module name. Further information, including general descriptions, timetable and room information, and links to module organisers’ web pages, is available on the departmental website. Timetable and room information is also available on the student notice boards.

MTH6100 Actuarial Mathematics
Organiser Dr R Harris
Level 6 Credit value 15 Semester B
Assessment 10% in-term, 90% final exam
Prerequisites MTH4100/MAS115 Calculus I, MTH4101/MAS125 Calculus II, MTH4108/MAS108 Probability I and MTH5118/MAS228 Probability II
Overlaps MAS224 Actuarial Mathematics

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 functions; the LT as model of cohort experience or stationary distribution; survival probabilities in terms of LTs. Reference to actual populations: tables of annuitants and assured lives. Select LTs.
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 Contingencies (Heinemann)
- Bowers, Gerber, Hickman et al., Actuarial Mathematics (SoA)
- Pollard, Mathematical Models for the Growth of Human Populations (CUP)

MTH702U Advanced Algorithmic Mathematics
Organiser Dr J N Bray
Level 7 Credit value 15 Semester B
Assessment 100% final exam
Prerequisites Consult the module organiser
Overlaps MAS400 Advanced Algorithmic Mathematics

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 (multi-variate) 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
Main text
- J von zur Gathen & J Gerhard, Modern Computer Algebra (CUP)
MTH703U Advanced Cosmology
Organiser Professor J E Lidsey
Level 7 Credit value 15 Semester A
Assessment 100% final exam
Prerequisites MTH4101/MAS125 Calculus II, MTH4102/MAS118 Differential Equations and MTH5106/MAS226 Dynamics of Physical Systems
Overlaps MAS401 Advanced Cosmology

Syllabus
- Observational basis for cosmological theories. Derivation of Friedmann models and their properties.
- Cosmological tests: source counts; flux-redshift and luminosity-volume diagrams; integrated background radiation; evolution.
- Observational cosmology: the distance scale and the Hubble constant; the age of the Universe; the density parameter.
- Physics of the Big Bang: cosmological nucleo-synthesis; the cosmic microwave background radiation (CMBR); the decoupling era; large and small scale anisotropy in the CMBR; galaxy formation: the growth of fluctuations; effect of hot and cold dark matter; viable galaxy formation scenarios.
- The very early Universe: phase transitions; inflation; cosmic strings.
- The intergalactic medium: evidence from X-ray and microwave backgrounds, absorption-line systems in quasar spectra; Gunn-Peterson effect; role of dust in pre-galactic era; the Sunyaev-Zel’dovich effect.

MTH6103 Advanced Statistics Project
Organiser Dr L Rass
Level 6 Credit value 30 Semester A and B
Assessment Written report, presentation and (possibly) oral exam
Prerequisites At least another 30 credits of level-6 statistics. Before registering you must consult the module organiser.
Overlaps MAS332 Advanced Statistics Project

Syllabus
The major part of this module is an individual project on some aspect of probability or statistical theory or applied statistics. It must be your 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.
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.

The project will be assessed primarily by a written report and, at the examiners’ discretion, an oral examination, but also by a presentation of 20–30 minutes in duration, to be given towards the end of semester 6. The contribution of the presentation will be on a sliding scale that will never decrease the project mark by more than 10% or increase it by more than 20%, and provided you make a reasonable attempt at giving a presentation it will not decrease your project mark.

MTH5100 Algebraic Structures I
Organiser Professor S Majid
Level 5 Credit value 15 Semester B
Assessment 10% coursework, 10% in-term test, 80% final exam
Prerequisites MTH4104/MAS117 Introduction to Algebra
Overlaps MAS201 Algebraic Structures I

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


Books
Reading list
• P J Cameron, Introduction to Algebra (Oxford)

MTH6104 Algebraic Structures II
Organiser Dr J N Bray
Level 6 Credit value 15 Semester A
Assessment 10% in-term, 90% final exam
Prerequisites MTH5100/MAS201 Algebraic Structures I
Overlaps MAS305 Algebraic Structures II

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
• P J Cameron, Introduction to Algebra (OUP)

Other text
• W Ledermann and A J Weir, Introduction to Group Theory, second edition (Longman)

MTH6105 Algorithmic Graph Theory
Organiser Dr P Keevash
Level 6 Credit value 15 Semester B
Assessment 10% in-term, 90% final exam
Prerequisites Either MTH4108/MAS108 Probability I or MTH4104/MAS117 Introduction to Algebra
Overlaps MAS236 Algorithmic Graph Theory, 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 texts
- Gibbons, Algorithmic Graph Theory, Cambridge University Press
- Wilson and Watkins, Graphs, An Introductory Approach, Wiley

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MTH705U Applied Statistics
Organiser Dr B Bogacka
Level 7 Credit value 15 Semester A
Assessment 3 reports (about 10–15 pages each, on separate topics), 33% each
Prerequisites MTH5120/MAS232 Statistical Modelling I, MTH6116/MAS314 Design of Experiments, MTH6139/MAS328 Time Series
Overlaps MAS421 Applied Statistics

Syllabus The semester will be divided into three four-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 module organiser before registering.

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MTH707U Astrophysical Fluid Dynamics
Organiser Dr S V Vorontsov
Level 7 Credit value 15 Semester B
Assessment 100% final exam
Prerequisites Consult the module organiser
Overlaps MAS402 Astrophysical Fluid Dynamics

Syllabus
1. Basic fluid equations: Newtonian gravity; energy equations; thermodynamics; virial theorem.
2. Simple models of astrophysical fluids and their motions; linear perturbations about equilibrium; waves; typical scales.
3. Jeans instability and star formation.
4. Theory of rotating bodies.
5. Spherically symmetric accretion; Bernoulli’s theorem; Bondi problem.
6. Viscous accretion discs; thin discs; steady discs.
7. Radial oscillation of stars; linear adiabatic wave equation; bounds on frequencies; non-adiabatic oscillations; quasi-adiabatic approximation.
8. Linear adiabatic non-radial oscillations; mode classification; JWKB method.
9. Helioseismology; asteroseismology.
10. Nonlinear acoustic waves; shocks; self-similarity solution for supernova blast wave.

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MTH708U Astrophysical Plasmas
Organiser Professor D H Burgess
Level 7 Credit value 15 Semester A
Assessment
Prerequisites Consult the module organiser
Overlaps MAS429 Astrophysical Plasmas
Syllabus A plasma is an ionized gas where the magnetic and electric field play a key role in binding the material together. Plasmas are present in almost every astrophysical environment, from the surface of pulsars to the Earth’s ionosphere. This course explores the unique properties of plasmas, such as particle gyration and magnetic reconnection. The emphasis is on the plasmas found in the Solar System, from the solar corona and solar wind to the outer reaches of the heliosphere and the interstellar medium. Fundamental astrophysical processes are explored, such as the formation of supersonic winds, magnetic energy release, and plasma coupling. The course highlights the links between the plasmas we can observe with spacecraft and the plasmas in more distant and extreme astrophysical objects.

**MTH709U Bayesian Statistics**

**Organiser** Dr L Pettit  
**Level** 7  
**Credit value** 15  
**Semester** B  
**Assessment** 100% final exam  
**Prerequisites** MTH6134/MAS339 Statistical Modelling II  
**Overlaps** MAS442 Bayesian Statistics

**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, randomised clinical trials, radiocarbon dating.

**Books**

**Main texts**

- Lee P M, Bayesian Statistics: An Introduction, (3rd Ed) Edward Arnold

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**MTH4100 Calculus I**

**Organiser** Dr R Klages  
**Level** 4  
**Credit value** 15  
**Semester** A  
**Assessment** 20% coursework and in-term tests, 80% final exam  
**Prerequisites** A-Level Mathematics or equivalent  
**Overlaps** MAS115 Calculus I, ECN114 Math. Methods in Economics and Business I

**Syllabus**


3. Limits. Calculating limits using the Limit Laws and by eliminating zero denominators algebraically. The precise definition of a limit, finding deltas algebraically for given epsilons. One-sided limits and limits at infinity. Limits involving \( \sin \frac{x}{x} \). Limits at infinity of rational functions,
Horizontal and oblique asymptotes. Infinite limits and vertical asymptotes. Continuous functions. Intermediate Value Theorem for continuous functions (without proof) and its applications.


6. Derivatives III. Indeterminate forms \((0/0, \infty/\infty, \infty - \infty)\) of limits and l’Hôpital’s Rule. Limits involving \((1 + 1/x)^x\). Logarithmic, power and exponential rates of growth. Implicit differentiation. Tangent and normals to curves defined by \(f(x, y) = 0\) or parametrically. Derivatives of inverse functions. Inverse trigonometric functions (graphs, derivatives). Hyperbolic functions (algebra of, inverse functions, derivatives, graphs).

7. Integration I. Indefinite integral as anti-derivative. Techniques for evaluating indefinite integrals. Integration by substitution and integration by parts as the reverse processes of the chain rule and product rules. First order separable differential equations. First order linear differential equations by the method of integrating factor. (Technical dexterity of evaluating integrals will be checked using test assessments.)


Books

Main text

- Calculus I and II follow Thomas’ Calculus and make use of an interactive maths web site MyMathLab, which is tied to the book. Buying this book in advance is not advisable. The book and access code for MyMathLab will be available at a discounted price in September from the QM bookshop.

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**MTH4101 Calculus II**

Organiser: Professor C D Murray

**Level 4 Credit value 15 Semester B**

Assessment: 10% coursework, 10% in-term test, 80% final exam

Prerequisites: MTH4100/MAS115 Calculus I


**Syllabus**

1. Complex numbers I: definition and their necessity for elementary operations, geometric representation, loci and regions in the complex plane, quadratic equations with real coefficients.

2. Complex numbers II: Euler’s relation (the concept of series introduced but systematic treatment deferred to Calculus III), DeMoivre’s Theorem and applications to trigonometric identities, square root and log functions. Application to integrals \(\int e^{ax} \cos(bx) \, dx\).


Part 7 – Page 6
4. Series II. Series of positive terms and the Integral Test for convergence (second look at improper integrals). The direct comparison and limit comparison tests. The ratio and root tests. Alternating series, absolute and conditional convergence (examples, Leibniz’s Theorem, estimation of the truncation error, the absolute convergence test).


Books
Main text

- Calculus I and II follow Thomas’ Calculus and make use of an interactive maths web site MyMathLab, which is tied to the book. Buying this book in advance is not advisable. The book and access code for MyMathLab will be available at a discounted price in September from the QM bookshop.

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<thead>
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<th>MTH5102 Calculus III</th>
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<tbody>
<tr>
<td><strong>Organiser</strong></td>
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<tr>
<td><strong>Level</strong></td>
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<tr>
<td><strong>Credit value</strong></td>
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<tr>
<td><strong>Semester</strong></td>
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<tr>
<td><strong>Assessment</strong></td>
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<tr>
<td><strong>Prerequisites</strong></td>
</tr>
<tr>
<td><strong>Overlaps</strong></td>
</tr>
</tbody>
</table>

**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.
6. Fourier series: full, half and arbitrary range series. Parseval’s Theorem.
Books
Main text
- Thomas’ Calculus, 11th Edition (Addison Wesley)

Other texts
- M R Spiegel, Vector Analysis (Schaum Outline Series, McGraw-Hill)
- S Simons, Vector Analysis for Mathematicians, Scientists & Engineers (Pergamon Press)

MTH6107 Chaos and Fractals
Organiser Professor C Beck
Level 6 Credit value 15 Semester A
Assessment 10% in-term, 90% final exam
Prerequisites MTH4103/MAS114 Geometry I and MTH4101/MAS125 Calculus II
Overlaps MAS308 Chaos and Fractals

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
- Beck/Schoegl, Thermodynamics of Chaotic Systems (CUP)
- D Gulick, Encounters with Chaos (McGraw Hill)

MTH6108 Coding Theory
Organiser Dr M Fayers
Level 6 Credit value 15 Semester B
Assessment 10% in-term, 90% final exam
Prerequisites MTH5112/MAS212 Linear Algebra I
Overlaps MAS309 Coding Theory

Syllabus The concept of an error-correcting code is a very important one, with wide applications in communications. This module approaches the subject from a pure-mathematics perspective, to give the student a thorough grounding in construction of codes and decoding algorithms, and the main coding theory problem.
1. Basic concepts: codes, minimum distance, equivalence of codes.
2. The Main Coding Theory Problem. The Hamming, Singleton and Plotkin bounds.
4. Linear codes. Generator matrices and parity-check matrices. Syndrome decoding. (A very brief review of the required linear algebra will be given.)
5. Examples: Hamming, Reed-Muller and MDS codes. The Gilbert-Varshamov bound.

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

Other text
• J H van Lint, Introduction to coding theory (Springer)

MTH6109 Combinatorics
Organiser Professor B Jackson
Level 6 Credit value 15 Semester A
Assessment 10% in-term, 90% final exam
Prerequisites MTH5112/MAS212 Linear Algebra I
Overlaps MAS219 Combinatorics

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
• P J Cameron, Combinatorics (CUP)

Other texts
• J H Van Lint, R M Wilson, A Course in Combinatorics (CUP)
• I Anderson, A first course in combinatorial theory (OUP)
• N L Biggs, Discrete Mathematics, Oxford Science Publication (OUP)

MTH6110 Communicating and Teaching Mathematics: the Undergraduate Ambassadors Scheme
Organiser Dr C Agnor
Level 6 Credit value 15 Semester B
Assessment Journal of teaching activity (2,500 words) 25%; end-of-unit report (2,500 words) 35%; end-of-unit presentation on “special project” (10 minutes plus 5 minutes discussion) 25%; teacher’s end-of-unit report 15%
Prerequisites Acceptance based on academic record and an interview in semester 5; consult the module organiser for details

Syllabus Students will typically begin by observing the teacher’s handling of the class and progress from this classroom assistant stage through small teaching tasks to at least one opportunity to undertake whole class teaching, possibly for a short part of a lesson. They will represent and promote mathematics as a potential university choice.
Students will undertake and evaluate a special project on the basis of discussion with the teacher. This may involve a specific in-class teaching problem or an extra-curricular project such as a lunchtime club or special coaching periods for higher ability pupils. The student will keep a journal of their own progress in working in the classroom environment, and they will be asked to submit a reflective written report on the special project and other relevant aspects of the school placement experience. This format is standard within the Undergraduate Ambassadors Scheme (http://www.uas.ac.uk/).

• Initial day of training.
• Competitive interview system to ensure students’ suitability for the module.
• Student will be matched with an appropriate school and a specific teacher in the local area.
• Student will spend the equivalent of half a day a week in the school every week for a semester.
• No formal lectures.
• A supporting tutorial for one hour once a week for students to share experiences.
• Teachers will act as the main source of guidance but students will also be able to discuss their progress with the Module Coordinator and the More Maths Grads team as needed.
• End of unit presentation of special project (15 minutes per student)

Books
You should consult:
• The National Curriculum website: http://www.nc.uk.net/home.html
• The Teacher Training Agency website: http://www.canteach.gov.uk
• The National Centre for Excellence in the Teaching of Mathematics: http://www.ncetm.org.uk
• Improving Learning in Mathematics: challenges and strategies, Malcolm Swan, which can be downloaded from http://www.maths4life.org/content.asp?CategoryId=1068

MTH5103 Complex Variables
Organiser Dr K Malik
Level 5 Credit value 15 Semester B
Assessment 10% coursework, 10% in-term test, 80% final exam
Prerequisites MTH4101/MAS125 Calculus II or equivalent
Overlaps MAS205 Complex Variables

Syllabus
1. Complex numbers, functions, limits and continuity.
2. Complex differentiation, Cauchy-Riemann equations, harmonic functions.
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
Other texts
• M R Spiegel, Complex Variables (Schaum Outline)
• R V Churchill & J.W. Brown, Complex Variables and Applications (McGraw Hill)
• H A Priestley, Introduction to Complex analysis (OUP)
• I N Stewart and D O Tall, Complex Analysis (Cambridge University Press)
• G Cain, http://www.math.gatech.edu/~cain/winter99/complex.html (Complex Analysis)
• Tristan Needham, Visual Complex Analysis (Oxford University Press)

MTH5104 Convergence and Continuity
Organiser Dr M Walters
Level 5 Credit value 15 Semester A
Assessment 10% coursework, 10% in-term test, 80% final exam
Prerequisites MTH4100/MAS115 Calculus I or equivalent
Overlaps MAS111 Convergence and Continuity

Syllabus
1. Real numbers: Algebraic properties, inequalities, supremum and infimum, completeness axiom for the existence of the supremum.
3. 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 \( \exp(x) \).
4. Real functions: Definition of limit, properties of limits.
5. 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 texts
• R Hagarty, Fundamentals of Mathematical Analysis (2nd ed.), Prentice-Hall, 1993, chapter 2 (going easy on axioms), chapters 3–5, chapter 6 (part). NB: this text does not cover sequences of functions.
• J M Howie, Real Analysis, Springer, 2001, chapters 1–3, chapter 4 (part)

MTH6115 Cryptography
Organiser Professor B Jackson
Level 6 Credit value 15 Semester B
Assessment 30% coursework, 70% final exam
Prerequisites MTH4104/MAS117 Introduction to Algebra and
             MTH5112/MAS212 Linear Algebra I
Overlaps MAS335 Cryptography
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).

Examples of optional topics which may be included: secret sharing, quantum cryptography, the Enigma cipher

Books
Reading list
• Dominic Welsh, ‘Codes and Cryptography’, Oxford University Press
• Paul Douglas Stinson, Cryptography: Theory and Practice (Chapman and Hall)

MTH6116 Design of Experiments
Organiser Dr H Grossmann
Level 6 Credit value 15 Semester B
Assessment 20% in-term, 80% final exam
Prerequisites MTH6134/MAS339 Statistical Modelling II
Overlaps MAS314 Design of Experiments
Syllabus Real life experiments will be discussed from several applications in business, especially market research, industry and science, including medicine.
1. Treatment structure: factors, main effects, interaction.
2. Completely randomised designs.
4. Row-column designs.
5. Experiments on people and animals.
6. Nested blocks, split-plot designs.
7. General orthogonal designs.
8. Incomplete-block designs.
9. Factorial designs in incomplete blocks.
Seven or eight 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
- Cox, The Planning of Experiments (Wiley)
- John, Statistical Design & Analysis of Experiments (MacMillan)
- Kempthorne, The Design & Analysis of Experiments (Wiley)
- Cochran/Cox, Experimental Design (Wiley)
- Clarke/Kempson, Introduction to the Design & Analysis of Experiments (Arnold)

MTH4102 Differential Equations
Organiser  Professor J E Lidsey
Level 4 Credit value 15 Semester B
Assessment  10% coursework, 10% in-term test, 80% final exam
Prerequisites  MTH4100/MAS115 Calculus I, MTH4103/MAS114 Geometry I
Overlaps  MAS118 Differential Equations, 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. Particularly 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 visualisation.
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 Linearisation Theorem and examples. Linearisation breakdown by examples.

Books
Main text

MTH5105 Differential and Integral Analysis
Organiser  Dr T Prellberg
Level 5 Credit value 15 Semester B
Assessment  10% coursework, 10% in-term test, 80% final exam
Prerequisites  MTH5104/MAS111 Convergence and Continuity
Overlaps  MAS221 Differential and Integral Analysis

Syllabus

2. Integration: Darboux definition of Riemann integral, simple properties. Continuous functions are integrable (via uniform continuity). 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.


Books
Main text
- R Haggerty, Fundamentals of Mathematical Analysis (Addison-Wesley)

Other texts
- C Clark, Elementary Mathematical Analysis (Wadsworth, 1982)
- M D Hatton, Mathematical Analysis (Hodder & Stoughton, 1977)
- B M Mitchell, Calculus (without analytic geometry) (Heath, 1969)

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**MTH5106 Dynamics of Physical Systems**

Organiser: Dr J Cho

**Level 5 Credit value 15 Semester A**

Assessment: 10% coursework, 10% in-term test, 80% final exam

Prerequisites: MTH4101/MAS125 Calculus II and MTH4102/MAS118 Differential Equations

Overlaps: MAS226 Dynamics of Physical Systems

**Syllabus**
Some topics may already have been met in A-level Physics or Mechanics.
- 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; (e.g. 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
Texts
- P Smith and R C Smith, Mechanics (Wiley)
- Phil Dyke & Roger Whitworth, Guide 2 Mechanics (Palgrave Mathematical Guides)

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**MTH6117 Entrepreneurship and Innovation**

Organiser: Adele Roberts-Hunt from SIMFONEC, City Research and Enterprise, City University; QM contact Dr F J Wright

**Level 6 Credit value 15 Semester A**

Assessment: 25% report (group work), 25% essay (individual), 50% final exam

Prerequisites: None, but validation is required

Overlaps: DCS341 Entrepreneurship and Innovation, PHY333 Entrepreneurship and Innovation

**Syllabus**
The aim of this module is to increase your awareness of the commercial opportunities available to you in the area of mathematical sciences. We examine how to cultivate an entrepreneurial mind set and discuss the routes available for turning your ideas into business ventures. The module provides an introduction to a number of crucial business skills such as financial planning, business planning and how to sell yourself and your ideas.
• Highlight the importance of commercialisation of innovative ideas both in the university and the industrial environment.
• Creatively explore commercial opportunities within mathematics and science.
• Introduce the different routes available to take an idea to market.
• Develop the skills required to start a business venture.
• Explain the key considerations involved in intellectual property and idea protection.
• Introduce the key aspects of financial management required in the development of a business venture.

Assessment will include a group 5-page business plan and 10-minute presentation, and an individual 1,000 to 2,000 word essay/report.

Books
Optional texts
• The Definite Business Plan (2nd Edition), Richard Stutely, Prentice Hall, 2002

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MTH710U Enumerative and Asymptotic Combinatorics
Organiser Professor T W Müller
Level 7 Credit value 15 Semester A
Assessment 100% final exam
Prerequisites MTH6109/MAS219 Combinatorics
Overlaps MAS439 Enumerative and Asymptotic 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.
6. Asymptotic techniques: order notation: \( O, o, \sim \). Stirling’s formula. Techniques from complex analysis including Hayman’s Theorem.

See module organiser before registering.

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MTH3100 Essential Mathematical Skills
Organiser Semester 1: Professor B J Carr; Semester 2: Dr F J Wright
Level 3 Credit value 15 Semester A and B
Assessment 100% multiple choice test
Prerequisites None
Overlaps MAS010 Essential Mathematical Skills

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. Perform simple estimations
6. Compute quotient and remainder of polynomial division
7. Simplify polynomial and rational expressions
8. Simplify expressions involving square roots
9. Perform algebraic substitutions
10. Solve linear and quadratic equations and inequalities

Books
Main text
• Essential Mathematics http://www.maths.qmul.ac.uk/~fv/books/em/embook.pdf (web-book)

MTH735U Extrasolar Planets and Astrophysical Discs
Organiser Professor R Nelson
Level 7 Credit value 15 Semester B
Assessment 100% final exam
Prerequisites None

Syllabus Extrasolar planets
• Detection techniques: Doppler method, transit method, direct detection, microlensing
• Statistical description of data: mass distribution; orbital properties; correlation with stellar metallicity, physical properties
• Properties of individual exoplanets and exoplanet systems
• Comparison with Solar System planets

Planetary system formation model
• Formation of protoplanetary discs during star formation
• Protoplanetary disc properties
• Dust coagulation, runaway growth, oligarchic growth
• Terrestrial planet formation via giant impacts
• Giant planet formation: core accretion model versus gravitational instability model
• Planet migration

Origin of life
• Definition of life
• Conditions required for emergence of life – the habitable zone
• Basic ideas about emergence of self-replicating molecules (RNA, DNA)

Accretion discs
• Basic accretion disc theory: angular momentum transport mechanisms; diffusion equation for evolution;
• origin of disc turbulence through the MRI
• Close binary systems: classification; the Roche potential; Cataclysmic Variables; low and high mass X-ray binaries; outburst phenomena
• Accretion discs in active galactic nuclei – observations and models

Books
Main texts
• Planetary Sciences, I de Pater & J J Lissauer
• Accretion Power in Astrophysics, J Frank, A King, D Raine

MTH711U Extremal Combinatorics
Organiser Dr P Keevash
Level 7 Credit value 15 Semester B
Assessment 100% final exam
Prerequisites None
Overlaps MAS444 Extremal Combinatorics

Syllabus
2. The Discrete Cube: Sperner’s theorem. Shadows and isoperimetric inequalities (LYM inequality, the Kruskal-Katona theorem, Harper’s theorem, edge isoperimetric inequality).
4. Other Topics: other topics of a similar flavour chosen according to class interest and time.

**Books**
The lecture notes will be self contained. Examples of books giving background material and further reading are:
- B Bollobás, Combinatorics, Cambridge University Press, 1986
- B Bollobás, Modern Graph Theory, Springer-Verlag, 1998

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**MTH6119 Fluid Dynamics**
Organiser Dr J Cho
Level 6 Credit value 15 Semester B
Assessment 10% in-term, 90% final exam
Prerequisites MTH5102/MAS204 Calculus III and MTH5106/MAS226 Dynamics of Physical Systems, or consult the module organiser.
Overlaps MAS349 Fluid Dynamics

**Syllabus**
1. Introduction
   - Mathematical preliminaries: vector identities, integral theorems, tensors and index notation.
   - Lagrangian and Eulerian descriptions, material derivative and stream line.
   - Euler and vorticity equations, conservation of mass and momentum, equation of state
2. Viscosity
   - Reynolds number – swimming tadpoles, disappearing windows and galaxies
   - Poiseuille and boundary layer flows
   - Diffusion of shear and vorticity
3. Waves
   - Wave dispersion, dispersion relation, phase and group velocities, linearisation
   - Shallow- and deep-water waves, sound: tsunamis and shouting upwind
   - Planetary and gravity waves, the weather and the ozone hole
   - Nonlinear behaviour: characteristics, hydraulic jumps, shocks and solitons
4. Vortices and vorticity
   - Kelvin and Helmholtz theorems, vortex lines, pairs and shedding, flying
   - Vortex sheets and Kelvin-Helmholtz instability, billow clouds

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

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**MTH4109 Fundamentals of Statistics I**
Organiser Dr H Grossmann
Level 4 Credit value 15 Semester A
Assessment 10% coursework, 10% in-term test, 80% exam
Prerequisites MTH4108/MAS108 Probability I
Overlaps MTH4106/MAS113/MAS113X Fundamentals of Statistics I, ECN104 Introductory Statistics for Economics and Business

**Syllabus** As MTH4106 Introduction to Statistics, but this module is only for second-year students who postponed MAS113 in their first year in order to take MAS010.

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**MTH6120 Further Topics in Mathematical Finance**
Organiser Professor C Beck
Level 6 Credit value 15 Semester B
Assessment 10% in-term, 90% exam
Prerequisites MTH4101/MAS125 Calculus II, MTH5118/MAS228 Probability II and MTH6121/MAS343 Introduction to Mathematical Finance
Overlaps MAS345 Further Topics in Mathematical Finance

**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 optimisation models.
5. Exotic options.
6. Some examples beyond geometric Brownian motion models.
7. Autoregressive models and mean reversion.

Books
Main text

MTH4103 Geometry I
Organiser Professor L H Soicher
Level 4 Credit value 15 Semester A
Assessment 10% coursework, 10% in-term test, 80% final exam.
Prerequisites A-Level Mathematics or equivalent
Overlaps MAS114 Geometry I

Syllabus
1. Phrasebook up to \( \mathbb{R}^3 \).
2. Vectors in 2-space and 3-space, expressed as \( xi + yj + zk \) 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.
5. Vector products in \( \mathbb{R}^3 \). Volume of parallelepiped as given by triple scalar product and determinant.
6. Linear transformations in \( \mathbb{R}^2 \), expressed by matrices with respect to the standard basis i, 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 \( 2 \times 3 \) 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.
MTH5109 Geometry II: Knots and Surfaces
Organiser Professor M A H MacCallum
Level 5 Credit value 15 Semester B
Assessment 10% coursework, 10% in-term test, 80% final exam
Prerequisites MTH4103/MAS114 Geometry I and MTH4101/MAS125 Calculus II
Overlaps MAS231 Geometry II: Knots and Surfaces

Syllabus
1. Knots and the unsolved problem of their classification. Reidemeister moves, Jones polynomial. Examples including trefoil, figure-eight.
2. Parametrised regular curves, their curvature and torsion defined by vector cross and dot products. Unit speed parametrisation 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 Möbius 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

MTH713U Graphs, Colourings and Designs
Organiser Professor A Hilton
Level 7 Credit value 15 Semester B
Assessment 100% final exam
Prerequisites None
Overlaps MAS408 Graphs, Colourings and Designs

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.

Books
The lecture notes will be self contained. The following books cover certain aspects of the material:
- B Bollobas, Modern Graph Theory, Springer-Verlag, 1998 (Chapter 5)
- C J Colbourn and A Rosa, Triple Systems, Oxford, 1999 (Chapters 1 and 2)
MTH714U Group Theory
Organiser       Professor R A Wilson
Level 7 Credit value 15 Semester A
Assessment      100% final exam
Prerequisites   MTH6104/MAS005 Algebraic Structures II, or MTH5100/MAS201 Algebraic
                Structures I supplemented with some preliminary reading on groups
Overlaps        MAS428 Group Theory

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 module organiser before registering.

MTH4104 Introduction to Algebra
Organiser       Dr I Tomasic
Level 4 Credit value 15 Semester B
Assessment      10% coursework, 10% in-term test, 80% final exam
Prerequisites   MTH4103/MAS114 Geometry I
Overlaps        MAS117 Introduction to Algebra

Syllabus
1. Mathematical basics: proofs, necessary and sufficient conditions, proofs and counterexamples,
   definitions, existence and uniqueness.
   Polynomials, matrices.
3. Sets, subsets, functions, relations. One-to-one and onto functions. Equivalence relations and
   partitions.
4. Division algorithm and Euclidean algorithm. Modular arithmetic. Solving polynomials; remain-
   der and factor theorems.
5. Rings and fields, ideals, factor rings.
6. Groups, subgroups, cyclic groups, Lagrange’s Theorem.
7. Permutations, symmetric group, sign.

Books
Reading list

MTH715U Introduction to Dynamical Systems
Organiser       Dr W Just
Level 7 Credit value 15 Semester A
Assessment      100% final exam
Prerequisites   MTH6107/MAS308 Chaos and Fractals
Overlaps        MAS424 Introduction to Dynamical Systems

Syllabus
• Dynamical systems in one and two dimensions.
• Computation of periodic orbits, their multipliers and invariant manifolds.
• Key bifurcations and related numerics.
• Computation of entropy and dimensions.
• Numerical integration of ODEs, with application to Poincaré surfaces of section (Henon’s
  method).
MTH4105 Introduction to Mathematical Computing
Organiser Dr H Touchette
Level 4 Credit value 15 Semester A
Assessment 10% coursework, 10% in-term test, 80% final exam
Prerequisites A-Level Mathematics or equivalent
Overlaps MAS116 Introduction to Mathematical Computing

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: plotting 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
1. 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.
2. User-defined Functions: Arrow syntax; anonymous and named functions; polynomial and elementary transcendental examples; use with map; predicates (Boolean-valued functions); select and remove.
3. 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.
4. Conditional Execution: if ... then ... end if; else; elf; 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.
5. Procedures: proc ... end proc; variable scope; local; global; return value versus side effects; return; error; print; applications such as base conversion, simple statistics.
6. 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
• F J Wright, Computing with Maple, Chapman & Hall, CRC Press 2001

MTH6121 Introduction to Mathematical Finance
Organiser Dr D S Stark
Level 6 Credit value 15 Semester A
Assessment 10% in-term, 90% exam
Prerequisites MTH4108/MAS108 Probability I and MTH4101/MAS125 Calculus II
Overlaps MAS343 Introduction to Mathematical Finance

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

MTH5110 Introduction to Numerical Computing
Organiser Dr W Just
Level 5 Credit value 15 Semester B
Assessment 20% coursework, 80% final exam
Prerequisites MTH4103/MAS114 Geometry I, MTH4105/MAS116 Introduction to Mathematical Computing and MTH4101/MAS125 Calculus II
Overlaps MAS235 Introduction to Numerical Computing

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
• F J Wright, Computing with Maple, Chapman & Hall/CRC (2001)

MTH4106 Introduction to Statistics
Organiser Professor S G Gilmour / Professor R A Bailey
Level 4 Credit value 15 Semester B
Assessment 10% coursework, 10% in-term test, 80% exam
Prerequisites MTH4108/MAS108 Probability I

Syllabus
1. Ideas of statistical modelling, populations and samples, simple plots, mean and median. Practical: Introduction to Minitab.
3. Revision of discrete RVs. Goodness of fit tests for discrete RVs, basic ideas, p-values, fixed significance level tests, estimation of parameters, grouping classes. Revision of continuous RVs. Practical: Plots, illustrated by pulse data.
6. Random samples, sampling distribution of sample mean and variance. Point estimates, unbiasedness, calculation of bias. Distribution of sample total. Practical: Normal approx of binomial, illustration of LLN and CLT.
10. Approximate 2-sample test when variances are unequal. Matched pairs t test, discussion about design and blocking and when to use which test. Practical: 2-sample t test, matched pairs t test.

Books
Main texts 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


MTH5112 Linear Algebra I

Organiser Dr O Bandtlow
Level 5 Credit value 15 Semester A
Assessment 10\% coursework, 10\% in-term test, 80\% final exam
Prerequisites MTH4103/MAS114 Geometry I
Overlaps MAS212 Linear Algebra I

Syllabus

4. Vector spaces (over \( \mathbb{R} \) and \( \mathbb{C} \)): Definition and examples. Subspaces. Spanning sets. Linear independence. Basis and dimension of a vector space. Change of basis. Row and column spaces, rank. The null space.

5. Linear Transformations: Definition and examples. Matrix representations of linear transformations. The law of change of matrix representation under a change of basis. The Rank-Nullity Theorem.


7. Eigenvalues and Eigenvectors: The equation \( \lambda \mathbf{x} = A \mathbf{x} \). The characteristic polynomial. Eigenvalues and eigenvectors of special classes of matrices. Real symmetric matrices: orthogonal diagonalisation. Similarity: distinct eigenvalues and diagonalisation.

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

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**MTH6140 Linear Algebra II**

<table>
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<tr>
<th>Organiser</th>
<th>Professor O Jenkinson</th>
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<td>Level 6</td>
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<td>Assessment</td>
<td>10% in-term, 90% final exam</td>
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<tr>
<td>Prerequisites</td>
<td>MTH4104/MAS117 Introduction to Algebra and MTH5112/MAS212 Linear Algebra I</td>
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<tr>
<td>Overlaps</td>
<td>MAS317 Linear Algebra II</td>
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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)

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**MTH6122 Linear Operators and Differential Equations**

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<th>Organiser</th>
<th>Professor C-H Chu</th>
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<td>Assessment</td>
<td>10% in-term, 90% final exam</td>
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<tr>
<td>Prerequisites</td>
<td>MTH4101/MAS125 Calculus II and MTH5112/MAS212 Linear Algebra I or equivalent</td>
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<tr>
<td>Overlaps</td>
<td>MAS346 Linear Operators and Differential Equations</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
Other texts
- 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 & Traill, Some Mathematical Methods of Physics (McGraw-Hill)

MTH717U MSci Project
Organiser Dr M Walters
Level 7 Credit value 30 Semester A and B
Assessment Written report, presentation and (possibly) oral exam
Prerequisites Before registering you must consult the module organiser.
Overlaps MAS410 MSci Project

Syllabus The project will be assessed primarily by a written report and, at the examiners’ discretion, an oral examination, but also by a presentation of about 30 minutes in duration, to be given towards the end of semester 8. The contribution of the presentation will be on a sliding scale that will never decrease the project mark by more than 10% or increase it by more than 20%, and provided you make a reasonable attempt at giving a presentation it will not decrease your project mark.
Your report must present the study of some mathematical topic at fourth-year undergraduate level and must be your 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. You can write your report in a single semester or spread over two semesters, depending on your other modules.

MTH6123 Mathematical Aspects of Cosmology
Organiser Dr A G Polnarev
Level 6 Credit value 15 Semester B
Assessment 10% in-term, 90% final exam
Prerequisites MTH5102/MAS204 Calculus III and MTH5106/MAS226 Dynamics of Physical Systems in Mathematical Sciences programme; PHY122 Mathematical Techniques 2 and PHY116 From Newton to Einstein in Physics programme.
Overlaps MAS347 Mathematical Aspects of Cosmology

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 polarisation.
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
Reading list
- M Rowan-Robinson, Cosmology (OUP 3rd Edition)
- J Silk, The Big Bang (Freeman 2nd Edition)
- M Berry, Principles of Cosmology and Gravitation (CUP)
- J Islam, An Introduction to Mathematical Cosmology (CUP)
- B J Carr, Cosmology – old lecture notes

I24001 Mathematical Education for Physical and Mathematical Sciences
Organiser Dr Melissa Rod at the Institute of Education; QM contact Dr F J Wright
Level 6 Credit value 15 Semester A and B
Assessment 50% coursework essay (to be submitted towards the end of Semester B) and 50% final exam (to be sat in May)
Prerequisites A second-year mean mark of at least 50%; also see below

Syllabus The aim of this level-6 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 (IoE, http://www.ioe.ac.uk/) at 20, Bedford Way, seven minutes walk from Euston Square tube station. Lectures will take place during both of Semesters A and B on Mondays from 5:15pm to 7:00pm for 18 sessions: nine in the autumn term and nine in the spring term, starting on Monday 6th October and excluding reading weeks. 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 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, to express your interest before Wednesday 24 September 2008, giving your full name and student number;
- attend the introductory meeting, provisionally on Monday 29 September 2008 at Queen Mary in Maths 103 at 5:00–6:00 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 two weeks 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 15 credits (1 course unit) and will be counted as an MTH 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).
MTH6124 Mathematical Problem Solving
Organiser Professor S Majid and Dr M Fayers
Level 6 Credit value 15 Semester B
Assessment Written solutions to questions and oral exam
Prerequisites Places are limited; contact the module organisers to validate registration.
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.

MTH5117 Mathematical Writing
Organiser Professor F Vivaldi
Level 5 Credit value 15 Semester A
Assessment 20% coursework, 80% final exam
Prerequisites passing the first year
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
Other texts
- G Chartrand, A Polymeny, and P Zhang, Mathematical proofs, a transition to advanced mathematics, Addison-Wesley (2003)

MTH716U Measure Theory and Probability
Organiser Professor O Jenkinson
Level 7 Credit value 15 Semester B
Assessment 100% final exam
Prerequisites MTH5105/MAS221 Differential and Integral Analysis and MTH732U/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.

MTH6126 Metric Spaces
Organiser Professor M Jerrum
Level 6 Credit value 15 Semester A
Assessment 10% in-term, 90% final exam
Prerequisites MTH5104/MAS111 Convergence and Continuity

Syllabus
- Definition of metric space; examples, including finite metric spaces, function spaces, normed vector spaces, product spaces.
- Convergence and continuity in metric spaces.
- Equivalent metrics.
- Open and closed sets, properties, continuity in terms of pre-images of open sets.
- (Sequential) compactness, properties of compact spaces, uniform continuity. Bolzano-Weierstrass Theorem.
- Completeness; examples, including C[0,1]. Examples of completions of metric spaces. Contraction mappings, Banach fixed-point theorem, applications, e.g., to solutions of differential equations.
- Further topics if time allows, such as the Heine-Borel Theorem.

Books
- W A Sutherland, Introduction to Metric and Topological Spaces, OUP 1975 (chapters 2, 5–9)
- Yu Safarov, Real Analysis II (lecture notes)

MTH6128 Number Theory
Organiser Professor P J Cameron
Level 6 Credit value 15 Semester B
Assessment 10% in-term, 90% final exam
Prerequisites MTH4104/MAS117 Introduction to Algebra
Overlaps MAS320 Number Theory

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

MTH6129 Oscillations, Waves and Patterns
Organiser Professor R K Tavakol
Level 6 Credit value 15 Semester B
Assessment 10% in-term, 90% final exam
Prerequisites MTH5102/MAS204 Calculus III and MTH5106/MAS226 Dynamics of Physical Systems
Overlaps MAS229 Oscillations, Waves and Patterns; 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 vibrations 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
Other texts
- Vibrations and Waves: A P French (Chapman and Hall)
- The Physics of Vibrations and Waves: H J Pain (John Wiley and Sons)
- Vibrations and Waves in Physics: I G Main (Cambridge University Press)
- Wave Motion: Billingham and A C King (Cambridge University Press)
- Physics of Waves: W C Elmore and M A Heald (McGraw-Hill)
- Waves: C A Coulson (Oliver and Boyd)
- Wave Physics: S Nettel (Springer Verlag)

MTH4108 Probability I
Organiser Dr J R Johnson / Professor R A Wilson
Level 4 Credit value 15 Semester A
Assessment 10% coursework, 10% in-term test, 80% final exam
Prerequisites A-level Mathematics or equivalent
Overlaps MAS108 Probability I

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 Morgan’s 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.
6. Conditional probability. Definition. Sampling without replacement done in stages rather than as set of outcomes. Proof by induction that \( P(E_1 \cap E_2 \cap \cdots \cap E_n) = P(E_1) \times P(E_2 | E_1) \times \cdots \times P(E_n | E_1 \cap \cdots \cap E_{n-1}) \). Theorem of Total Probability. Use sigma notation with suffix i.
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. Mean and variance of \( aX + b \).
9. Familiarity with the following 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
- Hines/Montgomery, Probability & Statistics in Engineering & Management Science (Wiley)
- J A Rice, Mathematical Statistics & Data Analysis (Wadsworth)
- S Ross, A First Course in Probability (Prentice Hall)

MTH5118 Probability II
Organiser Dr L Rass
Level 5 Credit value 15 Semester A
Assessment 10% coursework, 10% in-term test, 80% final exam
Prerequisites MTH4108/MAS108 Probability I and MTH4106/MAS113 Introduction to Statistics. Instead of the latter, MAS4109/MAS113X Fundamentals of Statistics I can be taken concurrently.
Overlaps MAS228 Probability 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
MTH6130 Probability III
Organiser  Professor I Goldscheid
Level 6  Credit value 15  Semester B
Assessment  10% in-term, 90% final exam
Prerequisites  MTH5118/MAS228 Probability II
Overlaps  MAS338 Probability III

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
Main text
• N M Taylor and S Karlin, An Introduction to Stochastic Modeling

MTH6132 Relativity
Organiser  Professor R K Tavakol
Level 6  Credit value 15  Semester A
Assessment  10% in-term, 90% final exam
Prerequisites  MTH4102/MAS118 Differential Equations, MTH4101/MAS125 Calculus II and MTH5112/MAS212 Linear Algebra I
Overlaps  MAS322 Relativity

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 texts
• 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]

MTH720U Relativity and Gravitation
Organiser Dr A G Polnarev
Level 7 Credit value 15 Semester B
Assessment 100% final exam
Prerequisites MTH6132/MAS322 Relativity
Overlaps MAS412 Relativity and Gravitation

Syllabus
• Introduction to general relativity.
• Derivation from basic principles of the Schwarzschild, Reisner-Nordstrom, Kerr and Kerr-Neuman solutions of Einstein's field equations.
• Physical aspects of strong gravitational fields around black holes.
• Generation, propagation and detection of gravitational waves.
• Weak general relativistic effects in the solar system and binary pulsars.
• Alternative theories of gravity and experimental tests of general relativity.

MTH722U Rings and Modules
Organiser Dr M Fayers
Level 7 Credit value 15 Semester A
Assessment 100% final exam
Prerequisites MTH6104/MAS305 Algebraic Structures II or MTH5100/MAS201 Algebraic Structures I supplemented with some preliminary reading on rings
Overlaps MAS427 Rings and Modules

Syllabus This course is designed to give an overview of rings and modules. The definition of a ring will not be assumed, but familiarity with the basic definitions will be helpful. What is essential is a thorough grounding in linear algebra. The idea of this course is to give the student a wide rather than deep view of module theory, with definitions and basic properties of a variety of concepts; the only major theorem that will be proved is Wedderburn’s Theorem.
1. Definitions of rings, modules, homomorphisms. The Isomorphism Theorems.
3. Exact sequences and hom functors. Projective and injective modules.
4. Tensor products, flat modules.
5. Chain conditions, Artinian and Noetherian rings and modules. Composition series.

Books
Recommended reading
• John A Beachy, Introductory Lectures on Rings and Modules, Cambridge UP 1999
The following general algebra texts may be useful for consultation:
• P M Cohn, Algebra (3 vols), Wiley 1974–77
• N Jacobson, Basic Algebra (2 vols) Freeman 1980

MTH5119 Sampling, Surveys and Simulation
Organiser Dr R A Sugden
Level 5 Credit value 15 Semester A
Assessment 10% in-term test, 24% questionnaire design, 16% coursework, 50% final exam
Prerequisites MTH4106/MAS113 Fundamentals of Statistics I, MAS125 Calculus II
Overlaps MAS234 Sampling, Surveys and Simulation

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

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

MTH723U Sets, Logic and Categories
Organiser Professor I M Chiswell
Level 7 Credit value 15 Semester A
Assessment 100% final exam
Prerequisites Previous exposure to abstract mathematics
Overlaps MAS413 Sets, Logic and Categories

Syllabus An introductory module covering set-theoretic axioms, sets and classes, ordinals and cardinals, choice principles, first-order logic, functors, natural transformations, limits and colimits, adjoints, free algebras, and additive categories.

MTH724U Solar System
Organiser Dr J R Donnison
Level 7 Credit value 15 Semester A
Assessment 100% final exam (up to 10% of final mark can be obtained from coursework)
Prerequisites MTH5106/MAS226 Dynamics of Physical Systems
Overlaps MAS423 Solar System

Syllabus The material presented in this module will be chosen from the following:
1. General overview/survey
2. Fundamentals: two-body problem, continuum equations
3. Terrestrial planets: interiors, atmospheres
4. Giant planets: interiors, atmospheres
5. Satellites: three-body problem, tides
6. Resonances and rings
7. Solar nebula and planet formation
8. Asteroids, comets and impacts

Books
Main texts
- I de Peter & J J Lissauer, Planetary Sciences (Cambridge University Press)
- C D Murray & S F Dermott, Solar System Dynamics (Cambridge)

Other texts
MTH5120 Statistical Modelling I
Organiser Dr L Pettit
Level 5 Credit value 15 Semester B
Assessment 20% coursework, including any in-term tests, 80% final exam
Prerequisites MTH4106 Introduction to Statistics/MAS113 Fundamentals of Statistics I, MTH5112/MAS212 Linear Algebra I and MTH5118/MAS228 Probability II
Overlaps MAS232 Statistical Modelling 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.
4. Estimation: maximum likelihood, least squares, Gauss-Markov Theorem, properties of estimators, estimating mean responses, estimating \( \sigma^2 \).
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.
10. Use of Minitab to apply the theory to practical data analysis.

Books
Main text
- B Abraham and J Ledolter, Introduction to Regression Modeling (Duxbury)
- Lindley/Scott, New Cambridge Elementary Statistical Tables (CUP)

Other texts
- Draper & Smith, Applied Regression Analysis (Wiley)
- Sen & Srivastava, Regression Analysis (Springer)

MTH6134 Statistical Modelling II
Organiser Dr D S Coad
Level 6 Credit value 15 Semester A
Assessment 20% in-term, 80% final exam
Prerequisites MTH5120/MAS232 Statistical Modelling I
Overlaps MAS339 Statistical Modelling II

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.
5. Nested, crossed and general structures.

Books
Main text

Other texts

MTH6136 Statistical Theory
Organiser Dr B Bogacka
Level 6 Credit value 15 Semester B
Assessment 10% in-term, 90% final exam
Prerequisites MTH4106 Introduction to Statistics or MAS113/MAS113 Fundamentals of Statistics I, MTHS118/MAS228 Probability II
Overlaps MAS230 Fundamentals of Statistics II
Syllabus The theory developed will be used to justify the methods introduced in MTH4106 Introduction to Statistics or MAS113 Fundamentals of Statistics I 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 estimators obtained from these methods, asymptotic properties of MLEs.
3. Confidence intervals: methods of obtaining CIs using pivots, likelihood CIs.

Books
Main text

Other texts

MTH725U Stellar Structure and Evolution
Organiser Professor I P Williams
Level 7 Credit value 15 Semester B
Assessment 100% final exam
Prerequisites Consult the module organiser
Overlaps MAS415 Stellar Structure and Evolution
Syllabus
1. Observational properties of stars, the H-R diagram, binary stars, clusters, solar and stellar oscillations.
2. Physical properties of stellar interiors: virial theorem, gravitational energy, radiative transfer, opacity and equation of state, convection, nuclear reactions.
3. Equations of stellar structure and evolution. Order of magnitude estimates, simple stellar models. Convective cores and envelopes, the Cowling model, models of the Sun, acoustic models, massive stars, small mass stars.
4. Pre-main sequence evolution, evolution on the main sequence, post main sequence evolution. Degeneracy, models of white dwarfs, models of red giants. Late stages of stellar evolution, nucleosynthesis.

The module includes some exposure to simple numerical techniques of stellar structure and evolution; computer codes in Fortran.

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**MTH726U The Galaxy**

**Organiser** Dr J R Donnison

**Level 7 Credit value 15 Semester B**

**Assessment** 100% final exam

**Prerequisites** MTH5102/MAS204 Calculus III

**Overlaps** MAS430 The Galaxy

**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.

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**MTH6138 Third-Year Project**

**Organiser** Dr M Walters

**Level 6 Credit value 15 Semester A or B**

**Assessment** Written report, presentation and (possibly) oral exam

**Prerequisites** Before registering you must consult the module organiser.

**Overlaps** MAS342 Third-Year Project. You will not normally be allowed to take this option together with another project module.

**Syllabus** A project in any area of mathematics, including astronomy and computing, which is offered in both of semesters 5 and 6. It may be a simplified version of an MSci project, although some MSci projects may not be available as third-year projects. The list of available MSci projects and supervisors is available on the School of Mathematical Sciences website. The project will be assessed primarily by a written report and, at the examiners’ discretion, an oral examination, but also by a presentation of about 20 minutes in duration, to be given towards the end of semester 6. The contribution of the presentation will be on a sliding scale that will never decrease the project mark by more than 10% or increase it by more than 20%, and provided you make a reasonable attempt at giving a presentation it will not decrease your project mark.

Your report must present the study of some mathematical topic at third-year undergraduate level and must be your 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 3,000 and 4,000 words.

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**MTH6139 Time Series**

**Organiser** Dr B Bogacka

**Level 6 Credit value 15 Semester A**

**Assessment** 20% in-term, 80% final exam

**Prerequisites** MTH4101/MAS125 Calculus II and MTH5118/MAS228 Probability II

**Overlaps** MAS328 Time Series, 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 \( p = q = 1 \).
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
- P J Brockwell and R A 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)
- P Diggle, Time Series: A Biostatistical Introduction (Oxford)
- A C Harvey, Time Series Models (Philip Allan)

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**MTH734U Topics in Probability and Stochastic Processes**

**Organiser**  
Dr R A Sugden

**Level 7**  
Credit value 15  
**Semester B**  

**Assessment**  
100% final exam

**Prerequisites**  
MTH6130/MAS338 Probability III

**Overlaps**  
MAS420 Topics in Probability and Stochastic Processes

**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.

Books

Main texts
- W Feller, An Introduction to Probability Theory and its Applications I (Wiley)