College of Engineering

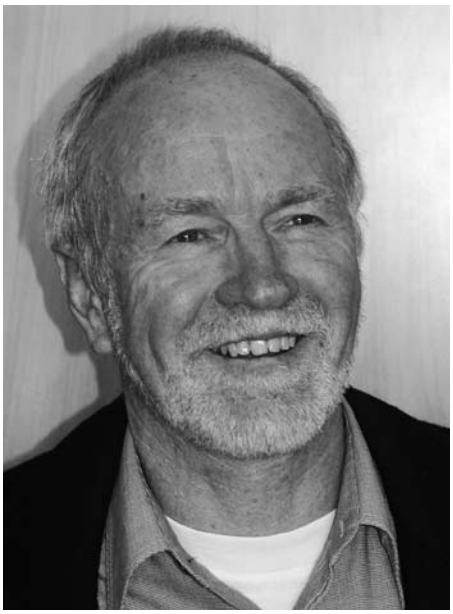
UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Mathematics and Statistics

Department handbook

07

Welcome to Mathematics and Statistics at UC



Mathematics and statistics are living subjects with new techniques and theories constantly being devised, tested and explored. The extensive use of computers in a wide range of academic areas has led to an increasing demand for statistical and mathematical analysis in many new and diverse fields.

It has been said that it is mathematics that offers the natural sciences a certain measure of security which, without mathematics, they could not hope to attain.

You will find our mathematics and statistics courses are aimed not only at those wishing to become specialists in these subjects, but also at students majoring in engineering, physics, computer science, biology, management and a host of other disciplines.

You will find our courses exciting, challenging, relevant and thoroughly up-to-date as all our lecturers are actively engaged in research in some aspect of mathematical and statistical science.

This handbook is provided to help you plan a course of study in mathematics or statistics. It will also assist you in choosing appropriate courses that complement studies in other disciplines.

You should make the most of your opportunity at university to study subjects under the guidance of experts in our subject areas. I wish you enjoyment in your studies of the fascinating range of topics that we offer.

If you have further questions please contact us.

Associate Professor David Wall
Head of Department

BSc/BA Degree Structure

You can complete either a Bachelor of Science (BSc) or a Bachelor of Arts (BA) majoring in either mathematics or in statistics. A BSc or BA consists of a minimum of 360 points taken over three years. Typically, the degree is made up of 144 points from 100-level courses, 132 points from 200-level courses and 84 points from 300-level courses. Of the 84 points at 300-level, at least 56 must be from your chosen major subject. Note that you can take 100-level courses in your 2nd year of study and 100- and 200-level courses in your 3rd year of study. For full details of the requirements, see the UC calendar regulations below.

Calendar Regulations

To qualify for the Degree of Bachelor of Arts:

(a) a candidate must pass courses having a minimum total value of 360 points.

(b) at least 254 of the 360 points must be from the Schedule to the Regulations for the Bachelor of Arts.

(c) the remaining 106 points may be for courses from any degree of the University. They will be subject to the Regulations of the other degree.

(d) at least 216 points must be for courses above 100-level.

(e) at least 84 points must be for courses at 300-level.

(f) at least 56 points of that 84 must be in a single subject and from the Schedule to the Regulations of the Bachelor of Arts.

To qualify for the Degree of Bachelor of Science:

(a) a candidate must pass courses having a minimum total value of 360 points.

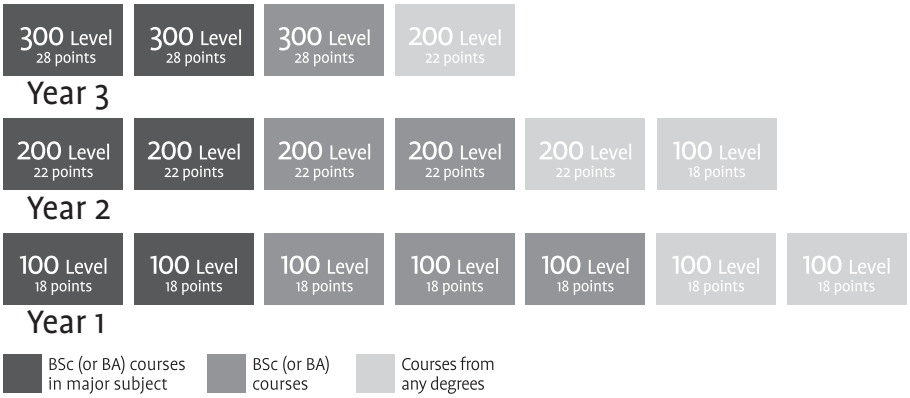
(b) at least 254 points of the 360 must be from the Schedule to the Regulations for the Bachelor of Science.

(c) the remaining 106 points of the 360 may be for courses from any degree of the University. They will be subject to the Regulations of the other degree.

(d) at least 216 points must be for courses above 100-level.

(e) at least 84 points must be for courses at 300-level.

(f) at least 56 points of that 84 must be in a single subject from the Schedule to the Regulations for the Bachelor of Science or from a list of specified courses approved for the major requirement.



A typical programme for a BSc (or BA) majoring in either mathematics or statistics.

Starting Your Degree in Mathematics or Statistics

There are many different pathways through mathematics and statistics. (See the section on Pathways Through Mathematics and Statistics). Choose a programme that keeps your options open, particularly at the 100- and 200-level. Generally, business, industry and government want people who have a broad background in a variety of mathematical and statistical areas. Include other subjects in your degree to expand your knowledge of the applications of mathematics and statistics. Common choices include physics, computer science, biology, chemistry, management and economics.

Mathematics and statistics are in both the arts and science schedules. The Bachelor of Science (BSc) and Bachelor of Arts (BA) are three-year undergraduate degrees requiring a minimum of 360 points. For a first-year full-time student, a sensible number of points to take is about 126 (1.05 course weight).

If you are good at mathematics or statistics, seriously consider aiming for a BSc (Hons) or BA (Hons) degree, an extra one year's study after your BSc or BA. (See the section on Postgraduate Study). People with honours level qualifications in both mathematics and statistics are highly employable in commerce, industry and research institutes and it is sensible to include mathematics papers in your statistics degree and statistics papers in your mathematics degree, or consider the mathematics and statistics joint honours programme.

Mathematics Major

Most students begin by taking the following core mathematics courses in their first year.

- MATH108 (18 points) is a course in calculus and linear algebra. The calculus material follows on from NCEA level 3 calculus. MATH108 is available as a first semester course, a second semester course and also as a whole year course. It is a prerequisite for the second core first year course:
- MATH109 (18 points) builds on the linear algebra and calculus developed in MATH108. It is available as a first semester course, a second semester course and as a summer course.

Together, these courses will let you into any 200-level mathematics course.

Statistics Major

Most students take the following courses in their first year.

- STAT111 (18 points) is a full-year course designed to give students a sound basic knowledge of the subject and a good grounding in how statistics are used to tackle genuine problems. An alternative is STAT112, which is the second semester equivalent of STAT111.
- MATH108 (18 points) – see above.

You should preferably also take MATH109, although you may do MATH109 in your second year. Together, STAT111 and MATH108 will let you into any 200-level statistics course.

Choosing the right course

Any student who meets standard university entrance requirements may enrol in any of the 100-level mathematics and statistics courses (except for MATH109 which has MATH108 as a prerequisite).

Students intending to take MATH108 as a first or second semester course should have at least 15 points in NCEA Level 3 Mathematics with Calculus, including both the differentiation and integration achievement standards (or the equivalent Unit Standards).

The whole year version of MATH108 is a good option for students who want to take the paper at a slower pace. We strongly advise that you have at least 12 points in NCEA Level 3 Mathematics with Calculus, including at least one of the differentiation and integration achievement standards (or the equivalent Unit Standards).

For STAT111 (or STAT112), it is important to do as well as possible in NCEA Level 3 subjects, especially the Statistics with Modelling and/or Mathematics with Calculus.

More detailed advice is available via the Prospective Students link at www.math.canterbury.ac.nz. We also recommend that students intending to take any of the MATH108 offerings do the pre-entry self-assessment quiz, also available at this link.

The Department will consider allowing students direct entry into MATH109 if they have a high level of achievement (mostly excellences and merits) in NCEA Level 3 Mathematics with Calculus. Each year, we also offer a few outstanding students direct entry into 200-level mathematics/statistics. Please contact the Department in person if you wish to discuss either of these options.

Other 100-level mathematics courses (all 18 points)

- MATH101 is a whole year introductory course, emphasising applications of mathematics. It is particularly good for students who have not studied mathematics for some time, or who lack confidence in their mathematical skills. MATH108 (possibly the whole year version) is the best follow up to this paper.
- MATH115 is a whole year course designed particularly for computer science students. The discrete mathematics taught in this course is also useful for students majoring in mathematics.
- MATH134 is a first semester course in logic that is taught jointly by mathematics and philosophy staff and is double-coded with PHIL134. Some computer science students find it useful too.
- MATH171 is a second semester course in mathematical modelling and simulation. It complements existing 100-level courses in the mathematical sciences, and is particularly recommended for students interested in applying mathematics to real-world problems.

Pathways Through Mathematics and Statistics

A degree from the University of Canterbury is highly flexible and allows you to design a personal course to meet your needs. You can do either a Bachelor of Science (BSc) or a Bachelor of Arts (BA) with a mathematics or statistics major. Set out below are possible courses of study but they are suggestions only and staff will be happy to advise you.

In order to complete a degree with mathematics as a major subject, you will need at least 56 points of mathematics courses at 300-level, supported by 44 points at 200-level. For a degree with statistics as a major subject, you will need at least 56 points of statistics courses at 300-level, supported by 33 points at 200-level. However, it is always better to have a broader background in your major, so we strongly recommend that you take more than this absolute minimum of papers.

It is essential for a mathematics or statistics major that you take the core courses in your chosen major subject at each level, and that you supplement these with courses chosen according to your interests in mathematics, statistics and other subject areas.

Core Mathematics

Year 1 MATH108, MATH109
Year 2 MATH264 or (MATH261 and MATH262), and MATH254 or (MATH251 and MATH252), andMATH243

- At the 100-level your core study in mathematics will be the techniques of calculus and linear algebra.
- At the 200-level the core courses cover calculus, linear algebra and analysis.
- At the 300-level your courses are chosen from MATH310 - MATH399.

Core Statistics

Year 1 STAT111 (or STAT112), MATH108
Year 2 MATH109, STAT212, STAT214, STAT222 and/or STAT224
Year 3 STAT312, STAT313, STAT315, STAT316

- At the 100-level your core study in statistics will give you a sound basic knowledge of the subject and a good grounding in how statistics are applied to tackle genuine problems.
- At the 200-level the core courses cover statistical distribution, inference and probability.
- At the 300-level your courses become more specialised and depend on where your interests lie.

Although these core courses are not required to major in mathematics or statistics, we recommend that all majors take them. This will also help ensure that you have the appropriate pre-requisites to take a wide range of more specialised courses which may be chosen from the following areas:

Applied Mathematics, Physical Sciences and Engineering

The applied mathematician is more concerned with how to use mathematics than with how to develop mathematics for its own sake. As well as the traditional areas of mathematical physics and numerical analysis, “applied mathematics” means mathematical biology, modelling of problems in industry, fluid dynamics and meteorology, approximation and optimisation, discrete applied mathematics (including coding theory), and mathematical economics. If you are interested in applied mathematics, the physical sciences or engineering, you will probably find the following courses of most interest to you.

Applied Mathematics

Year 1 MATH171
Year 2 MATH271, MATH282
Year 3 MATH333, MATH342, MATH352, MATH353, MATH361, MATH363, MATH371, MATH381

It is very important for students going on in applied mathematical subjects to have a sound background in pure mathematics as well.

Pure Mathematics

The pure mathematician is attracted by the intrinsic fascination and beauty of mathematics, and by a desire to test the limits of mathematical techniques, rather than a desire to apply it to the outside world. Pure mathematics – dealing with abstractions in algebra, analysis, geometry and many other areas of mathematics – is a stimulating and rewarding pursuit in its own right. If you are interested in pure mathematics, you will probably find the following courses of most interest to you.

Pure Mathematics

Year 1 MATH115, MATH134
Year 2 MATH221, MATH222, MATH231
Year 3 MATH321/322, MATH333, MATH334, MATH335, MATH336, MATH342, MATH352, MATH361, MATH391

Much of pure mathematics, however, originates with problems in the sciences and other areas such as economics. It is extremely valuable for all pure mathematicians to have some understanding of applied mathematics.

Statistics for Mathematics Majors

Everyone should consider taking some statistics in their degree programme. Even if you do not intend to become a statistician, you will be faced with statistical information in all walks of life. Look at the papers. Look at the stock market. Watch television or listen to the radio. Often you will come across comments of a statistical or probabilistic nature. Do some statistics so that you learn to interpret uncertain data in an intelligent way! The statistics courses of most interest to many mathematicians include:

Statistics

Year 1 STAT111 (or STAT112)
Year 2 STAT212, STAT214, STAT218, STAT222, STAT224
Year 3 STAT316

Computer Science

Many mathematics majors have a strong interest in computer science. In this case, we recommend you take options from amongst the following courses.

Computer Science:

Year 1 MATH115, MATH134, STAT111 (or STAT112)
Year 2 MATH221, MATH231, STAT218
Year 3 MATH321/322, MATH333, MATH334, MATH335, MATH336,MATH391

Biomathematics

Biomathematics applies methods from mathematics, statistics and computer science to solve biological problems and is an area of applied mathematics that has shown enormous growth in the past decade.

There are three main areas of biomathematics:

- Computational biology/bioinformatics is the study of genetics, protein structure and evolution. It has applications to medicine and drug design. It requires a sound knowledge of discrete mathematics, computer science and statistics.
- Biological modelling studies population dynamics and cellular processes. It has applications to ecology, epidemiology and medicine. It requires a sound knowledge of calculus, computer science and statistics.
- Biostatistics/bioinformetrics is the statistical analysis of populations. It has applications to ecology, forestry and population genetics. It requires a sound knowledge of statistics.

If you are interested in biomathematics, you should take a broad mixture of mathematics, statistics and biology courses. Mike Steel is the director of our Biomathematics Research Centre, and you can see him, Jennifer Brown or David Wall if you are interested in finding out more about this exciting area of applied mathematics and statistics.

Commerce

Mathematics and statistics are used extensively in many areas of commerce; for example, finance, accounting, management science, operations research and marketing. Commerce students may be particularly interested in the following courses.

Commerce:

Year 1 MATH108, STAT111
Year 2 STAT218, STAT222, STAT224
Year 3 STAT315, STAT317

Biology

It is good to have some mathematics and statistics in your biology degree, especially for students considering postgraduate study.

Biology:

Year 1 MATH108, STAT111
Year 2 STAT218, STAT222, STAT224
Year 3 STAT312, STAT315, STAT317

Postgraduate Study

The Department has a successful postgraduate programme for Honours, Masters and PhD degrees. Apart from the UC Scholarships, we may be able to offer some additional financial assistance in the form of part-time tutoring positions, and fees scholarships (at the NZ resident rate).

Calendar Regulations

BSc/BA (Hons) Mathematics

MATH449 (project) and eight courses chosen from MATH401-490 and STAT401-490 (other than MATH/STAT449). One of the eight courses must be MATH443 if the student has not been credited with MATH343 previously. Normally at least six courses will be chosen from the MATH course list.

Prereq: (1) 44 points from MATH210 299 (Note: Students will normally be expected to take MATH243, *and* either MATH254 or 264); *and*

(2) 56 points from MATH310-399; *and*

(3) an additional 28 points from MATH310-399 or STAT310-399 or other approved courses.

BSc/BA (Hons) Statistics

STAT449 (project) and eight courses chosen from STAT401-490 and MATH401-490 (other than STAT/MATH449). One of the eight courses must be STAT464 if the student has not been credited with STAT214 previously. Normally at least six courses will be chosen from the STAT course list.

Prereq: (1) MATH109 or MATH199; *and*

(2) 33 points from STAT210-299; *and*

(3) 56 points from STAT310-399; *and*

(4) an additional 28 points from MATH310-399 or STAT310-399 or other approved courses.

Honours Degrees

The Honours degree is a one-year coherent programme of study, consisting of an honours project and eight 400-level courses. The assessment of the Class of Honours is based on overall performance in the programme. To enrol in Honours you need to be eligible to graduate with a BA or BSc (360 points) and have the appropriate prerequisites for entry into Honours. Final approval for entry is given by the Head of Department.

The course section outlines the proposed 400-level courses for 2007. The final decision on which courses are offered will depend on student demand and staff availability. However, in every year there will always be at least one course offered in analysis, algebra, discrete mathematics, functional analysis, differential equations and computational mathematics. Every statistics 300-level course is offered as a 400-level course and courses in generalised linear models and bioinformatics are offered each year. A broad range of honours projects for 2007 is listed on the department web page. This list is not exhaustive, and there is plenty of scope for other possible projects. Project supervision is by mutual agreement between the supervisor and student. It is expected that a student will have arranged their project by the end of the first week of term. Assessment is based on a written report (80%), which is to be handed in by the end of September, and an oral or a poster presentation in early October (20%).

Specialised Honours Programmes

In addition to the single honours degrees, there are a number of joint honours programmes that you can study to combine mathematics with another subject. To keep your options open to enter these courses you must ensure you study a broad base of courses at lower levels, especially the core mathematics courses, so that you have the appropriate pre-requisites. For all joint honours programmes it is very important that you check the calendar regulations to ensure you are taking all the required courses. Some of the more relevant sections of the calendar are included below.

Mathematics and Statistics

You can do a joint degree in mathematics and statistics. This is a great thing to do and very marketable. You should start by taking the core mathematics and statistics courses; beyond that there is a range of suitable courses.

Mathematical Physics

The Department of Physics and Astronomy and the Department of Mathematics and Statistics offer a joint BSc (Hons) programme. This is aimed at students who are interested in both subjects and who do not wish to concentrate entirely on one at the expense of the other. As well as the core mathematics courses, you will probably be most interested in:

Year 1 MATH171
Year 2 MATH222, MATH271
Year 3 MATH322, MATH342, MATH361, MATH363, MATH371

The course coordinator for this programme is David Wiltshire (Physics), and you should seek advice from him or Ben Martin (Mathematics).

Mathematics and Philosophy

The interaction between mathematics and philosophy in the twentieth century has been far greater than at any previous time. The BSc (Hons) programme in mathematics and philosophy is designed for students with a highly creative mathematical ability whose interests in mathematics draw them towards foundational and philosophical issues. As well as the core mathematics courses you will probably be interested in:

Year 1 MATH134
Year 2 MATH208
Year 3 MATH301, MATH321, MATH335, MATH336, MATH342, MATH343, MATH392

For more details about this programme contact Douglas Bridges (Mathematics) or Philip Catton (Philosophy). See also *www.phil.canterbury.ac.nz*.

Mathematics and Economics

A joint degree in mathematics and economics will allow you to combine these two subjects and leave university with an excellent preparation for a professional career. If you wish to study for a joint degree in mathematics and economics you must take a mixture of mathematics and statistics alongside the required economics papers. As well as the core mathematics papers, courses of most interest might include:

Year 1 STAT111
Year 2 MATH243, STAT212, STAT216, STAT214
Year 3 MATH343, MATH353, MATH361, MATH363, STAT315, STAT317

For information about a joint degree in mathematics and economics talk to Douglas Bridges (Mathematics) or Seamus Hogan (Economics).

Calendar Regulations

BSc (Hons) in Mathematics and Statistics

MATH449 or STAT449; and eight other courses chosen from MATH401-490 and STAT401-490 (other than MATH449 or STAT449). One of the eight courses must be MATH443 if the student has not been credited with MATH343 previously, and one of the eight courses must be STAT464 if the student has not been credited with STAT214 previously. At least three courses will be chosen from the MATH course list and at least three courses will be chosen from the STAT course list.

Prereq: (1) 44 points from MATH210-299; *and*
(2) 33 points from STAT210-299; *and*
(3) 98 points from MATH310-399 *and* STAT310-399, including at least 42 points from each of the MATH *and* STAT course lists.

BSc (Hons) in Mathematics and Philosophy

MPHI450 and s even courses chosen from MATH401-490 (other than MATH449) and PHIL431-470. One of the seven courses must be MATH443 if the student has not been credited with MATH343 previously. Normally two courses will be chosen from the PHIL course list and five courses from the MATH course list.

Prereq: (1) 44 points from MATH210-299; *and*
(2) 84 points from MATH310-399; *and*
(3) 44 points from PHIL208, 209, 223, 233, MATH208, 209; *and*
(4) 28 points from PHIL301-399, MATH308, 309.

BSc (Hons) in Mathematical Physics

MAPH480 (Research Project) and six courses chosen from MATH401-490 (other than MATH449) and PHYS401-450. Normally, at least three courses must be chosen from each of the PHYS course list and at least two from the MATH course list. The choice of courses is subject to the approval of the Course Coordinator. The Research Project is equivalent to two courses.

Prereq: (1) PHYS221-224, 281, 282; *and*
(2) 44 points from MATH251-269;
(3) 112 points PHYS 300-level *and* MATH 300-level courses chosen with the approval of the Course Coordinator

Note: Students will normally be expected to take: PHYS310; at least 42 points from PHYS311, 312, 314, 316, 318, 322, 326; 56 points from MATH342, 343, 352, 353, 361, 362, 363, 371.

BSc (Hons) in Economics and Mathematics

Either:
ECON480 plus eight additional half-courses in 400-level ECON or MATH, including at least three half-courses in ECON and at least four half-courses in MATH; or

MATH449 plus eight additional half-courses in 400-level ECON or MATH, including at least four half-courses in ECON and at least three half-courses in MATH.

Prereq: (1) ECON201 and ECON230; *and*
(2) STAT212 and STAT214; *and*
(3) 66 points from 200-level MATH, normally consisting of MATH254, 264, 243; *and*
(4) 56 points from ECON321, 322, 323, 324, 325, 326, 331, 332; *and*
(5) 56 points from 300-level MATH or STAT, normally consisting of MATH343 *and*
42 points from MATH352, 353, 361, 363 with up to 28 points of 300-level STAT.

BSC (Hons) in Computational and Applied Mathematics

CAMS449 (project) and eight other approved courses chosen from MATH401-490, MSCI451-462 or STAT401-490 (other than MATH/STAT449). With the approval of the Programme Coordinator, candidates may substitute one or two courses from other subjects in an applications area.

Prereq: (1) 44 points from MATH251, 252, 254, 261, 262, 264 (Note: It is recommended that candidates also include one of MATH171, 271 or 282); *and*
(2) MATH381; *and*
(3) 70 points from MATH323, 346, 352, 353, 361, 362, 363, 371; *and*
(4) 44 points from other approved courses at 200-level or above (normally from CHEM, COSC, MATH, MSCI, PHYS, STAT or ENGINEERING courses).

Postgraduate Diploma in Science (PGDipSc)

This is a one year course which is equivalent to the first year of a Master's degree. It normally consists of eight 400-level papers. A completed PGDipSc can be substituted for part I of an MSc.

Calendar Regulations

PGDipSc in Mathematics

Eight courses chosen from MATH401-490 and STAT401-490 (other than MATH/STAT449). One of the eight courses must be MATH443 if the student has not been credited with MATH343 previously. Normally at least six courses will be chosen from the MATH course list. Not all courses will be offered in any one year.

Prereq: (1) 44 points from MATH210-299; *and*
(2) 56 points from MATH310-399; *and*
(3) an additional 28 points from MATH310-399 or STAT310-399 *or* other approved courses.

PGDipSc in Statistics

Eight courses chosen from STAT401-490 and MATH401-490 (other than STAT/MATH449). One of the eight courses must be STAT464 if the student has not been credited with STAT214 previously. Normally at least six courses will be chosen from the STAT course list.

Prereq: (1) MATH109 or MATH199; and
(2) 33 points from STAT210-299; *and*
(3) 56 points from STAT310-399; *and*
(4) an additional 28 points from MATH310-399 or STAT310-399 *or* other approved courses.

Research Degrees

There are a number of active research groups in pure, applied and computational mathematics, in statistics, and in bioinformatics. The department also jointly supervises postgraduate students in conjunction with other departments or outside organizations, depending on the nature of the student's research topic. Information about possible research areas in the department may be found on the departmental website, or by talking to the department's postgraduate coordinator, or any academic staff member.

Master of Science (MSc) or Master of Arts (MA)

A Master's degree is a two-part degree. The first part consists of eight 400-level papers, and the second a research project which is presented as a thesis. Part II students are supervised by a senior supervisor who is a continuing academic staff member and at least one other supervisor.

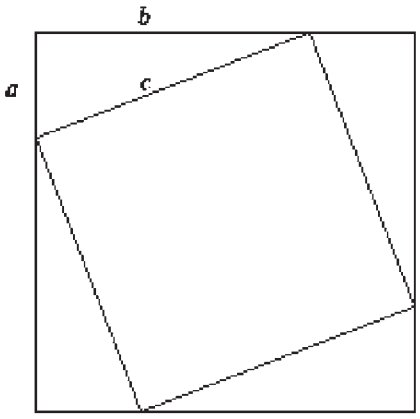
Students who are eligible to do a PGDipSc may enrol in the first part of a Master's degree. Students who have completed part I with an average grade of C+ or better, or who hold an appropriate Honours degree or PGDipSc, may enrol in part II once supervision has been arranged. Part II normally takes one year full time, but may take up to a maximum of two years. A Master's degree may be done part-time over a longer period. We almost always ask that you enrol for a BSc/BA (Hons) or PGDipSc in your first year.

Master's level papers in Engineering

Some of the department's 400-level papers are also offered as 600-level engineering mathematics (EMTH) papers. For more information please refer to the section on honours courses.

Doctor of Philosophy (PhD)

A PhD is a research degree that typically takes three years of study, but can take up to four. To enrol for a PhD, a student must have a BSc/BA (Hons) with either first class honours, or second class honours, division one, or a Master's degree. The student works under the direction of a supervision team led by an academic staff member with whom they have a shared research interest. The results of the work are presented in thesis form.



An inspiring picture containing one of our students' favourite proofs.

Current Student Profiles

Daniel Lond

In my first year at UC, I chose an engineering intermediate year, planning to go on to electrical, but at the end of my first semester I knew mathematics and computer science were for me and made a couple of changes to my programme. I took the core courses MATH108 and 109 and COSC121 and 122 which were necessary to get into second year courses in MATH and COSC, while MATH171 provided a link between the two because it involved programming to solve mathematical problems. I also took PHYS111 as an interest subject.

In my second year, the maths papers I enrolled in included the 'core' calculus and linear algebra courses (MATH254 and 264), and some very excellent (and fun!) pure papers (MATH221, 222 and 231), providing a good introduction to actually proving things. I also took several COSC papers. This way I could move into just about any 300-level course in either discipline. At this stage I hadn't even decided my major yet – let alone whether I should choose pure or applied maths.

The way I saw things by the beginning of my third year, if I had a solid grounding in pure maths then I could teach myself all the applied maths and programming skills that I needed to know, so I chose MATH321, 343, 352, 361 and 371. I talked to a lot of lecturers to help me choose suitable courses.

Having earned a BSc, I could make a start on my honours courses. I took eight 400-level MATH courses and a research project on Elliptic Curve Cryptography. The courses tend to vary from year to year but there'll always be something interesting to do – I chose papers with a lot of analysis and linear algebra. I made sure that the first half of my honours programme was heavier than the second so that I could concentrate on writing up my research project in the second half. Pretty much straight after my exams I accepted a PhD. scholarship with my honours supervisor Dr. Ben Martin and presently I'm happily working away in my office.

Ryoko Ito

I am currently studying towards a BSc (Hons) in Mathematics and Economics. I have done a combination of courses in pure and applied mathematics in my third year including MATH342, 343, 352 and 363. This helped me discover that I personally find mathematics a very intriguing and curious subject. The economics aspect of my academic studies is very well complimented by the mathematics. I am doing well in economics partly because of my extensive knowledge of mathematics, which is a huge advantage. My future plans include studying towards a PhD, possibly overseas, and subsequently beginning my career armed with a strong education in mathematics, macroeconomics, microeconomics and econometrics. Mathematics proved useful in combination with other endeavours also when I did research on biological modeling during the summer holidays after graduating. I have never done any biology courses and have limited knowledge of the subject, but my knowledge of mathematics allowed me to finish the research and to do it well. Studying mathematics therefore has given me the opportunity to explore a subject with many possibilities that is both intellectually interesting and helpful towards future career plans.

Ryoko Ito (left) and Daniel Lond (right).

Scholarships and Prizes

The Department offers a range of scholarships and prizes to students studying mathematics or statistics each year.

Undergraduate Scholarships and Prizes

UC Emerging Leaders' Scholarships: Category D - 2x scholarships at $3500 each towards tuition fees for first year students enrolled in mathematics and/or statistics at level 100 or 200. Contact the Scholarships office for application details.

Department Scholarships: You do not need to apply for the undergraduate scholarships.

Number of scholarships that may be offered each year:

Level	Full fees for MATH/STAT courses	Up to $1,000 for MATH/STAT courses
200	2	4
300	2	4
400	3	8

1. All scholarships are eligible to students who are majoring in mathematics or statistics and are doing: (a) at least 66 points of MATH or STAT or other approved courses at 200-level; or (b) at least 84 points of MATH or STAT or other approved courses at 300-level; or (c) at least six MATH or STAT or other approved courses at 400-level.

2. The scholarships will pay for MATH or STAT courses only and at the domestic rate.

3. Holders of 300-level or 400-level scholarships will normally be expected to do some tutoring or marking for the department, for which they will receive additional remuneration.

Scholarships of up to $3000 are also available for students doing summer projects in mathematics or statistics (MATH/STAT305 and MATH/STAT491). These scholarships are applied for in August for projects commencing in November/December.

The following prizes are awarded annually and on excellence in mathematics or statistics:

- *Cook Memorial Prize:*
  For final Honours students ($1200).
- *Page Memorial Prizes:*
  Two prizes at level 300 ($500 each).
- *Peter Bryant Memorial Prizes:*
  Two prizes at level 100 and 200 ($500 each).
- *Brent Wilson Prize:*
  For applied mathematics at level 300 ($500).
- *Gordon Petersen Prize:*
  For pure mathematics at level 200 ($500).
- *Statistics New Zealand Prize:*
  For statistics at level 300 ($300).

Postgraduate Scholarships

These postgraduate scholarships will be offered on the basis of:

(a) the student's potential, as demonstrated by their performance at the Honours level, and,

(b) the length of time since the named supervisor last supervised a postgraduate student with a departmental scholarship.

These scholarships will pay full fees at the domestic rate plus up to $6000 per year, for one year in the case of a Master's scholarship, and for up to three years in the case of a Doctoral scholarship. This amount may be reduced if the student accepts another scholarship. Holders of departmental postgraduate scholarships will normally be expected to do some tutoring or marking for the department, for which they will receive additional remuneration.

Other Awards

- Statistics New Zealand Maori and Pacific Islands Scholarships: To assist a Maori and a Pacific Islander attend university and obtain a statistics or mathematics undergraduate qualification ($3,500 per year for up to 3 years).
- J. Connal Scholarships: For BA students who excel in Latin, English, French, history or mathematics level 200. ($400 per year for 2 years). No application required.
- Lord Rutherford Memorial Research Fellowship: For outstanding merit and promise in physics, chemistry or mathematics at the postgraduate level ($20,000 per year for 2 years).
- Sims Empire Scholarship: For outstanding merit and promise in physics, chemistry, mathematics or medicine at the postgraduate level for study in Great Britain ($15,000 per year for 2 years).
- Professor C. C. Farr Memorial Scholarship: For students who are enrolled in an honours or postgraduate degree in physics and/or astronomy and/or mathematical physics ($500 per annum). No application required.

For details on applications for these awards, or if you have any questions, please contact the Scholarships Office:

Web: www.canterbury.ac.nz/scholarships

Email: scholarships@canterbury.ac.nz

The Scholarships Office also has a file on Māori and Pacific Island Scholarships. An increasing number of these are available in science and commerce in particular.

Tutoring Work

There are opportunities for senior undergraduate and postgraduate students in mathematics or statistics to undertake paid tutoring work for our undergraduate courses. This can involve taking tutorial classes and supervising labs of around 20 students and is a great way to develop teaching skills and earn some extra money.

Career Opportunities

Graduates with Bachelor's degrees are employed as analysts, engineers, teachers, modellers, programmers, bankers, meteorologists, statisticians and auditors. According to a 2005 graduate employment survey undertaken for the New Zealand Vice-Chancellors' Committee, nearly 50% of mathematics/statistics graduates do further study. Of those employed, 42% are in business services, 21% are in manufacturing and retail, 13% are in service industries, 10% are in government, health and community services, and 5% are in education. The average beginning salary for 2004 graduates in full-time employment in 2005 was around $38,500.

Employers include computer companies, banks and insurance companies, tertiary institutions, telecommunications companies, investment companies, the energy industry, market research companies, transportation companies, Statistics New Zealand and the retail industry.

Many employers want people who have a broad background in mathematics, statistics, computation and science. They value the ability to think precisely and reason logically; these are skills you will develop from your mathematical studies. While some jobs require specific mathematical or statistical skills, many employers will hire mathematicians and statisticians because of their general problem-solving abilities and their capacity for abstract thought: they want bright people they can train. Growth areas include financial mathematics and computing combined with mathematics. There is a severe shortage of people with statistical knowledge.

Potential Employers

Government Organisations

Government Communications Security Bureau
– cryptography, signal processing, systems analysis.

Land Transport Safety Authority of New Zealand
– traffic modelling.

The Treasury
– economic forecasting and analysis.

Ministry of Education
– statistical analysis.

Ministry of Fisheries
– fisheries management, ecological modelling, analysis.

Ministry of Health
– statistical analysis, epidemiological modelling.

Ministry of Social Development
– statistical analysis.

Accident Compensation Corporation
– statistical analysis.

Royal New Zealand Navy
– signal processing, systems analysis.

Statistics New Zealand
– statistical analysis (e.g., of housing, trade, health).

Environment Canterbury
– resource management, modelling.

Ministry of Research, Science and Technology
– policy development and analysis.

Department of Conservation
– ecological statistics, possum control, modelling of invasive species.

Canterbury District Health Board
– modelling of disease processes.

Crown Research Institutes

Industrial Research Limited
– communications and signal processing, geothermal modelling, robotics.

National Institute of Water & Atmosphere Ltd (NIWA)
– oceanography, fisheries management, ecological modelling.

Commerce and Industry

Meteorological Service of New Zealand
– fluid mechanics, modelling.

Orion
– network analysis.

Pacific Edge Biotechnology Ltd
– biomathematics, biotechnology, bioinformatics, computational biology.

CES Communications
– cryptography.

Rodgers & Partners Ltd
– business consultancy and analysis.

Tower Managed Funds Investments Ltd
– actuarial analysis.

Weyerhaeuser NZ
– logistics co-ordination.

Education Institutes

School mathematics teacher
– mathematics, statistics.

University teaching and research
– technicians, tutors, research assistants, lecturers.

Department Staff

Research Strengths

In pure mathematics, there are particularly strong researchers working in combinatorics, the foundations of mathematics, algebra, geometry, harmonic analysis, the potential theory of differential operators, and group theory.

The applied mathematics group has strengths in applied nonlinear differential equations, dynamical systems, computational mathematics, discrete mathematics and mathematical modelling. Applications include biological and physical systems, and biomedical, chemical and electrical engineering.

The statistics group has strong research interests in applied statistics, with particular applications in ecology, forestry, medicine and econometrics.

Members of the department are engaged in research in a number of fields within mathematics and statistics. Within the department we have a research centre, the Biomathematics Research Centre, and staff are members of many other research groups including the Allan Wilson Centre for Molecular Ecology and Evolution, the Centre for Bioengineering and the Centre for Mathematics in Industry. We have strong links to other departments, especially to biology, commerce, computer science, engineering and physics.

Academic Staff and Research Interests

Rick Beatson: Mathematics, statistics and fast algorithms for fitting spatial data. Radial basis functions. Visualisation. Applications to laser scanner and geophysical data. Neural networks, Kriging and Cross Validation.

Arno Berger: Dynamical systems. Ergodic theory. Applied probability and stochastic processes. Stability and bifurcation theory. Classical mechanics. Symmetry and scaling.

Douglas Bridges: Constructive foundations of analysis, topology, algebra, and physics. Computability and complexity. Mathematical economics.

Bob Broughton: Mathematical education, numerical mathematics.

Jennifer Brown: Ecological statistics, environmental monitoring, animal population assessment, sampling theory, experimental design.

Qui Bui: Fourier analysis. Wavelet analysis. Weighted functions spaces. Littlewood-Paley theory.

Easaw Chacko: Probability theory, stochastic processes, time-series analysis, biostatistics, survey sampling.

Ian Coope: Nonlinear optimisation. Linear algebra and applications. Scientific and statistical computing. Computational mathematics.

John Hannah: Abstract and linear algebra. Mathematics education. History of mathematics.

Mark Hickman: Symmetries of differential equations. Invariance under groups. Algebraic computing. Dynamical systems.

Alex James: Modelling of problems in combustion and ecology including larval fish growth and the role of environmental stochasticity.

Dominic Lee: Computational, Bayesian and nonparametric statistics, with applications in medical research, bioinformatics, signal processing and image processing.

Ben Martin: Group theory, geometric invariant theory and cryptography.

Mike Plank: Mathematical biology. Modelling problems in biology, ecology and engineering, including cardiovascular disease and kidney function.

Chris Price: Numerical, non-smooth and global optimisation.

Marco Reale: Econometrics. Time Series. Graphical Modelling.

Peter Renaud: Functional analysis. Ergodic theory. Cryptography. Clifford algebras. Quantum Mechanics.

Carl Scarrott: Spatial statistics, extreme value methods and spectral analysis with application to problems in industry, environment and other sciences.

Charles Semple: Combinatorics, computational complexity and computational biology.

Mike Steel: Discrete and stochastic models, bioinformatics, theoretical biology and evolutionary genetics.

Gūnter Steinke: Geometry. Topology. Groups. Combinatorics.

Bill Taylor: Probability, with emphasis on discrete probability processes and the connection between probability and logic.

David Wall: Mathematical biology. Applied dynamical systems. Mathematical wave theory. Inverse problems. Computational mathematics.

Neil Watson: Partial differential equations and potential theory.

Phil Wilson: Mathematical modelling in biology and industry. Multiscale information transfer and emergent phenomena. Philosophy and communication of mathematics.

Postdoctoral and Research Staff

Britta Basse
Frank Lad
Bob Long
Erick Matsen
Richard Penny
Oliver Will

Technical Staff

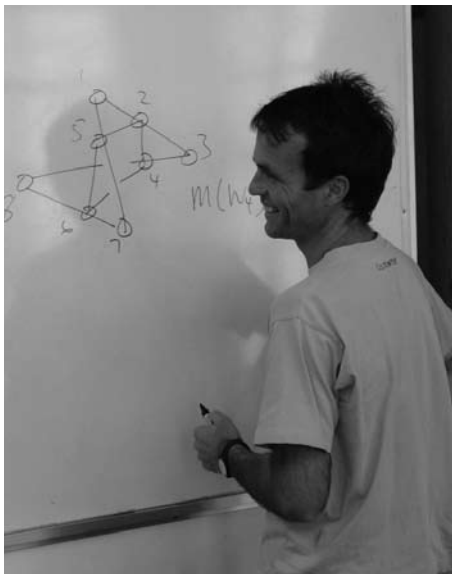
Paul Brouwers - Technician
Steve Gourdie – Senior Technician
Allen Witt – Senior Programmer/Analyst

Administrative Staff

Julie Daly
Sarah Vincent
Pauline Auger

Senior Tutors and Teaching Staff

Liz Ackerley
Jane Clucas
Irene David
Pam Hurst
Jacqui Nokes
David Robinson
Clemency Williams



Help and Advice

If you have any problems, you are always welcome to approach any member of staff for help. Academic staff and course administrators have two designated office hours per week during which they are happy to assist students. You may prefer to arrange an appointment by e-mail or by asking the lecturer after class or by leaving a message at reception.

The course web pages are also a valuable source of information. The 'Undergraduate Students' page has further details:

www.math.canterbury.ac.nz/php/undergraduate/

Please remember that staff members are always willing to help with genuine problems, but we won't know you have a problem unless you tell someone.

Course changes and advice

If you would like advice about planning your course of study to match your career goals, please contact the student advisor at the College of Engineering.

For specific academic programme advice, any of the course advisors listed below will help you decide which course best suits your needs.

Mathematics: Alex James, John Hannah
Statistics: Jennifer Brown
Honours: Charles Semple, Jennifer Brown
Postgraduates: Chris Price

Problems and complaints

- Depending on the problem, people to contact to get matters sorted out are your lecturers, course coordinators or administrators, tutors or class representatives. They may be able to provide help, or direct you to other places where you can seek support. Names and contact details of your class representatives are on the course web pages and the 'Undergraduate Students' webpage.
- For further advice contact the departmental grievance committee through the coordinator, Gunter Steinke or through the Education Coordinator in the Student Union building.

Preparation Courses

If you intend to enrol in one of the core mathematics courses, MATH101 or 108, or STAT111 or 112, and feel that your background is inadequate, then the preparation courses that are run in January/February may be for you. These courses are advertised in the *Enrolment Handbook* and in the *Student Guide*. For more information see **www.math.canterbury.ac.nz/courses/summer.**

Frequently Asked Questions

How do I find out about my course?

All our courses have webpages containing course information which you should familiarise yourself with. You will be expected to access the course webpage regularly to download course material and look for news items. Course links are on the 'Undergraduate Students' page:

www.math.canterbury.ac.nz/php/undergraduate/

Some of the courses have course readers which contain material such as tutorial questions, lecture notes, formula sheets and tables etc, and all course details.

What if I have difficulty with the course material?

For help with this, you can see your lecturer during her/his office hours, you can ask your tutor in a tutorial, or you can go along to the help classes, where available. The course webpage or course news will contain details. Make sure you have specific questions to ask and that you have first worked at the problem yourself.

How do I organise my tutorials?

Many mathematics and statistics courses cater for very large numbers of students so tutorials are available at a number of times during the week. Tutorial enrolment is mainly done online and you can choose a time to suit your other commitments. You will be informed of how to do this during the first lecture. However, tutorial enrolment is often on a first-come first-served basis and if you leave enrolling until the last minute you may find the group you want is full. In exceptional circumstances, the course administrator will help find a time.

What do I do if I'm sick and miss an assessment?

Personal circumstances can cause you to miss a test or exam, or impair your performance in them. Look in the *University Calendar* or the *Enrolment Handbook* for the regulations concerning aegrotats, but you should also see the lecturer in charge of the course.

Do I need to attend tutorials?

No single element of any course is strictly compulsory! However, the importance of tutorials cannot be over-emphasised and many courses assign a percentage (typically 5%) of the assessment to tutorial attendance, preparation and/or participation. If you do not participate in tutorials, then you will have great difficulty passing the tests and examinations. **You should regard tutorial attendance as compulsory if you plan to succeed**.

What if I can't understand the material even after seeking help?

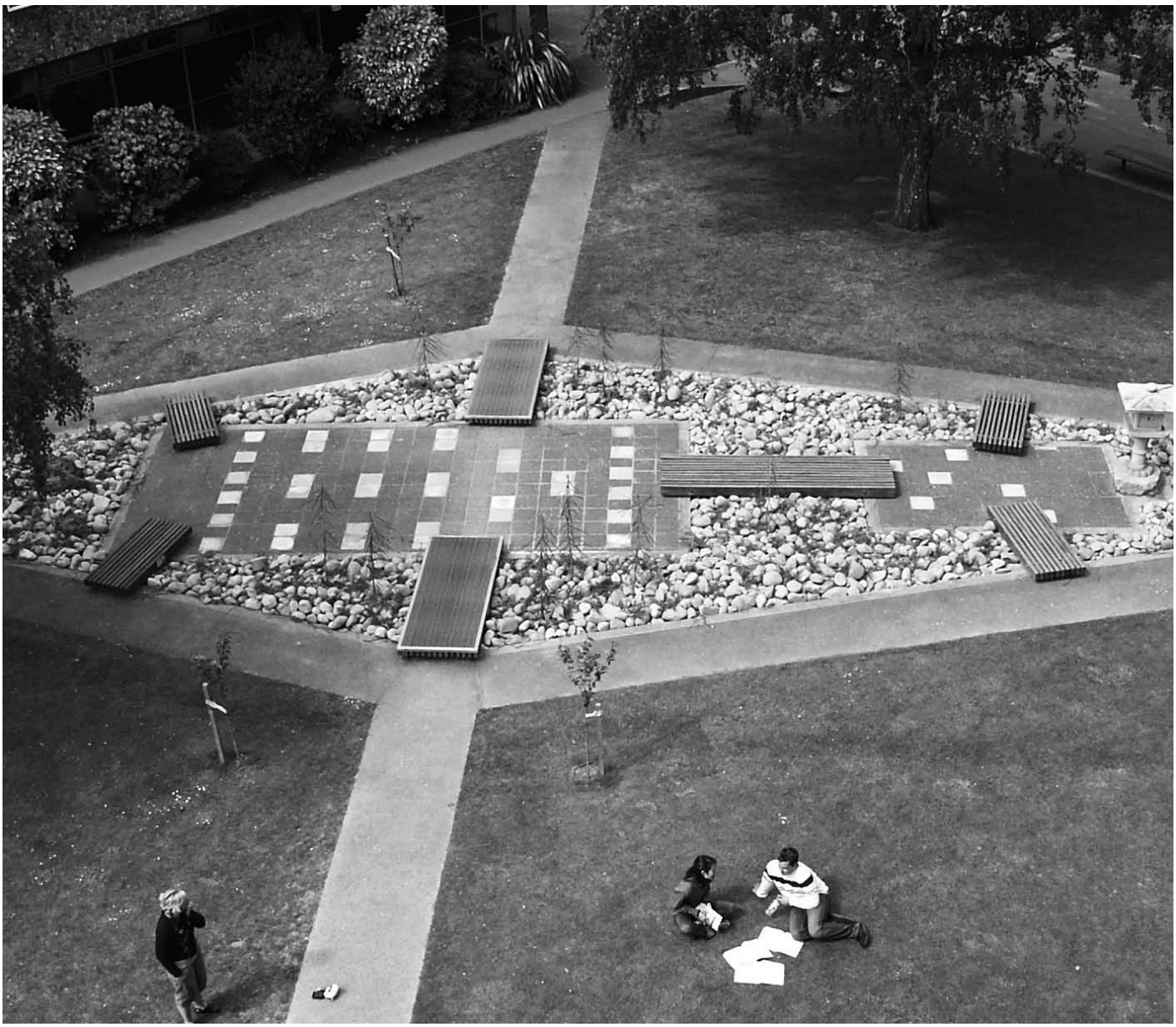
Some people may need additional help even after all formal means of support have been tried. Some people take more than one attempt to pass a paper. A list of private tutors is available from our reception, if you need individual help.

Department Facilities

The Department of Mathematics and Statistics has modern, well equipped teaching and research computer laboratories, classrooms and meeting rooms.

The computing facilities include cutting edge 64-bit Windows systems, as well as Linux and UNIX operating systems. The labs are fitted out with fully networked workstations designed to satisfy the performance demands of modern mathematical and statistical computing applications. Four computer labs in the basement of the building service all our undergraduate courses. These are complemented by two fully equipped labs on level 4 for our advanced honours and postgraduate students. These facilities have extended opening hours and are equipped with fast and reliable printing services. Research students have computer access provided in their departmental office. The departmental computing facilities can be accessed remotely from any of the computer labs on campus, so you don't even need to be physically in the building. The building itself has full wireless coverage.

A complete range of mathematical and statistical computing software is provided, along with all the usual IT packages. The leading technical computer languages in mathematics and statistics, MATLAB and 'R', are available, along with Maple for symbolic algebra. Other statistical computing is provided by SAS and Statistica.



The Bridges of Friendship Garden. The paths and bridges embody the famous Kōnigsberg bridges problem. The problem is to find a path around all the bridges that crosses each bridge exactly once (without going around the far ends of the diamond), or to prove that it can't be done. The layout of bridges is from the Prussian town of Kōnigsberg.

100-level courses

MATH101

Introductory Mathematics with Applications **18 points**

MATH101-07W (C)

Introduction to calculus, trigonometry and algebra. Emphasis on setting up mathematical models of problems, solving them and interpreting the solutions. Applications to the physical, life and earth sciences as well as to commerce and the humanities.

Restrictions: MATH104, MATH105, MATH106, MATH107, MATH108, MATH109, MATH171

Enquiries: Pamela Hurst

MATH108

Mathematics 1C **18 points**

MATH108-07S1 (C)
MATH108-07S2 (C)
MATH108-07W (C)

Introduction to the ideas, techniques and applications of linear algebra and calculus.

Restrictions: MATH104, MATH105, MATH106

Enquiries: Department of Mathematics and Statistics reception

MATH109

Mathematics 1D **18 points**

MATH109-07S1 (C)
MATH109-07S2 (C)
MATH109-06SU2 (U)

Extension of the calculus and linear algebra introduced in MATH108.

Prerequisite: MATH106 or MATH108.
Restrictions: MATH104, MATH105, MATH107.

Enquiries: Günter Steinke (semester two course); Bill Taylor (semester one course); Irene David (summer course).

MATH115

Discrete Mathematics 1 **18 points**

MATH115-07W (C)

Discrete mathematics is that part of mathematics not involving limit processes. It includes logic, the integers, finite structures, sets and networks.

Enquiries: Bill Taylor

MATH134

Logic and Computability **18 points**

MATH134-07S1 (C)
MATH134-07SU1 (C)
Introduction to logic and computability.

Restrictions: PHIL134, PHIL144, MATH144
Enquiries: Douglas Bridges

MATH171

Mathematical Modelling and Computation **18 points**

MATH171-07S2 (C)

An introduction to mathematical modelling and simulation via case studies using standard computer packages. Structured programming for mathematical problem solving.

Recommended Preparation: MATH108, currently enrolled in or have completed MATH105 or MATH109

Restrictions: EMTH171
Enquiries: Alex James

MATH199

AIMS - Advancing in Mathematical Sciences **36 points**

MATH199-07W (C)

This course is designed for secondary school students who may gain direct entry into level 200 university courses from school. It gives you the opportunity to study stimulating and interesting work while at school, and will prepare you well for second year mathematics.

Prerequisites: Subject to approval of the Head of Department.

Enquiries: Liz Ackerley

STAT111

Statistics 1 **18 points**

STAT111-07W (C)

Using statistics in real life situations. Emphasis on actual problems and real data sets. Introduction to Excel.

Restrictions: STAT112, STAT131
Enquiries: Carl Scarrott

STAT112

Statistics 1 **18 points**

STAT112-07S2 (C)

Using statistics in real life situations. Emphasis on actual problems and real data sets. Introduction to Excel.

Restrictions: STAT111, STAT131
Enquiries: Marco Reale

200-level courses

MATH208

Logic A **22 points**

MATH208-07S1 (C)

Prerequisites: Any 18 points in Philosophy or Mathematics or Computer Science.
Restrictions: PHIL225, PHIL246, PHIL346, PHIL208, PHIL308, MATH308

Enquiries: Douglas Bridges

MATH221

Algebra and Cryptography **11 points**

MATH221-07S1 (C)

The algebraic structure of integers and polynomials. Rings and finite fields. Introduction to cryptography.

Prerequisites: MATH104 or MATH105 or MATH106 or MATH107 or MATH108 or MATH109 or MATH115

Restrictions: MATH211, MATH315

Enquiries: Peter Renaud

MATH222

Groups and Symmetry **11 points**

MATH222-07S2 (C)

An introduction to the methods of abstract algebra via the study of symmetries and permutations.

Prerequisites: MATH104 or MATH105 or MATH106 or MATH107 or MATH108 or MATH109 or MATH115
Restrictions: MATH211

Enquiries: Ben Martin

MATH231

Discrete Methods **11 points**

MATH231-07S2 (C)

An introduction to graph theory, a central area of discrete mathematics in which many real world problems can be interpreted and solved.

Prerequisites: MATH104 or MATH105 or MATH106 or MATH107 or MATH108 or MATH109 or MATH115
Restrictions: MATH215

Enquiries: David Robinson

MATH243

Analysis 2 **11 points**

MATH243-07S1 (C)

This course gives a deeper understanding of the real number system, calculus and limits.

Prerequisites: MATH104 or MATH105 or MATH107 or MATH109
Restrictions: MATH212

Enquiries: Arno Berger and Qui Bui

MATH251

Linear Systems **11 points**

MATH251-07S1 (C)

Introduction to linear algebra. Linear systems, numerical solution of large linear systems, vector spaces, linear transformations.

Prerequisites: MATH104 or MATH105 or MATH107 or MATH109
Restrictions: MATH204, MATH217, MATH254, EMTH203, EMTH204

Enquiries: Department of Mathematics and Statistics reception

MATH252

Matrix Algebra 2 **11 points**

MATH252-07S2 (C)

Eigenvalues and eigenvectors, inner product spaces, orthogonality, quadratic forms, complex spaces.

Prerequisites: MATH104 or MATH105 or MATH107 or MATH109
Restrictions: MATH204, MATH217, MATH254, EMTH203, EMTH204

Enquiries: Arno Berger

MATH254

Linear Algebra 2 **22 points**

MATH254-07S2 (C)

An accelerated course in Linear algebra. Linear systems, complex vector spaces, linear transformations, eigenvalues and eigenvectors, inner product spaces, orthogonality, quadratic forms, numerical solution of large linear systems.

Prerequisites: MATH104 or MATH105 or MATH107 or MATH109 and Head of Department approval.
Restrictions: MATH204, MATH217, MATH251, MATH252, EMTH203, EMTH204

Enquiries: Peter Renaud

MATH261

Multivariate Calculus **11 points**

MATH261-07S1 (C)

An extension of the ideas of differentiation and integration to multivariate functions and to vector valued functions.

Prerequisites: MATH104 or MATH105 or MATH107 or MATH109
Restrictions: MATH204, MATH218, MATH219, MATH264, EMTH201, EMTH202, EMTH204, EMTH210

Enquiries: Mike Plank

MATH262

Differential Equations and Transforms **11 points**

MATH262-07S2 (C)

An introduction to second order ordinary differential equations. Laplace transforms, Fourier series, Complex functions.

Prerequisites: MATH104 or MATH105 or MATH107 or MATH109
Restrictions: MATH204, MATH218, MATH219, MATH264, EMTH201, EMTH202, EMTH204, EMTH210

Enquiries: Mark Hickman

MATH264

Multivariate Calculus and Differential Equations **22 points**

MATH264-07S1 (C)

An accelerated course in calculus of several variables, vector fields and ordinary differential equations.

Prerequisites: MATH104 or MATH105 or MATH107 or MATH109 and Head of Department approval.
Restrictions: MATH204, MATH218, MATH219, MATH261, MATH262, EMTH201, EMTH202, EMTH204, EMTH210, EMTH264

Enquiries: John Hannah

MATH271

Mathematical Modelling and Computation 2 **11 points**

MATH271-07S2 (C)

Use of the package MATLAB including matrix algebra, user-defined functions, surface plotting. Numerical methods including solutions of systems of linear equations, solution or ordinary differential equations and systems of equations, approximation techniques. Modelling projects.

Prerequisites: (MATH171 or MATH280 or MATH281 or MATH282) AND (EMTH201 or EMTH202 or EMTH204 or EMTH210 or MATH261 or MATH264). Or high grade in MATH104, MATH105, MATH107 or MATH109 and Head of Department approval.
Restrictions: MATH266, EMTH271

Enquiries: John Hannah

MATH282

Introduction to Scientific Computing **11 points**

MATH282-07SU1 (C)

As for MATH 281. Limited entry. See limitation of entry regulations.

Prerequisites: MATH104 or MATH105 or MATH107 or MATH109
Restrictions: MATH280, MATH281

Enquiries: Bob Broughton

STAT212

Statistical Distributions **11 points**

STAT212-07S1 (C)

Distribution and densities, expectations, moments and MGF, discrete distributions, continuous distributions, sampling distributions.

Prerequisites: (MATH104 or MATH105 or MATH106 or MATH107 or MATH108 or MATH109) and (STAT111 or STAT112 or STAT131)
Restrictions: STAT221, STAT223, STAT231

Enquiries: Mike Steel

STAT214

Statistical Inference **11 points**

STAT214-07S2 (C)

Point estimation, confidence intervals, hypothesis testing, likelihood, linear models, regression and analysis of variance.

Prerequisites: (1) STAT111 or STAT112, (2) MATH108
Restrictions: STAT221

Enquiries: Dominic Lee

STAT216

Probability **11 points**

STAT216-07S1 (C)

Combinatorial probability, distribution theory, Markov chains and stochastic systems.

Prerequisites: STAT111 or STAT112 or MATH108
Restrictions: STAT231, MATH223

Enquiries: Bill Taylor

STAT218

Computational Methods in Statistics **11 points**

STAT218-07S2 (C)

Computational techniques, exploratory data analysis and statistical inference.

Prerequisites: STAT111 or STAT112 or MATH108 or MATH115 or MATH171

Enquiries: Department of Mathematics and Statistics reception

STAT222

Applied Statistics **11 points**

STAT222-07S1 (C)

A practical introduction to commonly used statistical practices. The emphasis is on real data and the application of statistical techniques.

Prerequisites: STAT111 or STAT112 or STAT131
Restrictions: FORE222, FORE210, STAT220

Enquiries: Marco Reale

STAT224

Regression Modelling **11 points**

STAT224-07S2 (C)

Regression models are the most widely used statistical tools for examining the relationships among variables. This course will provide a practical introduction to the fundamentals of regression modelling.

Prerequisites: STAT111 or STAT112 or STAT131
Restrictions: FORE224, FORE210, STAT220

Enquiries: Carl Scarrott

300-level courses

MATH301

Mathematics in Perspective **14 points**

MATH301-07S1 (C)

Topics in the history, philosophy, directions and culture of mathematics including significant results from the past and an outline of some major areas of progress in the 20th century.

Prerequisites: 36 points in Mathematics or Statistics or Engineering Mathematics at 100 level, and 44 points from the BA or BSc Schedule at 200 level in Mathematics, Statistics, Engineering Mathematics, related subjects, or other subjects with good grades, as approved by the Head of Department.

Enquiries: John Hannah

MATH305

Mathematics Project **14 points**

MATH305-06SU2(C)

This 150 hour course provides students with an opportunity to develop mathematical or statistical research skills to extend and strengthen their understanding of an area of mathematics or statistics.

Prerequisites: 44 points from MATH210-299, and approval of Head of Department.
Restrictions: STAT305

Enquiries: Alex James and Ben Martin

MATH321

Fields and Commutative Rings **14 points**

MATH321-07S1 (C)

An introduction to fields and rings, including applications to coding theory and the impossibility of constructions such as 'squaring the circle'.

Prerequisites: MATH221 or MATH222 (or MATH254 or EMTH204 with Head of Department approval)
Restrictions: MATH311

Enquiries: Gunter Steinke

MATH333

Coding Theory **14 points**

MATH333-07S1 (C)

An introduction to the mathematics underlying communication codes, in particular linear codes and ciphers.

Prerequisites: 22 points from MATH221, MATH222, MATH231, MATH251, MATH252, MATH254, EMTH203, EMTH204 or 22 points at 200 level Maths with Head of Department approval.
Restrictions: MATH315

Enquiries: Charles Semple

MATH334

Combinatorics **14 points**

MATH334-07S2 (C)

Modern combinatorics and discrete mathematics with an emphasis on design theory.

Prerequisites: 22 points from MATH221, MATH222, MATH231, MATH251, MATH252, MATH254, EMTH203, EMTH204 or 22 points at 200 level Maths with Head of Department approval.
Restrictions: MATH315

Enquiries: Gunter Steinke

MATH336

Foundations of Mathematics **14 points**

MATH336-07S2 (C)

An introduction to the philosophy of mathematics, classical and intuitionistic logic, set theory, and Gödel's theorems.

Prerequisites: 22 points from MATH221-282 or EMTH200-204 or EMTH210-271; or approval of Head of Department.
Enquiries: Douglas Bridges

MATH342

Applications of Complex Variables **14 points**

MATH342-07S2 (C)

Application of complex variable theory in the physical and engineering sciences. Contour integration. Conformal mappings.

Prerequisites: (22 points from MATH219, MATH264, EMTH204) or (MATH261 and MATH262) or MATH243 or EMTH202
Restrictions: MATH319

Enquiries: Chris Price

MATH343

Metric, Normed and Hilbert Spaces **14 points**

MATH343-07S1 (C)

An introduction to those parts of modern analysis essential for many aspects of pure and applied mathematics, physics, economics and finance.

Prerequisites: (MATH243 or MATH264 or EMTH202) or (22 points from MATH200 or EMTH200 as approved by the Head of Department).
Restrictions: MATH312

Enquiries: Qui Bui

MATH352

Applied Matrix Algebra A **14 points**

MATH352-07S1 (C)

Introduction to computational optimisation and the associated linear algebra.

Prerequisites: MATH251 or MATH252 or MATH254 or EMTH203 or EMTH204.
Recommended Preparation: MATH280 or MATH281 or MATH282 or MATH271
Restrictions: MATH317

Enquiries: Department of Mathematics and Statistics reception

MATH353

Applied Matrix Algebra B **14 points**

MATH353-07S2 (C)

Introduction to the theory and application of eigensystems and the associated linear algebra.

Prerequisites: MATH252 or MATH254 or EMTH203 or EMTH204.
Recommended Preparation: (MATH251 or MATH352) and (MATH271, MATH280, MATH281 or MATH282)
Restrictions: MATH317

Enquiries: Bob Broughton

MATH361

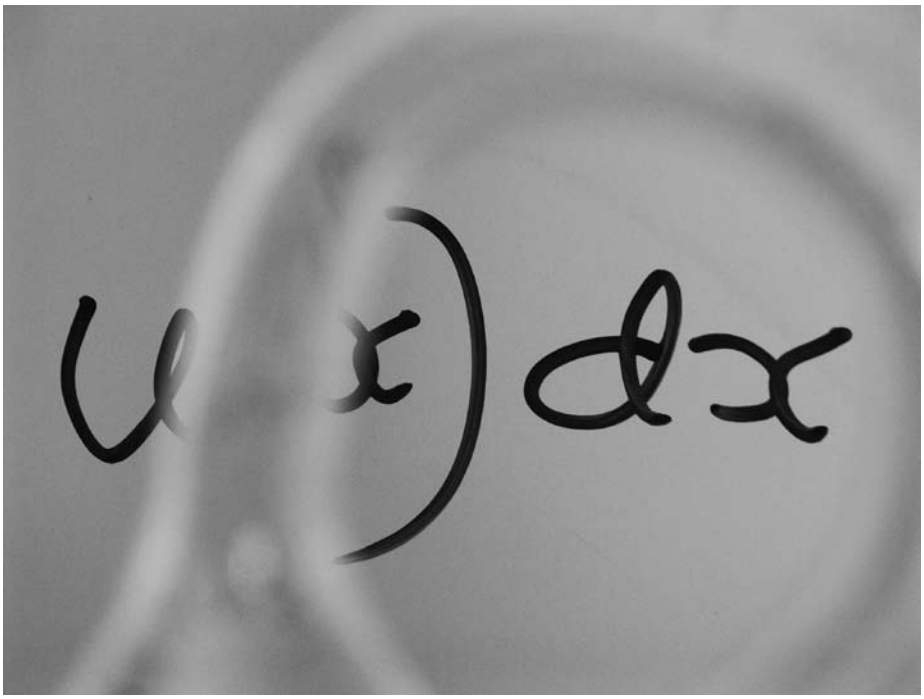
Partial Differential Equations **14 points**

MATH361-07S1 (C)

An introduction to the methods of solution for partial differential equations and to their applications.

Prerequisites: 22 points from MATH219, MATH261, MATH262, MATH264, EMTH202, EMTH204
Restrictions: MATH314, MATH318, MATH319

Enquiries: Mark Hickman



MATH363

Dynamical Systems **14 points**

MATH363-07S2 (C)

An introduction to nonlinear systems, the use of linearisation techniques and bifurcation theory.

Prerequisites: 22 points from MATH219, MATH261, MATH262, MATH264, EMTH202, EMTH204.

Recommended Preparation: MATH252, MATH254 or EMTH203
Restrictions: MATH318

Enquiries: Department of Mathematics and Statistics reception

MATH371

Vector Calculus and Modelling **14 points**

MATH371-07S1 (C)

Applications of calculus in solving applied problems in science and engineering. Techniques for modelling and solving physical continuous systems.

Prerequisites: MATH219 or MATH264 or MATH261 or MATH262 or EMTH202 orEMTH204.
Restrictions: MATH318

Enquiries: David Wall

MATH376

Applied Stochastic Modelling **14 points**

MATH376-07S2 (C)

Theory and applications of Markov processes. Applications to population dynamics, queuing and reliability.

Prerequisites: *i)* 11pts from STAT212, STAT214, STAT216 and a further 11 pts from STAT210 to STAT299. *ii)* MATH109 or MATH199.
Recommended Preparation: STAT212, STAT216, and 11 points from MATH252, MATH254, MATH261, MATH262, MATH264, EMTH202, EMTH203, EMTH204
Restrictions: STAT316

Enquiries: Department of Mathematics and Statistics reception

MATH381

Advanced Scientific Computing **14 points**

MATH381-07S2 (C)

The use of advanced MATLAB routines for numerical methods in a range of topics including: the solution of nonlinear algebraic equations; systems of ordinary differential equations; two-point boundary value problems; partial differential equations; nonlinear optimization; numerical integration; numerical approximation.

Prerequisites: (MATH261 or MATH262 or MATH264 or EMTH202 or EMTH204) and (MATH266 or MATH271 or MATH280 or MATH282)
Restrictions: MATH366, MATH367

Enquiries: David Wall

MATH391

Special Topic: Cryptography **14 points**

MATH391-07S2 (C)

Enquiries: Ben Martin

STAT305

Statistics Project **14 points**

STAT305-06SU2 (C)

This 150 hour course provides students with an opportunity to develop mathematical or statistical research skills to extend and strengthen their understanding of an area of mathematics or statistics.

Prerequisites: 33 points from STAT210-299, and approval of Head of Department.
Restrictions: MATH305

Enquiries: Alex James and Ben Martin

STAT312

Sampling Methods **14 points**

STAT312-07S1 (C)

Sampling techniques and designs. Special sampling designs for surveys of animal populations.

Prerequisites: 11 pts from STAT212, STAT214, STAT222, STAT224 and a further 11 pts from STAT210 to STAT299.

Enquiries: Easaw Chacko

STAT313

Computational Statistics **14 points**

STAT313-07S2 (C)

Data analysis and statistical inference based on permutation methods, EDF methods, bootstrap and resampling methods, kernel methods and Markov chain methods.

Prerequisites: *i)* 11pts from STAT212, STAT214, STAT222, STAT224 and a further 11 pts from STAT210 to STAT299. *ii)* MATH108.
Recommended Preparation: STAT218, and either MATH109 or MATH199

Enquiries: Easaw Chacko

STAT314

Statistical Inference **14 points**

STAT314-07S1 (C)

Estimation and hypothesis testing from both Bayesian and classical viewpoints.

Prerequisites: i) 11pts from STAT212, STAT214 and a further 11 pts from STAT210 to STAT299. ii) MATH109 or MATH199.

Recommended Preparation: STAT212 and STAT214
Enquiries: Marco Reale

STAT315

Multivariate Statistical Methods **14 points**

STAT315-07S2 (C)

Detailed study of multivariate methods. Application of multivariate methods, test statistics and distributions.

Prerequisites: 11pts from STAT212, STAT214, STAT222, STAT224 and a further 11 pts from STAT210 to STAT299.
Recommended Preparation: MATH252 or MATH254

Enquiries: Carl Scarrott

STAT316

Applied Stochastic Modelling **14 points**

STAT316-07S2 (C)

Theory and applications of Markov processes. Applications to population dynamics, queuing and reliability.

Prerequisites: *i)* 11pts from STAT212, STAT214, STAT216 and a further 11 pts from STAT210 to STAT299. *ii)* MATH 109 OR MATH199.

Recommended Preparation: STAT212, STAT216 and 11 points from MATH252, MATH254, MATH261, MATH262, MATH264, EMTH202, EMTH203,EMTH204
Restrictions: MATH376

Enquiries: Department of Mathematics and Statistics reception

STAT317

Time Series Methods **14 points**

STAT317-07S1 (C)

Analysis of sequentially collected data including data modelling and forecasting techniques.

Prerequisites: *i)* 11pts from STAT212, STAT214, STAT222, STAT224 and a further 11 pts from STAT210 to STAT299, ECON211 and MSC1210. *ii*) MATH109 or MATH199.
Recommended Preparation: 11 pts from MATH251, MATH252, MATH254 and 11 pts from MATH271, MATH282, STAT216

Enquiries: Easaw Chacko

STAT391

Special Topic: Bayesian Statistics **14 points**

STAT391-07S2 (C)

Prerequisites: *i)* 11pts from STAT212, STAT214 and a further 11 pts from STAT210 to STAT299. *ii)* MATH109 or MATH199.

Recommended Preparation: STAT218

Enquiries: Dominic Lee

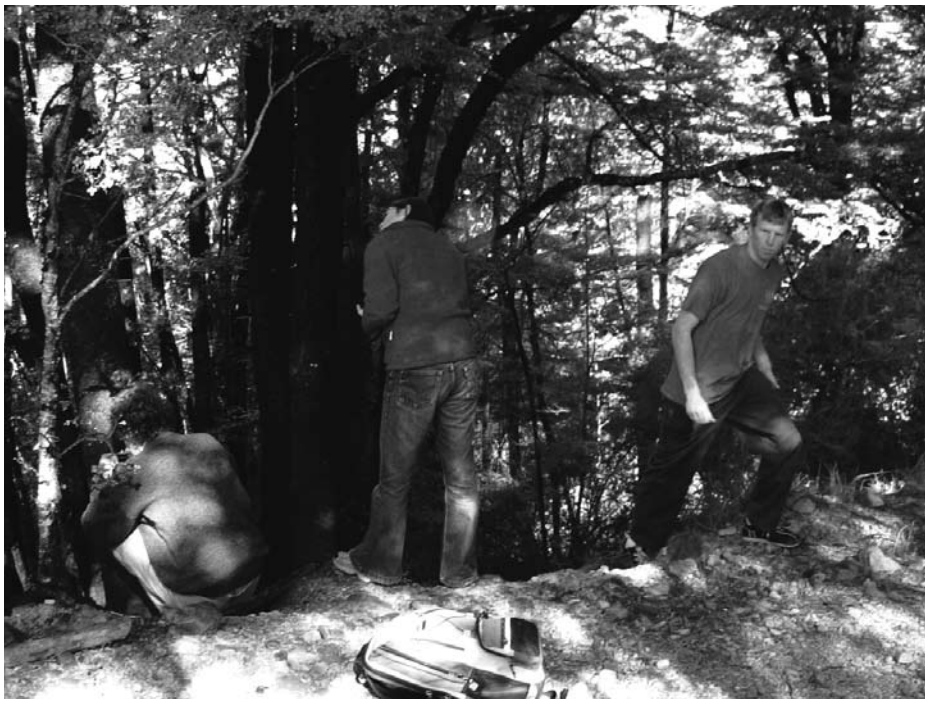
STAT392

Special Topic: Data Mining **14 points**

STAT392-07S2 (C)

Prerequisite: STAT111, STAT112 or STAT131 and 22 points at the 200 level in a relevant area.

Enquiries: Marco Reale



MATH406 students on a field trip measuring insect honeydew production in Ashley Forest.

400-level courses

MATH401

Dynamical Systems 1 **15 points**
MATH401-07S2 (C)
Enquiries: Michael Plank

MATH405

Bioinformatics **15 points**
MATH405-07S1 (C)
Enquiries: Mike Steel

MATH406

Mathematical Models in Biology **15 points**
MATH406-07S1 (C)
Enquiries: Alex James

MATH407

Special Topic: Moving Frames and Exterior Differential Systems **15 points**
MATH407-07S1 (C)
Enquiries: Mark Hickman

MATH409

Special Topic: Cryptography **15 points**
MATH409-07S2 (C)
Enquiries: Ben Martin

MATH410

Approximation Theory 1 **15 points**
MATH410-07S2 (C)
Enquiries: Rick Beatson

MATH412

Unconstrained Optimization **15 points**
MATH412-07S1 (C)
Enquiries: Chris Price and Ian Coope

MATH420

Hilbert Spaces **15 points**
MATH420-07S2 (C)
Enquiries: Arno Berger

MATH425

Fourier Transformations and Distribution Theory **15 points**
MATH425-07S2 (C)
Enquiries: Qui Bui

MATH426

Differential Geometry **15 points**
MATH426-07S1 (C)
Enquiries: Gunter Steinke

MATH427

Lie Groups and Lie Algebras **15 points**
MATH427-07S1 (C)
Enquiries: Gunter Steinke

MATH429

Combinatorics **15 points**
MATH429-07S1 (C)
Enquiries: Charles Semple

MATH431

Special Topic: Algebra and Symbolic Computation **15 points**
MATH431-07S2 (C)
Enquiries: John Hannah

MATH432

Foundations of Mathematics **15 points**
MATH432-07S2 (C)
Enquiries: Douglas Bridges

MATH433

Special Topic: Mathematics in Perspective **15 points**
MATH433-07S1 (C)
Enquiries: John Hannah

MATH437

Special Topic: Representation Theory **15 points**
MATH437-07S1 (C)
Enquiries: Ben Martin

MATH438

Special Topic: Measure and Integration **15 points**
MATH438-07S2 (C)
Enquiries: Department of Mathematics and Statistics reception

MATH439

Special Topic: Fields and Commutative Rings **15 points**
MATH439-07S1 (C)
Enquiries: Gunter Steinke

MATH441

Special Topic: Mathematical Economics **15 points**
MATH441-07S2 (C)
Enquiries: Douglas Bridges

MATH442

Special Topic: Wavelet and Data Compression **15 points**
MATH442-07S2 (C)
Enquiries: Peter Renaud

MATH443

Special Topic: Metric, Normed and Hilbert Spaces **15 points**
MATH443-07S1 (C)
Enquiries: Qui Bui

MATH449

Project **30 points**
MATH449-07W (C)
Enquiries: Department of Mathematics and Statistics reception

MATH491

Summer Research Project **15 points**
MATH491-06SU2 (C)
Enquiries: Alex James and Ben Martin

STAT405

Bioinformatics **15 points**
STAT405-07S1 (C)
Enquiries: Mike Steel

STAT440

Probability Theory **15 points**
STAT440-07S1 (C)
Enquiries: Dominic Lee

STAT445

Special Topic: Multivariate and Financial Time Series **15 points**
STAT445-07S1 (C)
Enquiries: Marco Reale

STAT446

Special Topic: Generalised Linear Models **15 points**
STAT446-07S1 (C)
Enquiries: Jennifer Brown and Marco Reale

STAT449

Project **30 points**
STAT449-07W (C)
Enquiries: Department of Mathematics and Statistics reception

STAT452

Applied Statistics **15 points**
STAT452-07S1 (C)
STAT452-07S2 (C)
Enquiries: Jennifer Brown

STAT455

Sampling Methods **15 points**
STAT455-07S1 (C)
Enquiries: Jennifer Brown

STAT456

Time Series and Stochastic Processes **15 points**
STAT456-07S1 (C)
Enquiries: Easaw Chacko

STAT458

Applied Stochastic Modelling **15 points**
STAT458-07S2 (C)
Enquiries: Easaw Chacko

STAT459

Computational Statistics **15 points**
STAT459-07S2 (C)
Enquiries: Dominic Lee

STAT460

Special Topic: Extreme Value Statistics **15 points**
STAT460-07S2 (C)
Enquiries: Carl Scarrott

STAT461

Special Topic: Bayesian Statistics **15 points**
STAT461-07S2 (C)
Enquiries: Dominic Lee

STAT462

Special Topic: Data Mining **15 points**
STAT462-07S2 (C)
Enquiries: Marco Reale

STAT463

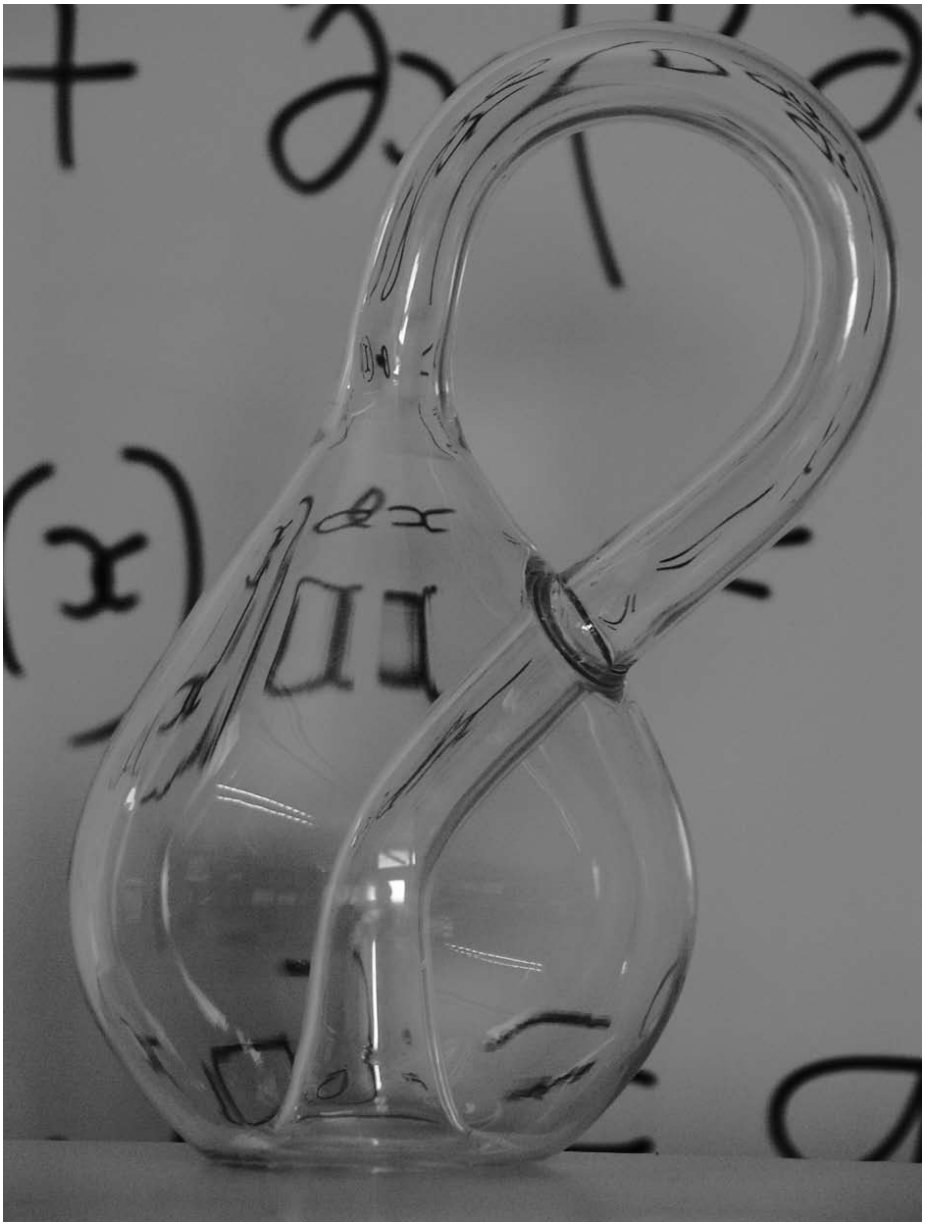
Multivariate Statistical Methods **15 points**
STAT463-07S2 (C)
Enquiries: Carl Scarrott

STAT464

Statistical Inference **15 points**
STAT464-07S1 (C)
STAT464-07S2 (C)
Enquiries: Easaw Chacko

STAT491

Summer Research Project **15 points**
STAT491-06SU2 (C)
Enquiries: Alex James and Ben Martin



The Klein bottle: an example of a non-orientable surface. Picture a bottle with a hole in the bottom. Now extend the neck. Curve the neck back on itself, insert it through the side of the bottle without touching the surface, and extend the neck down inside the bottle until it joins the hole in the bottom. A true Klein bottle in four dimensions does not intersect itself where it crosses the side. Unlike a drinking glass, this object has no "rim" where the surface stops abruptly. Unlike a balloon, a fly can go from the outside to the inside without passing through the surface (so there isn't really an "outside" and "inside").

Engineering mathematics and statistics courses

EMTH171

Mathematical Modelling and Computation **18 points**

EMTH171-07S2 (C)

An introduction to mathematical modelling and simulation via case studies using standard computer packages. Structured programming for mathematical problem solving.

Recommended Preparation: MATH108
Restrictions: MATH171

Enquiries: Alex James

EMTH202

Calculus 1 **15 points**

EMTH202-07W (C)

Differentiation and integration of multivariate functions and vector valued functions; transform methods for solving differential equations.

Prerequisites: Subject to approval of the Dean of Engineering and Forestry

Enquiries: Mike Plank and Mark Hickman

EMTH203

Linear Algebra **15 points**

EMTH203-07W (C)

Linear systems; numerical solutions of linear equations; vector spaces and linear transformations; eigenvalues and eigenvectors; inner product spaces, orthogonality and quadratic forms; complex spaces.

Prerequisites: Subject to approval of the Dean of Engineering and Forestry

Enquiries: Mark Hickman and Arno Berger

EMTH204

Calculus and Algebra **30 points**

EMTH204-07W (C)

An accelerated course in linear algebra and calculus of several variables; linear systems and equations; vector spaces and linear transformations; eigenvalues and eigenvectors; inner product spaces, orthogonality and quadratic forms; vector fields and ordinary differential equations.

Prerequisites: Subject to approval of the Dean of Engineering and Forestry

Enquiries: John Hannah and Peter Renaud

EMTH205

Engineering Statistics **6 points**

EMTH205-07S2 (C)

Measurements and data. Probability and random variables. Common distributions. Estimation and hypothesis testing. Regression. Reliability.

Prerequisites: Subject to approval of the Dean of Engineering and Forestry

Enquiries: Dominic Lee

EMTH210

Engineering Mathematics **15 points**

EMTH210-07S1 (C)

Partial differentiation, differential equations, integration, Fourier series and linear algebra.

Prerequisites: Subject to approval of the Dean of Engineering and Forestry

Enquiries: Chris Price

EMTH271

Mathematical Modelling and Computation 2 **15 points**

EMTH271-07S2 (C)

Use of the package MATLAB including matrix, algebra, user-defined functions, surface plotting. Numerical methods including solutions of systems of linear equations, solution of ordinary differential equations and systems of equations, approximation techniques. Modelling projects. Engineering applications using spreadsheets.

Prerequisites: Subject to approval of the Dean of Engineering and Forestry
Restrictions: MATH271

Enquiries: John Hannah

EMTH391

Engineering Applied Mathematics and Statistics **12 points**

EMTH391-07S2 (C)

Elementary probability and statistics, distributions, estimation and confidence intervals, goodness of fit tests. Partial differential equations, their use in modelling engineering applications, methods of solution and properties of these solutions.

Prerequisites: (EMTH210 or EMTH271) and subject to approval of the Dean of Engineering and Forestry.
Restrictions: MATH361, ENCI303, EMTH205, ENME330

Enquiries: Mike Plank and Carl Scarrott

EMTH410-417

Special topics **15 points**

Enquiries: Department of Mathematics and Statistics reception

EMTH600-610

These papers are available for students on the Masters of Engineering degree

Enquiries: Department of Mathematics and Statistics reception

Contact Information

Please contact us if you have further questions regarding our courses or research.

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