Mathematics and Statistics Handbook 2013

College of Engineering

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
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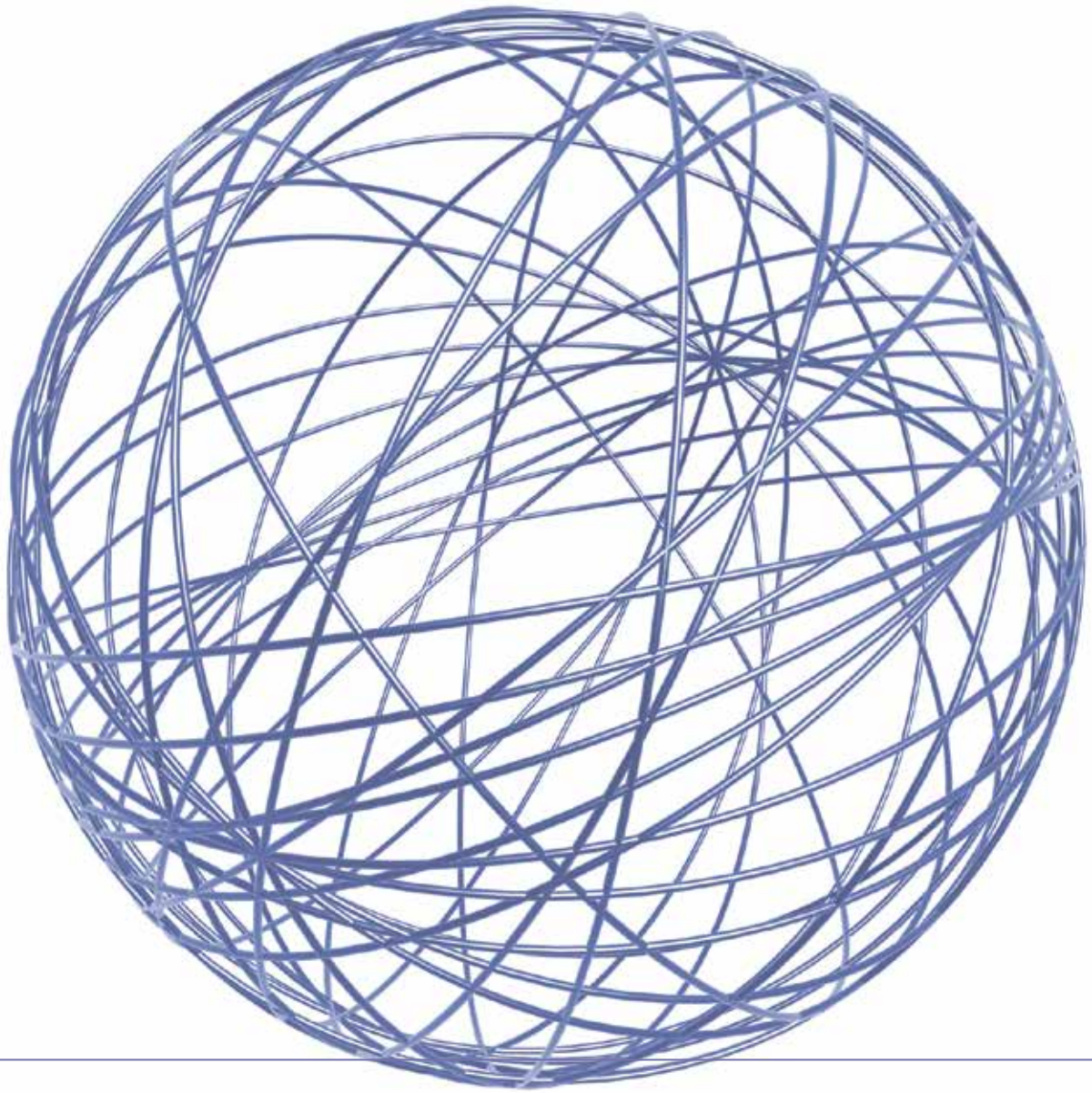

UC ENGINEERING

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Welcome to the Department of Mathematics and Statistics

"Go down deep enough into anything," a recent international journal stated, "and you will find mathematics." Indeed, Mathematics and Statistics underpin almost everything we do in the modern age, despite being the oldest of subjects. From biology to business management, engineering to theoretical physics, commerce to computer science, and all subjects in between, Mathematics and Statistics are indispensable.

Mathematics and Statistics are versatile, dynamic and uniquely suited to negotiating, defining and driving the rapidly changing global landscape. Our department equips students with powerful tools to describe and analyse the world, and to develop new methods and techniques to address problems as they arise. Demand continues to accelerate for key skills that the mathematician and statistician possess, including quantitative understanding, theoretical insight, appreciation of pattern and structure, measured interpretation, analytical expertise, global communication and education.

Our department boasts a committed group of internationally acclaimed researchers who are dedicated to high-quality innovative and engaging teaching. Our interests span a wide range of fields, and we have strong links to other departments, especially to Computer Science, Chemistry, Physics, Geography, Geology, Biology, Economics and Finance, Philosophy and Engineering. We host the Biomathematics Research Centre, are partnered with Statistics New Zealand, and have strong links with industry both nationally and internationally.

Many of our staff have won teaching awards, and actively research various aspects of mathematics and statistics education and pedagogy. This has a positive impact on the delivery, relevance and quality of our teaching.

Demand for mathematicians and statisticians is expanding and opportunities are widespread. Make the most of this by taking – and enjoying! – our courses. Whether you intend to pursue Mathematics or Statistics as your major or use them to enhance your programme in another field, we will give you the competitive edge.

This handbook will help you plan your course of study in Mathematics or Statistics. Our department has a vibrant community of teachers and researchers who are committed to creating a terrific place to study and learn. We would love to hear from you, and encourage you to contact us for information and advice.

Professor Jennifer Brown
Head of Department

Associate Professor Günter Steinke
Deputy Head of Department

Enquiries

Level 4, Erskine Building.
Phone: +64 3 364 2600
Fax: +64 3 364 2587

Email: enquiries@math.canterbury.ac.nz
or enrolment@math.canterbury.ac.nz

Web: www.math.canterbury.ac.nz

Postal address:
Department of Mathematics & Statistics
University of Canterbury
Private Bag 4800, Christchurch 8140
New Zealand

University of Canterbury Contact Centre

For more information about study options or an enrolment pack, get in touch with the Contact Centre on:

Freephone: 0800 VARSITY
Phone: +64 3 364 2555
Email: enrol@canterbury.ac.nz
Web: www.canterbury.ac.nz/enrol

About the Department of Mathematics and Statistics

The Department of Mathematics and Statistics is located in the Erskine building and occupies floors four to seven. Reception is on level four. We offer a wide range of courses, and teach for all levels from first-year undergraduate to PhD. We also teach in the bridging programmes to support students new to university as well as run workshops through the study skills support team. Dedicated members also contribute to pan-University numeracy and quantitative literacy and support through the University of Canterbury Statistics Consultancy service.

Our people

The department has over 50 members, including academics, senior tutors, research fellows, and IT and administrative support staff. Our department is made up of a rich and diverse mix of New Zealand and international scholars who come from around a dozen different countries. The department has strong research interests in many fields within Mathematics and Statistics. A number of staff research in the area of Biomathematics, working on a variety of problems involving exciting cutting-edge Mathematics. There is a strong computational group in the department pursuing this rapidly advancing area of Mathematics, and leading international experts in various fields of Pure Mathematics. There are researchers working in logic and the history and philosophy of Mathematics, and Mathematics and Statistics education. The department has a dynamic research group in Applied Statistics. Our researchers have strong links to all other colleges and faculties at the University, and research is being used in Health, Economics, Finance, Engineering and Environmental Management.

Our facilities

The Department of Mathematics and Statistics has modern, well-equipped teaching and research facilities. The department's undergraduate computer labs utilise thin client technology. This allows them to provide a wide range of computing environments, which includes a conventional Windows desktop and a number of secure testing and exam environments. Access to the department undergraduate desktop can be from outside the university campus via a Microsoft Windows remote desktop environment. Honours and postgraduate students can access an additional range of software, a UNIX environment and a number of high-performance computational servers. The leading technical computer languages in Mathematics and Statistics, such as MATLAB, SAS, R, SPSS, Sage, Statistica and Python are available, along with Maple and Mathematica for symbolic algebra.

Our extras

As well as dedicated small teaching spaces and break-out rooms in the Erskine building, our department has its own library which, in addition to a large specialist collection, provides a restful place for reading, reflection and study. Our very own active student group, MATHSOC, has a large membership and enjoys themed movie screenings, live presentations and regular social events. Our undergraduate mentoring programme matches undergraduates with academic researchers to provide support and helpful advice and, most importantly, an additional friendly face around the department. Students also enjoy browsing through our polyhedra museum on level 5 and hanging out in the HUB on level 4, a dedicated students study space, where you can spread out with your stuff and help is on hand when you need it. Erskine also enjoys its very own café, aptly called "Reboot", with a full-time barista and gourmet treats.

Teaching and student support

Our philosophy

Mathematics and Statistics are not spectator sports! We know that the key to student success is engagement and enjoyment, and our staff are very enthusiastic about getting you involved. We use a variety of leading teaching techniques and supporting technologies, model our passion for the discipline, and have a keen interest in each and every one of our students. We are committed to developing your confidence as learners and inquirers.

Our support

We have a strong team of dedicated senior tutors supported by 85 tutors who have a broad range of backgrounds, ethnicities and expertise. Most importantly, we are all passionate about Mathematics and Statistics.

The nurturing learning environment includes a support HUB in our building with work spaces for students and help on hand when you need it.

Our courses

Most courses in Mathematics and Statistics are delivered via lectures; others have specifically tailored learning environments. In addition, courses typically have a tutorial component in which you will meet regularly in small groups with one of our experienced tutors to consolidate and work on the material covered in your lectures, and to offer personal assistance. As well as this, courses may have regular computer labs and dedicated examples classes. We also provide plenty of support via help sessions, online support and forums, office hours and informal drop-in periods.

Our awards

Our commitment to excellence in teaching is recognised by both students and the broader university community. Six of our staff have won prestigious University Teaching awards, as well as the UCSA "Best Lecturer of the Year" winner in the College of Engineering (2011) and "Top Three in the College" (2008). Over the years, several other staff have been singled out for their contributions. A number of our staff actively research in Mathematics and Statistics education and pedagogy and, due to their expertise and commitment to teaching, are invited to be keynote speakers at international conferences.

Our place in the university

Our department offers far more than just teaching and research. At almost any place in the University, you will come across us. We offer support for any students with questions about numeracy through the UC Learning Skills Centre (www.lps.canterbury.ac.nz/lsc/). You don't need to be taking one of our courses to get help here and the workshops we host are a great place to meet other students.

A great place to start your study at UC is with a Science Headstart course over summer (www.canterbury.ac.nz/bridging/). See www.math.canterbury.ac.nz and click on Courses to view the Mathematics and Statistics courses offered.

If you are a postgraduate student then you will be pleased to know that our department hosts a statistical consulting unit. If you have any Mathematics or Statistics questions about your research, come over and see us.

'Maths is done by people. I make sure my students never forget this. We need to talk with each other, 'think ahead', look at problems from various directions, ask questions and work together.'

Dr Rua Murray

Senior Lecturer

Winner of the 2009 University of Canterbury Prestigious Teaching Award

Our commitment

We pride ourselves on the interaction and support we give to students. You are always welcome to approach staff with any problems you have. There are many options to seek advice, give feedback and get support. These include our lecturers, senior tutors, administrative support staff and nominated class representatives. We have dedicated members of staff who can help students with particular issues.

The advisors listed below will help with any problems you might have deciding which course best suits your needs.

- **100-level MATH**: Dr Miguel Moyers-Gonzalez
- **100-level STAT**: Mrs Irene David
- **200-level MATH**: Dr Peter Renaud (S1) and Professor Charles Semple (S2)
- **200-level STAT**: Dr James Degnan
- **300-level MATH**: Dr Alex James (S1) and Professor Mike Steel (S2)
- **300-level STAT**: Dr Dominic Lee
- **400-level**: Dr Mark Hickman
- **Postgraduate**: Dr Clemency Montelle

The department grievance contacts are:

- Professor Mike Steel (m.steel@math.canterbury.ac.nz)
- Irene David (i.david@math.canterbury.ac.nz)

The department disabilities representatives are:

- Irene David (i.david@math.canterbury.ac.nz)
- Sarah Vincent (s.vincent@math.canterbury.ac.nz)

Our assistance

Personal wellbeing

There are many university services available to help with your physical and mental wellbeing. These include the Student Health and Counselling Service, Liaison Office, UC Careers, Internships & Employment, International Student Support and Chaplaincy Service. See www.canterbury.ac.nz/currentstudents.shtml

Unexpected circumstances

Sometimes personal circumstances can cause you to miss a test or exam, or impair your performance in them. Please let us know about this as soon as possible, as we will do all we can to support you. The University regulations should be consulted for the rules concerning aegrotats: www.canterbury.ac.nz/regulations

Private tutoring

If you need regular individual help, a list of private tutors is available from reception.

Undergraduate degree structure

A major in Mathematics or Statistics is generally taken as part of a Bachelor of Science or a Bachelor of Arts. Later, you can proceed to a BSc(Hons) or BA(Hons), MSc, MA, PGDipSc or PhD. You can usefully take Mathematics or Statistics courses while majoring in another subject. Students studying Accounting, Biology, Chemistry, Computer Science, Ecology, Economics, Engineering, Finance, Geology, Geography, Management Science, Physics, and Psychology often take Mathematics and/or Statistics up to 300-level.

First–year students will normally enrol in 120 points made up of eight 100-level, 15-point courses (four each semester).

When choosing your first-year courses, you should include courses that allow you to advance to 200-level in at least two, and preferably three, subjects. For full details of the requirements to major in a specific subject, see the UC Regulations: www.canterbury.ac.nz/regulations

To the right are the requirements for a Bachelor of Science (BSc). Requirements for other bachelors degrees differ slightly; see the UC Regulations for details.

'Having a Maths degree makes you stand out to employers. It is a tough degree, but it is so rewarding and pays off in the long run.'

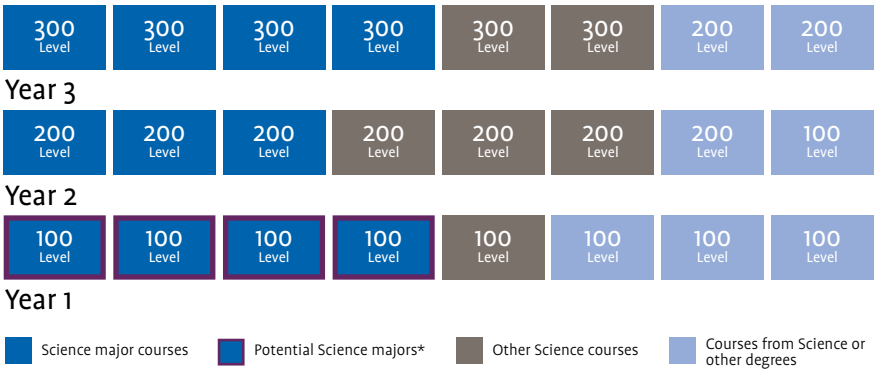
Katy Bergstrom

Bachelor of Science in Mathematics and Economics

Bachelor of Science with Honours n Economics

Economics Analyst,
Reserve Bank of New Zealand

Bachelor of Science – typical degree structure



Each small block represents a 15-point course. However, some courses may be 30 points (or more).

**Students should allow for more than one potential major subject. Students should check the 100-level requirements for their potential majors as some majors require more than two 100-level courses or enrolment in a complementary subject such as Mathematics.*

BSc requirements for students first enrolled from 2010 onwards:

- At least 360 points in total.
- At least 255 points must be from Science courses.
- The remaining 105 points can be from any courses of your choice.
- At least 225 points must be from courses above 100-level, with at least 90 points at 300-level, at least 60 of which must be in a single subject – this is your major.
- For the BSc requirements for students enrolled prior to 2010, see www.science.canterbury.ac.nz

First year

Mathematics

Mathematics has a range of entry-level courses pitched at different levels so we can cater for a wide variety of backgrounds and interests. We can help you determine which courses are right for you.

Please contact Dr Miguel Moyers-Gonzalez (m.moyersgonzalez@math.canterbury.ac.nz) for advice or the UC liaison office.
100-level courses include:

- MATH 101 Methods of Mathematics – 15 points
- MATH 102 Mathematics 1A – 15 points
- MATH 103 Mathematics 1B – 15 points
- MATH 120 Discrete Mathematics – 15 points
- MATH 130 Introduction to Logic and Computability – 15 points
- MATH 170 Mathematical Modelling and Computation – 15 points

The core of the 100-level (i.e. first–year) programme consists of linear algebra and calculus, found in the two courses MATH 102 and MATH 103. MATH 103 follows on from MATH 102 and has MATH 102 as a prerequisite. If you want to do a significant amount of Mathematics in your degree, you should take both these courses. MATH 102 is required if you intend to major in several other subjects. We recommend that if you have not studied maths for some time, or do not have a strong mathematics background, you should take the preparatory paper MATH 101.

MATH 101 proceeds at a gentle pace, and includes the introduction and revision of key mathematical concepts. It is designed to improve the technical skills and understanding of students, and raise their confidence in mathematics. This can then be followed by MATH 102 (and maybe MATH 103) where appropriate.

MATH 102 is a course which deals with the basic ideas in calculus and linear algebra and their applications in many fields. Topics include linear equations and matrices, vector geometry, functions, limits, continuity, differentiation, integration and functions of two or more variables.

More information on courses:
www.canterbury.ac.nz/courses

MATH 103 is a course which consolidates the concepts from MATH 102, and introduces more advanced ideas in calculus and linear algebra. It also incorporates the study of Statistics. It is a prerequisite for many courses in Mathematics and Statistics and other subjects at 200-level.

MATH 120 is a course for students who are interested in the abstract structure of mathematics and its relations to modern-day applications, such as cryptography. It is particularly recommended for students majoring in Mathematics or Computer Science.

MATH 130 is a course on logic that is taught by both Mathematics and Philosophy staff. It explores formal and informal reasoning, aspects of symbolic logic and patterns of inference, and, given the subject covered, is valuable in any undergraduate degree.

MATH 170 provides an introduction to mathematical modelling and computation. It complements existing 100-level courses in the mathematical sciences and is particularly recommended for those who wish to major in Applied Mathematics.

Direct entry

Students who have performed exceptionally well at NCEA Level 3 in mathematics with calculus and/or statistics and modelling may be eligible for direct entry into a second–year mathematics course. Please contact the department for further information.

‘I love those moments when several ideas from different areas come together to form something elegant and unified.’

James Bonifacio

Bachelor of Science with Honours in Mathematical Physics.

Statistics

Our first year paper is a gateway to all further study in Statistics and has been uniquely designed to cater for all students, whatever their background. Many students need Statistics to support and enhance their studies in other subject areas, such as the Life Sciences, the Physical Sciences, the Social Sciences, Management and Computer Science. Others will wish to do a substantial amount of Statistics in their undergraduate programme.

- STAT 101 Statistics 1 – 15 points

STAT 101 is our first–year course in Statistics. This course is specifically designed so that every student, no matter what background they have, can develop statistical literacy. This course is unique in its use of a mix of lectures and online learning so that you can create your very own pathway of study. It will give you a sound knowledge of the subject and a good grounding in how Statistics is applied to tackle genuine problems. For further information, please don't hesitate to contact Irene David (i.david@math.canterbury.ac.nz). There are no prerequisites for this course.

Please note not all courses may be offered in 2013. For up to date information see www.canterbury.ac.nz/courses

Pathways

Preparation courses

If you intend to enrol in MATH 101, MATH 102 or STAT 101, and feel that your background is inadequate, then the preparation courses that we run in January/February may be for you.

For more information on these courses, see www.scienceheadstart.canterbury.ac.nz or email learningpreparationsupport@canterbury.ac.nz

To help you choose the course that is right for you, please talk to your school careers advisors, a UC liaison officer or contact our department. We also have a pre-entry self-assessment quiz which is useful if you are intending to enrol in MATH 102 (or EMTH 118). See *www.math.canterbury.ac.nz/php/prospective/pre-entry* for details.

100-level options

Students who want to take MATH 102 (or EMTH 118) and then MATH 103 (or EMTH 119, respectively) have various options:

- Take MATH 102 (or EMTH 118) in Semester 1 followed by MATH 103 (or EMTH 119, respectively) in Semester 2. This is recommended for those with a strong background in maths, or
- Take MATH 101 in Semester 1 followed by MATH 102 (or EMTH 118) in Semester 2 and then EMTH119 over the Summer or MATH 103 in Semester 1 the following year. This is recommended for those who need to consolidate their mathematical skills.

(Note – EMTH118 and EMTH119 are engineering mathematics courses designed for BE (Hons) students.)

‘You make maths fresh and fun and have enthusiasm off the Richter!... I loved your lectures!’

Student feedback

MATH 102 (Semester 1, Semester 2) and EMTH 118 (Semester 1, Semester 2)

We strongly advise students to have at least 18 credits in NCEA Level 3 mathematics with calculus, including differentiation and integration. Achieving some credits at merit or excellence is also a good preparation for 100-level Mathematics. The equivalent unit standards are also acceptable. Other suitable backgrounds include:

- 24 credits in NCEA Level 3 statistics with modelling
- Scholarship at NCEA Level 3 either mathematics with calculus or statistics and modelling
- 50%+ Bursary mathematics with calculus
- 60%+ Bursary mathematics with statistics
- A good pass in MATH 101
- Certificate in Foundation Studies (CertFounStudies) with an A or B in BRDG 016 (Mathematics Part One) and BRDG 017 (Mathematics Part Two); see Bridging Programmes for further information
- Cambridge International Examinations: a pass in A-level mathematics, or a good pass in AS-level mathematics (preferably including both units P1 and P2)

There are no prerequisites for MATH 101, MATH 120, MATH 130 or STAT 101. MATH 170 is designed to be taken concurrently with MATH 103.

Do you have 24 credits in NCEA Level 3 mathematics with calculus, with Excellence in most standards?	YES →	Contact the Department of Mathematics and Statistics to discuss direct entry into MATH 103 or EMTH 119.
NO ↓		
Do you have at least 18 credits in NCEA Level 3 mathematics with calculus, including differentiation and integration?	YES →	Suggested course: MATH 102 or EMTH 118.
NO ↓		
Do you have some credits in NCEA Level 3 mathematics with calculus or Level 3 statistics and modelling?	YES →	Suggested course: MATH 101.
NO ↓		
Do you have at least 16 credits in NCEA Level 2 Mathematics, including calculus?	YES →	Suggested course: MATH 101.
NO ↓		
If you do not meet the equivalent of any of the above conditions, consider an appropriate Bridging Programme or achieving the recommended NCEA credits outlined above.		

Beyond first year

We offer a wide variety of courses in Mathematics and Statistics at 200 and 300-levels. The Mathematics courses range from abstract Pure Mathematics through to computer-oriented applied courses. Up to five second-year Statistics courses are offered on topics including inference, probability, regression, applied statistics and computational methods.

If you are unsure which courses best suit your needs, contact one of the course advisers or the lecturer in charge of the course you are thinking of taking. If you are contemplating an Honours degree, include the core courses MATH 102 and MATH 103 in your first year of study. For an Honours degree in Statistics, MATH 103 or MATH 199 are also required. At 200-level, many students leave their options open regarding their preferred subject and take courses in both Mathematics and Statistics. You must ensure that you take the required prerequisites in first year for second year courses.

Second year

To complete a major in Mathematics, you should be doing at least 60 points at the 200-level, including the core courses MATH 201, MATH 202 and MATH 203. For Statistics, choose at least three courses. Choose from our other second-year courses according to what you are most interested in. Consider:

- Pure Mathematics: MATH 220, MATH 230 and MATH 240
- Applied Mathematics: MATH 220 and MATH 270
- Theoretical Statistics: STAT 211, STAT 213 and STAT 221
- Applied Statistics: STAT 201 and STAT 202

At this level, you may wish to leave your options open regarding your preferred subject and take courses in two subjects. Mathematics and Statistics are a natural pair. Other valuable combinations are with Physics, Computer Science, Economics, Chemistry, Biology and Finance, and other combinations are possible. Mathematics and Statistics will enhance any programme you are taking.

'For me, it is about giving students the support and confidence to realise this so they can shine. I get such a kick out of taking students from where they are to where they want to be.'

Phillipa Williams

Senior Tutor

Winner of the 2011 College of Engineering Lecturer of the Year Award - UCSA Students' Choice 2011

Third year

You now become more specialised because you are normally concentrating on one subject. Typically, you take 60 points of 300-level Mathematics or Statistics. For an Honours degree, a further 30 points of 300-level Mathematics or Statistics is required.

For Mathematics majors

It is recommended that you take the core courses MATH 302, MATH 303, MATH 353 and MATH 363, and choose from our other courses according to your interests. All Honours students should seriously consider taking MATH 343, either at 300-level or as a special topic at 400-level.

We encourage you to come and get some advice on your choice of programme. Please contact Dr Alex James (a.james@math.canterbury.ac.nz) for advice.

For Statistics majors

Students with an applied interest normally select courses from STAT 312, STAT 315, STAT 317, STAT 318 and STAT 391. Students with a theoretical and computational interest should take STAT 313, STAT 314 and STAT 316. Papers from Mathematics and/or other departments can be substituted, and will increase your options in your fourth year. For advice on the programme that is right for you, get in contact with Dr Dominic Lee (d.lee@math.canterbury.ac.nz).

Honours degrees

An honours degree usually requires an additional one-year coherent programme of study, consisting of an individualised Honours project and eight 400-level courses.

An honours degree provides an opportunity to confer a competitive edge to your degree, study those areas which you find interesting in further depth and enjoy the independence and rewards of engaging in supervised research. The intellectual training and experience given by this additional year will not only equip graduates for postgraduate research but also make them attractive to employers who value the specialisation, the ability to interact and communicate at an advanced level, and the discipline and skills gained from developing and successfully completing an independent project.

For details of the 400-level courses on offer, see www.canterbury.ac.nz/courses or the department's honours handbook, which is available from reception or the department website. The final decision on which courses are offered will depend on student demand and staff availability, but will span a wide range of cutting-edge research in Mathematics and Statistics. Project supervision is by mutual agreement between the supervisor and student.

There are a number of joint honours programmes where you can combine Mathematics and Statistics, or one of these with another subject for your course of study. To keep your options open for entering these programmes, you must ensure you study a broad base of courses at lower levels so that you have the appropriate prerequisites.

General honours programmes

The following are broad programmes which provide graduates with expansive, flexible analytical and quantitative skills that can be applied in a wide variety of contexts.

BSc(Hons) and BA(Hons) in Mathematics

Contact: Dr Mark Hickman (m.hickman@math.canterbury.ac.nz)

BSc(Hons) and BA(Hons) in Statistics

Contact: Dr Marco Reale (m.reale@math.canterbury.ac.nz)

Specialised honours programmes

BSc(Hons) in Mathematics and Statistics

You can do a joint honours degree in Mathematics and Statistics which combines a select range of complementary and mutually enhancing subjects in these two disciplines, resulting in computational and methodological expertise.

Contact: Dr Marco Reale (m.reale@math.canterbury.ac.nz)

BSc(Hons) in Mathematical Physics

In conjunction with the Physics and Astronomy Department, we offer a joint programme 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. You enter this programme at the 300-level where you normally take 60 points of 300-level MATH and 60 points of 300-level PHYS courses.

Contact: Dr Peter Renaud (p.renaud@math.canterbury.ac.nz)

BSc(Hons) in Mathematics and Philosophy

The BSc(Hons) programme in Mathematics and Philosophy is designed for students with a high creative mathematical ability whose interests in Mathematics draw them towards foundational and philosophical issues. The aim of the programme is to produce Honours graduates in Mathematics with a strong background in Philosophy and a keen awareness of the connections between the two fields.

Contact: Dr Clemency Montelle (c.montelle@math.canterbury.ac.nz)

BSc(Hons) in Computational and Applied Mathematics

This major is in the BSc(Hons) and MSc degrees, and draws on courses which combine Mathematics and computing. In addition to the required mathematics courses, a choice of courses in Management Science, Statistics or other subjects may be required.

Contact: Professor David Wall (d.wall@math.canterbury.ac.nz) or Dr Rick Beatson (r.beatson@math.canterbury.ac.nz)

BSc(Hons) in Finance and Mathematics

The management of financial risk is a huge part of the modern economy. Banks manage investment funds, exporters manage exchange rates and insurance companies need to make sure they have the resources to pay out after natural disasters! Students with knowledge of finance and the analytical and quantitative skills of a mathematician are highly sought after in the job market.

Contact: Dr Rua Murray (r.murray@math.canterbury.ac.nz)

BSc(Hons) in Finance and Statistics

In conjunction with the Department of Economics and Finance, we offer a BSc(Hons) programme. This is aimed at students who are interested in the interaction between the two disciplines of Finance and Statistics, providing students with the competitive edge in this area.

Contact: Dr Marco Reale (m.reale@math.canterbury.ac.nz)

BSc(Hons) in Economics and Mathematics

The BSc (Hons) programme in Economics and Mathematics is designed for students who combine a love of Pure Mathematics with an interest in how it is used to provide rigorous underpinnings for economic theory. Such students typically go on to either a PhD programme or else employment as a mathematical economist in government or finance.

Contact: Professor Douglas Bridges (d.bridges@math.canterbury.ac.nz)

Postgraduate programmes

There are a number of active research groups working on problems in Pure Mathematics, Applied Mathematics and Statistics.

Possible research areas in the department may be found in the postgraduate students area (www.math.canterbury.ac.nz/php/graduates/), or may be discussed with:

- Dr Clemency Montelle (c.montelle@math.canterbury.ac.nz)
- Dr Marco Reale (m.reale@math.canterbury.ac.nz)

In addition to the University of Canterbury scholarships, departmental scholarships and individual research grant related fellowships, there are other options for additional financial assistance in the form of part–time tutoring positions and fees scholarships (at the New Zealand resident rate).

Postgraduate Diploma in Science (PGDipSc)

This is a one-year full-time course. The course may be taken by any BSc graduate with 90 points in 300-level courses approved by the Head of Department, and must include 60 points from MATH 310–399 or from STAT 310–399. A pass in eight one–semester courses chosen at the 400-level is normally required. Your choice requires the approval of the Head of Department. A completed Postgraduate Diploma in Science (PGDipSc) can be substituted for the course work year of a two-year Master of Science (MSc) degree.

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

After obtaining your bachelor's degree in Mathematics or Statistics, you may enrol for a Masters degree. The minimum period of study is two years full-time after a BSc/BA degree, or one year full-time after the respective Honours. The first year of the two–year Masters degree consists of at least eight one–semester 400-level courses. Again, your choice requires the approval of the Head of Department. The second year (and also the one-year masterate) consists of a thesis only. We almost always ask that you enrol for a BSc(Hons)/BA(Hons) or PGDipSc in your first year.

Dr Blair Robertson completing practical research in the area of parabolic curves.

Doctor of Philosophy (PhD)

Having graduated with a satisfactory Honours or Master's degree, you may enrol for the degree of Doctor of Philosophy. You will work under the supervision of academic staff members with whom you have a shared research interest. This normally involves at least three years' full–time study. You must then prepare a thesis presenting the results of this research for examination.

'Thank you heaps for being without question, the best lecturer we've had so far. Your dedication is incredible: you seemed to be answering questions on Learn on an almost hourly basis, and the amount of information you made available to us was tremendous!'

Student feedback

Scholarships and prizes

The Department and the University of Canterbury offer a range of scholarships and prizes to students studying Mathematics or Statistics each year.

Undergraduate scholarships and prizes

UC undergraduate entrance scholarships

Up to $3,000 cash. For students who are completing NCEA Level 3 or equivalent University Entrance qualifications, no application is required.

UC emerging leaders' scholarships

All categories. Scholarships are valued at $5000 towards tuition fees.

UC Dux scholarships

Available to nominated secondary school Duxes who undertake their first year of undergraduate study at the University of Canterbury, who have completed or are completing a university entrance qualification, and who attended school in the year of nomination. The nomination must be done by the Principal or Deputy Principal of the student's high school. The awards provide $5,000 towards tuition fees.

UC Alumni Association scholarships

For students demonstrating an awareness of the value of an alumni community. Two scholarships valued at $5,000.

John McMillan scholarship in Economics and Mathematics

Up to two scholarships for students enrolling in a BSc degree, majoring in Mathematics and Economics and studying subjects consistent with the course of study for the combined BSc(Hons) degree in Economics and Mathematics. Each scholarship is tenable for one year and covers the full first-year tuition fee.

Riccarton Rotary Youth Trust scholarship

For a Canterbury school leaver facing major financial challenges to entering tertiary education. Up to $40,000 in total over four years.

Bright Start scholarships

To cover first-year fees for residents of the South Island, north of the Waitaki River, who face financial and/or personal challenges. Applicants may be school leavers or mature students. Offered if funds permit.

UC international student scholarships

For top-achieving students who can demonstrate leadership and contribution to the school and/or community (up to 10 awards at up to $15,000 per annum towards tuition fees).

UC Mathematics and Statistics high achievers awards

These scholarships recognise and support high-achieving students entering their first year of a BSc or BA degree programme and majoring in Mathematics or Statistics. Up to 5 awards of $1,000 available.

'The Mathematics and Statistics Department is a great department to be a part of – all of the postgraduate students are well-supported and the academic staff are always interested in what we are working on.'

Rachael Tappenden
PhD in Mathematics

Department undergraduate scholarships

Each year, the Department awards scholarships to outstanding students in the undergraduate programme. At each stage (200, 300 or 400-level) there will be a maximum of two full-fee scholarships and a maximum of three partial-fee scholarships. There are also scholarships for outstanding students entering the University after taking the Department's STAR course (MATH 199).

You do not need to apply for the Department undergraduate scholarships; they are offered on the basis of performance in MATH and STAT courses in the preceding year. To be eligible, you must satisfy one of the following criteria:

- Enrolled in at least 75 points in MATH or STAT, or other approved courses, at 200-level
- Enrolled in at least 90 points in MATH or STAT, or other approved courses, at 300-level
- Enrolled in at least 90 points in MATH or STAT, or other approved courses, at 400-level.

Fee scholarships will pay for MATH and STAT courses only and at the domestic fee rate.

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

Department Summer Scholarships

Competitive scholarships of up to $2,000 are available for summer projects supervised by academic staff in the Department. These are available to students who have completed the 200-level or 300-level programme. Applications are made in August for projects beginning in November/December.

Students who undertake summer projects may choose to enrol in MATH 395 / STAT 395 or MATH 491 / STAT 491 in order to gain a grade for the project, but such enrolment is not compulsory.

Note: Students interested in summer projects are strongly encouraged to apply for UC Summer Scholarships in the first instance, www.canterbury.ac.nz/summer

Mathematics and Statistics prizes

The following prizes are awarded annually for excellence in Mathematics or Statistics:

- Cook Memorial Prize: for final Honours students
- Page Memorial Prizes: two prizes at 300-level
- Peter Bryant Memorial Prizes: two prizes at 100-level and 200-level
- Brent Wilson Prize: for Applied Mathematics at 300-level

‘I have become very aware of the extraordinary teaching staff that UC has. People who have a passion for their field, a wealth of knowledge and the urge to share these with others.’

Remihana Emery

Ngāti Maniapoto, Ngāti Tuwharetoa, Ngāti Raukawa, Ngāti Kahungunu

Studying towards a Bachelor of Arts in Mathematics and Te Reo Māori

- Gordon Petersen Prize: for Pure Mathematics at 200-level
- Statistics New Zealand Prize: for Statistics at 300-level ($1,000)
- Helen Wily Prize: for Mathematical Sciences at 300-level and 400-level (female students

Postgraduate scholarships

Postgraduate scholarships will be offered on the basis of the student’s potential, as demonstrated by their performance at Honours level and above. At any given time, a staff member would normally be the senior supervisor of at most one student supported by a departmental postgraduate scholarship.

These scholarships will pay full fees at the domestic rate plus a stipend determined by the Department, 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 tutorials or marking for the department, for which they will receive additional remuneration.

There are also UC Doctoral and UC Masters Scholarships available.

Other awards

- Statistics New Zealand Maori and Pacific Island Scholarships: to assist a Maori and a Pacific Island student to attend university and obtain a Statistics or Mathematics undergraduate qualification ($3,500 per year for up to three years).
- J. Connal Scholarships: for BA students at 200-level who excel in Latin, English, French, History or Mathematics. ($400 per year for two 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 two 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 two 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.
- International Biometric Society Scholarship: for third-year students who are about to embark on a full-time fourth-year or Honours course in Statistics, Mathematical Statistics, Biostatistics or Biometrics. Current value: A$1,000.
- Fulbright Study Awards: for New Zealand graduate students to study in the USA or vice versa (www.fulbright.org.nz).

For more details about applying for these awards and for a full list of scholarships available please see www.canterbury.ac.nz/scholarships

Career opportunities

University graduates with strong analytical ability and quantitative skills are in high demand throughout the world.

Mathematicians and statisticians find themselves in a broad range of occupations, including financial institutions such as banks and insurance companies, actuarial science, IT and web-based companies, market research organisations, manufacturing companies, the pharmaceutical industry, public health institutes and medical statistics research, quality control, operations and market research, Crown Research Institutes, government departments (including Statistics New Zealand, Treasury, Ministry of Primary Industries), non-profit organisations, local bodies, teaching and educational institutes, and universities.

An undergraduate degree or postgraduate qualification in Mathematics or Statistics is a solid foundation for many careers around the world as well as in New Zealand. Increasingly, employers in both private and government sectors around the world seek top graduates from a general field, sometimes not specifying any particular discipline at all. They want bright people whom they will train. Your studies in Mathematics or Statistics develop your critical thinking and logical problem-solving skills, exactly the kind of skills that employers look for.

Statistics New Zealand
Analyst - Regional and Housing
Analysts - National and Enterprise Accounts
Analysts - Payments, Trade
Economic Statistician
Mathematical Statisticians
Analyst - Maori Statistics Unit
Economic Statistician/Analyst

Government Departments	Position
ACC	Analysts
Defence Technology Agency (DTA)	Scientist/Analyst
Government Communications Security Bureau	Communication Systems Analyst
Government Communications Security Bureau	Mathematician
NZ Transport Agency	Economic Analyst
Ministry of Education	Research Analysts
Ministry of Fisheries	Regional Intelligence Analyst
Ministry of Health	Intelligence Analyst
Ministry of Social Development	Analyst (several) - Forecasting and Modelling Unit
New Zealand Treasury	Analyst/Senior Analyst - Macro Forecasting and Analysis
Greater Wellington Regional Council	Senior Data Analyst

Industry and Commerce	Position
Meteorological Service of NZ	Trainee Meteorologists
Orion	Network Investment Analyst
Pacific Edge Biotechnology Ltd	Bioinformatician / Computational Biologist
Rodgers & Partners Consultants Ltd	Business Analyst
Tower Managed Funds Ltd	Actuarial Analyst
Weyerhaeuser NZ	Logistics Co–coordinator
Zespri International Ltd	Innovation Analyst
OCG Consulting Ltd	Actuary
Affinity ID	Business Intelligence Analyst
Indufor Asia Pacific Ltd	GIS/Remote Sensing Consultant
Fonterra	Optimisation Analysts
Synovate Ltd	Data Analyst/Scriptwriter

Generally, business, industry and government want people who have a broad background and interest in a variety of mathematical areas, computation and science. Therefore, you need to take courses that will expand your knowledge of applications of Mathematics and Statistics. The most directly applicable courses would be in Accounting, Biology, Computer Science, Economics, Engineering, Finance, Management Science and Physics. In particular, there are very good job opportunities in financial Mathematics and Statistics and in computing.

We now live in a technological age where information is plentiful but the people with the skills to analyse this data meaningfully are in short supply – the need for people who have a working knowledge of Statistics has burgeoned in recent years.

Over the last few years, the following job vacancies have been advertised locally for graduates in Mathematics or Statistics, or for people with expertise in these areas. Many of these jobs require competence in using software packages such as SAS. Familiarity with spreadsheet software such as Excel and databases is also useful. Most jobs also require strong oral and written communication skills, well developed interpersonal skills and the ability to work independently as well as in a team.

Two useful websites for ideas of the kinds of careers that Mathematics or Statistics can lead to are the: American Mathematical Society's Early Career Profiles website (www.ams.org/early-careers/) American Statistical Association's JobWeb (www.amstat.org/jobweb/index.cfm).

To find more specific information on occupations, explore the careers website. For general career enquiries, contact Careers, Internships and Employment (www.canterbury.ac.nz/careers/).

Research

Broad groupings of the department's research interests are highlighted below. Details of the department's publications are available in the UC Research Report. We welcome inquiries from prospective graduate students.

Algebra, Combinatorics and Logic

Areas of current research by the department include: clifford algebras, finite geometry, matroid theory, combinatorial and algorithmic population genetics, constructive analysis and topology, foundations of mathematics and algebraic biology. Staff actively working in these areas are Professor Douglas Bridges, Dr Maarten McKubre-Jordens, Dr Jeanette McLeod, Dr Raazesh Sainudiin, Professor Charles Semple, Professor Mike Steel and Associate Professor Günter Steinke.

Analysis and Geometry

The department's research strengths in these areas include: approximation theory, topological geometry, constructive analysis and topology, functional analysis (including applications to quantum theory), harmonic analysis, partial differential equations and potential theory, general topology and constructive mathematical economics. Staff active in those areas are Associate Professor Rick Beatson, Professor Douglas Bridges, Dr Qui Bui, Dr Maarten McKubre-Jordens, Dr Peter Renaud and Associate Professor Günter Steinke.

Applied Statistics

Applied Statistics broadly covers research where statistics is being used to help solve real-world problems. Examples include: environmental monitoring, risk assessment and uncertainty analysis, medical and engineering applications, and statistical genetics. Within the department staff who work in this area are Professor Jennifer Brown, Dr James Degnan, Dr Dominic Lee, Dr Elena Moltchanova, Dr Marco Reale, Dr Raazesh Sainudiin, Dr Carl Scarrott and Associate Professor Peter Smith.

Computational Mathematics

Broadly, this research area involves tool building in the form of the development and analysis of algorithms and methods for numerical computation. Areas of current research in the department include: numerical optimisation, approximation theory, algorithms for surface approximation, inverse problems, numerical linear algebra, interval analysis and rigorous set processing. Staff currently working in these areas are Associate Professor Rick Beatson, Dr Chris Price, Dr Raazesh Sainudiin and Professor David Wall.

Dynamical Systems and Differential Equations

Members of the department have interests in theoretical, computational and applied aspects of nonlinear differential equations and discrete time dynamical systems. Areas of particular activity include: chaotic dynamics, ergodic theory, inverse problems, nonlinear models in ecology and medicine, and symmetry methods. Permanent staff include Dr Mark Hickman, Dr Alex James, Dr Rua Murray, Dr Michael Plank and Professor David Wall.

Financial and Industrial Mathematics and Statistics

Broadly, this involves the use of mathematics to understand economics and finance, and processes arising in industrial settings. Specific interests include: econometrics; mathematical economics; fast surface fitting algorithms for applications in geophysics, image processing, computer graphics and custom manufacture; statistical design and analysis of communication systems; signal and image processing; acoustics and industrial applications of spatial statistics, extreme value methods and spectral analysis. Faculty members with interests in this area include Associate Professor Rick Beatson, Professor Douglas Bridges, Dr Qui Bui, Dr Dominic Lee, Dr Michael Plank, Dr Chris Price, Dr Marco Reale, Dr Carl Scarrott, Associate Professor Peter Smith and Dr Phil Wilson.

History and Philosophy of Mathematics, and Mathematics and Statistics Education

Areas of current research by the department include: mathematics in the ancient Near East, ancient Greece and India, and in Islam, with an emphasis on editing mathematical texts from these cultures from the original primary sources; mathematics during the Italian renaissance; the history of ancient mathematical astronomy; constructive mathematics; the foundations of mathematics; mathematics and statistics education in the tertiary sector; and mathematics and communication. Staff actively working in these areas are Professor Douglas Bridges, Prof Jennifer Brown, Dr John Hannah, Dr Alex James, Dr Maarten McKubre-Jordens, Dr Clemency Montelle and Dr Phil Wilson.

Mathematical Biology

The department hosts the Biomathematics Research Centre. This focuses on three broad areas: computational molecular biology and phylogenetics, ecological and physiological modelling, and statistical applications in ecology and medicine. Staff actively working in this area include Professor Jennifer Brown, Dr Alex James, Dr Dominic Lee, Dr Elena Moltchonova, Dr Michael Plank, Dr Raazesh Sainudiin, Professor Charles Semple, Professor Mike Steel, Professor David Wall and Dr Phil Wilson.

Theoretical and Computational Statistics

The Statistics group within the department has an active research programme in many aspects of theoretical and computational statistics. Particular topics include: stochastic processes, computational methods, Bayesian inference, statistical genetics, sampling theory, random matrices, extreme value theory and graphical models. Staff with research projects in this area include Professor Jennifer Brown, Dr James Degnan, Dr Dominic Lee, Dr Marco Reale, Dr Raazesh Sainudiin, Dr Carl Scarrott, Associate Professor Peter Smith and Professor Mike Steel.

2013 courses

100-level

MATH 101 Methods of Mathematics
15 Points 0.1250 EFTS

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.

R: MATH 102, MATH 103, MATH 108, MATH 109, MATH 170, MATH 171, MATH 199, EMTH 118, EMTH 119, EMTH 171. Students may not enrol concurrently with, or after obtaining a pass, in these courses.

MATH101-13S1 (C) **Semester 1**

MATH 102 Mathematics 1A
15 Points 0.1250 EFTS

An introductory course in calculus and linear algebra that is designed primarily for students who have done well in NCEA Mathematics with Calculus. This course deals with basic ideas in calculus and linear algebra which have applications in many areas of science and commerce.

R: MATH 108, MATH 199, EMTH 118

MATH102-13S1 (C) **Semester 1**
MATH102-13S2 (C) **Semester 2**

MATH 103 Mathematics 1B
15 Points 0.1250 EFTS

A consolidation of concepts from MATH102 and introduction to more advanced ideas in calculus and linear algebra. It also incorporates some study of statistics. It is a prerequisite for many courses in mathematics and other subjects at 200-level.

P: MATH 102 or MATH 108 or EMTH 118
R: MATH 109, MATH 199, EMTH 119

MATH103-13S1 (C) **Semester 1**
MATH103-13S2 (C) **Semester 2**

MATH 120 Discrete Mathematics
15 Points 0.1250 EFTS

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

R: MATH 115

MATH120-13S2 (C) **Semester 2**

MATH 130 Introduction to Logic & Computability
15 Points 0.1250 EFTS

An introduction to logic and computability.

R: MATH 134, PHIL 134, PHIL 138

MATH130-13S1 (C) **Semester 1E**

STAT 101 Statistics 1
15 Points 0.1250 EFTS

An introduction to the ideas, techniques and applications of statistics and probability.

R: STAT 111, STAT 112
EQ: STAT 111, STAT 112

STAT101-13S1 (C) **Semester 1**
STAT101-13S2 (C) **Semester 2**

MTH 118 Engineering Mathematics 1A
15 Points 0.1250 EFTS

A first course in the methods and applications of engineering mathematics. Topics include calculus, linear algebra, and modelling techniques. This Course is designed for engineering students who have done well in NCEA Mathematics with calculus.

R: MATH 102, MATH 108, MATH 199

EMTH118-13S1 (C) **Semester 1**
EMTH118-13S2 (C) **Semester 2**

EMTH 119 Engineering Mathematics 1B
15 Points 0.1250 EFTS

A continuation of EMTH118. Topics covered include methods and Engineering applications of calculus, differential equations, and linear algebra, along with an introduction to probability. This course is a prerequisite for many courses in engineering mathematics and other subjects at 200 level.

P: MATH 102, MATH 108 or EMTH 118
R: MATH 103, MATH 109, MATH 199

EMTH119-12SU2 (C) **Summer (Nov 12)**
EMTH119-13S2 (C) **Semester 2**

EMTH 171 Mathematical Modelling and Computation
15 Points 0.1250 EFTS

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

R: MATH 170, MATH 171
RP: MATH 109 or EMTH 119 (prior or concurrent enrolment recommended). If you are taking EMTH 171 concurrently with EMTH 118 you are likely to experience difficulties.

EMTH171-13S2 (C) **Semester 2**

MATH 170 Mathematical Modelling and Computation
15 Points 0.1250 EFTS

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

R: MATH 171, EMTH 171
RP: MATH 109 or MATH 103 (prior or concurrent enrolment recommended)

MATH170-13S2 (C) **Semester 2**

200-level

MATH 201 Mathematics 2
15 Points 0.1250 EFTS

This course deals with techniques in multivariable calculus and linear algebra which have applications in many areas of science, commerce and engineering. It is also preparation for many courses in advanced mathematics.

P: MATH 103 or MATH 109 or MATH 199 or EMTH 119
R: MATH 261, MATH 264, EMTH 202, EMTH 204, EMTH 210

MATH201-13S1 (C) **Semester 1**

MATH 202 Differential Equations and Vector Calculus
15 Points 0.1250 EFTS

This course deals with techniques for solving differential equations, and develops further tools for multivariable calculus, building on the material in MATH201.

P: MATH 201 or EMTH 210
R: MATH 262, MATH 264, EMTH 202, EMTH 204

MATH202-13S2 (C) **Semester 2**

MATH 203 Linear Algebra
15 Points 0.1250 EFTS

Linear algebra is a key part of the mathematical toolkit needed in the modern study of many areas in science, commerce and engineering. This course develops the fundamental concepts of linear algebra, including orthogonality, projections and eigenvalues, with an emphasis on practical applications and use of the computer package MATLAB.

P: MATH 103 or EMTH 119 or MATH 199
R: MATH 252, MATH 254, EMTH 203, EMTH 204, EMTH 211

MATH203-13S2 (C) **Semester 2**

MATH 220 Discrete Mathematics and Cryptography
15 Points 0.1250 EFTS

Discrete mathematics underpins many areas of modern-day science. This course is an introduction to graph theory and cryptography, two central topics in discrete mathematics.

P: One of MATH 102, MATH 103, MATH 108, MATH 109, MATH 115, MATH 120, MATH 199, EMTH 118 or EMTH 119.
R: MATH 221, MATH 231

MATH220-13S1 (C) **Semester 1**

MATH 230 Logic, Automata, and Computability
15 Points 0.1250 EFTS
An introduction to various formal logics, the theory of automata, and the theoretical limitations of the computer.

P: 30 points from MATH 100-199 excluding MATH 101; or with permission of the Head of Department
R: MATH 208, MATH 308, PHIL 208, PHIL 210, PHIL 308, PHIL 225, PHIL 246, PHIL 346
EQ: PHIL 210

MATH230-13S2 (C) **Semester 2**

MATH 240 Analysis and Groups
15 Points 0.1250 EFTS
The course comprises two very different subjects, analysis and groups, both fundamental to mathematics and requiring mathematically rigorous thinking. It gives a deeper understanding of the real number system and limits, and an introduction to the methods of abstract algebra via the study of symmetries and permutations.

P: MATH 103, MATH 109, MATH 199 or EMTH 119
R: MATH 222, MATH 243

MATH240-13S1 (C) **Semester 1**

MATH 270 Mathematical Modelling and Computation 2
15 Points 0.1250 EFTS
Numerical methods and stochastics: solving nonlinear equations; solving systems of linear equations; interpolation; initial value and boundary value problems for ordinary differential equations; Monte Carlo simulation and applications. Programming and problem solving using MATLAB and the application of these ideas.

P: (MATH 170 or MATH 171 or EMTH 171 or MATH 280 or MATH 282) and (EMTH 119 or MATH 103 or MATH 109 or MATH 199)
R: EMTH 271, MATH 271

MATH270-13S2 (C) **Semester 2**

MATH 280 Introduction to Scientific Computation
15 Points 0.1250 EFTS
Not offered in 2013
Introduction to the mathematical software package, MATLAB, that integrates technical computation, graphics, visualisation, and programming

P: MATH 103, MATH 109, MATH 199 or EMTH 119
R: MATH 281, MATH 282

STAT 201 Applied Statistics
15 Points 0.1250 EFTS
A practical introduction to commonly used statistical methods, designed to increase the breadth of statistics skills. The emphasis is on the application of statistical techniques to solve problems involving real data.

P: STAT 101, STAT 111, STAT 112 or STAT 131
R: FORE 210, STAT 220, FORE 222, STAT 222

STAT201-13S1 (C) **Semester 1**

STAT 202 Regression Modelling
15 Points 0.1250 EFTS
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.

P: STAT 101, STAT 111, STAT 112 or STAT 131
R: FORE 210, STAT 220, FORE 224, STAT 224

STAT202-13S2 (C) **Semester 2**

STAT 211 Random Processes
15 Points 0.1250 EFTS
This course introduces some of the most useful probability models that are widely used in biology, medicine, economics, finance, engineering, physics and many other areas. The models that will be covered are Markov chains, martingales and Poisson processes.

P: (STAT 101 or STAT 111 or STAT 112) and (MATH 102 or EMTH 118 or MATH 108) or MATH 103, MATH 109, MATH 199, EMTH 119
R: STAT 216

STAT211-13S1 (C) **Semester 1**

STAT 213 Statistical Inference
15 Points 0.1250 EFTS
This course provides the theoretical foundations for statistical estimation and testing at an introductory level. These are essential for more advanced studies in statistics at higher levels because they facilitate a deeper understanding of statistical techniques and their applications.

P: 1) MATH 103 or MATH 199 or EMTH 119; or 2) (STAT 101 or STAT 111 or STAT 112) and (MATH 102 or EMTH 118 or MATH 108 or MATH 109).
R: STAT 214

STAT213-13S2 (C) **Semester 2**

STAT 221 Monte Carlo Methods
15 Points 0.1250 EFTS
This course is about the generation of random numbers and their uses, including computer simulations to mimic and contrast random real-world phenomena. It will provide an intuitive and practical understanding of the basic methods in computational statistics, and show how to implement statistical algorithms to manipulate, visualise and comprehend various aspects of real-world data.

P: 1) MATH 103 or MATH 199 or EMTH 119; or 2) (STAT 101 or STAT 111 or STAT 112) and (MATH 102 or EMTH 118 or MATH 108 or MATH 109).
R: STAT 218

STAT221-13S1 (C) **Semester 1**

EMTH 200 Special Topic in Engineering Mathematics
15 Points 0.1250 EFTS
P: Subject to the approval of the Dean of Engineering and Forestry

EMTH200-13S1 (C) **Semester 1**
EMTH200-13S2 (C) **Semester 2**

‘The thing I enjoy most about my degree is the challenge and the thrill of problem solving.’

Thomas Li

Studying towards a Bachelor of Science with Honours in Mathematics

EMTH 201 Independent Course of Study
15 Points 0.1250 EFTS
P: Subject to the approval of the Dean of Engineering and Forestry

EMTH201-13S1 (C) **Semester 1**
EMTH201-13S2 (C) **Semester 2**

EMTH 210 Engineering Mathematics 2
15 Points 0.1250 EFTS
This course covers material in multivariable integral and differential calculus, linear algebra and statistics which is applicable to the engineering professions.

P: Subject to approval of the Dean of Engineering and Forestry
R: EMTH 202, EMTH 204, MATH 201, MATH 261, MATH 262, MATH 264

EMTH210-13S1 (C) **Semester 1**

EMTH 211 Engineering Linear Algebra and Statistics
15 Points 0.1250 EFTS
A linear/matrix algebra course using MATLAB, with engineering applications and a component of statistics for engineers.

R: EMTH 203, EMTH 204, MATH 203, MATH 254, MATH 252, MATH 251
RP: EMTH 210

EMTH211-13S2 (C) **Semester 2**

EMTH 271 Mathematical Modelling and Computation 2
15 Points 0.1250 EFTS
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.

P: (1) EMTH 171, MATH 170 or MATH 171; (2) Subject to approval of the Dean of Engineering and Forestry.
R: MATH 270, MATH 271

EMTH271-13S2 (C) **Semester 2**

300-level

MATH 302 Partial Differential Equations
15 Points 0.1250 EFTS
An introduction to the methods of solution for partial differential equations and to their applications.

P: MATH 264, EMTH 204, (MATH 261 and MATH 262), EMTH 202, MATH 202 or EMTH 210
R: MATH 361, EMTH 391, EMTH 413

MATH302-13S1 (C) **Semester 1**

MATH 303 Applied Matrix Algebra
15 Points 0.1250 EFTS
A continuation of 200-level linear algebra with computational and theoretical aspects and applications.

P: (MATH 251 and MATH 252), MATH 254, EMTH 204, MATH 203, EMTH 203 or EMTH 211.
R: MATH 352, EMTH 412

MATH303-13S1 (C) **Semester 1**

MATH 320 Discrete Mathematics
15 Points 0.1250 EFTS
Not offered in 2013
Modern combinatorics and discrete mathematics with an emphasis on design theory.

P: 30 points from MATH 201, MATH 202, MATH 203, MATH 220, MATH 240, EMTH 210, EMTH 211; or, 22 points from MATH 221, MATH 222, MATH 231, MATH 251, MATH 252, MATH 254, EMTH 203, EMTH 204.
R: MATH 333, MATH 334

MATH 321 Rings and Fields
15 Points 0.1250 EFTS
An introduction to fields and rings, including applications to coding theory and the impossibility of constructions such as 'squaring the circle'.

P: MATH 220, MATH 221, MATH 222, MATH 240 or (MATH 203, MATH 254, EMTH 204 or EMTH 211 with Head of Department permission) and a further 15 points from MATH 201-294
R: MATH 311

MATH321-13S1 (C) **Semester 1**

MATH 324 Cryptography and Coding Theory
15 Points 0.1250 EFTS
This course deals with the mathematical ideas underlying modern cryptography, including algebra, number theory and probability theory.

P: (MATH 220 or MATH 221) and a further 15 points from MATH 201-294
R: MATH 391

MATH324-13S2 (C) **Semester 2**

MATH 335 Computability Theory
15 Points 0.1250 EFTS
Not offered in 2013
Mathematical models of computation. Computability and non-computability. Abstract complexity theory.

P: 1) MATH 230 and (COSC 222 or COSC 261); or 2) 30 points in MATH or EMTH at 200 level, as approved by the Head of Department; or 3) MATH 230 and, with the approval of the Head of Department, an appropriate Philosophy course.

MATH 336 Foundations of Mathematics
15 Points 0.1250 EFTS
An introduction to the philosophy of mathematics, classical and intuitionistic logic, set theory, and Gödel's theorems.

P: 30 points in MATH or EMTH at 200 level, as approved by the Head of Department.
R: MATH 208, MATH 308

MATH336-13S2 (C) **Semester 2**

MATH 343 Metric, Normed and Hilbert Spaces
15 Points 0.1250 EFTS
An introduction to those parts of modern analysis essential for many aspects of pure and applied mathematics, physics, economics and finance.

P: 30 points from MATH 201, MATH 202, MATH 203, MATH 240, MATH 243, MATH 254, MATH 264, MATH 271, EMTH 202, EMTH 204, EMTH 210, EMTH 211 or EMTH 271.

MATH343-13S1 (C) **Semester 1**

MATH 353 Computational Mathematics and Applications
15 Points 0.1250 EFTS
This course looks at a variety of algorithms for solving important computational problems that arise in science, engineering, and commerce. Topics covered include an introduction to the numerical solution of partial differential equations, and numerical methods for the eigenvalue problem. Other topics include the Fast Fourier Transform, and numerical approximation techniques.

P: 1) Either MATH 201 or EMTH 210; AND 2) One of MATH 202, MATH 203, MATH 240, MATH 270, EMTH 211 or EMTH 271. With the permission of the Head of Department a high grade in either MATH 201 or EMTH 210 will suffice.
R: EMTH 414

MATH353-13S2 (C) **Semester 2**

MATH 363 Dynamical Systems
15 Points 0.1250 EFTS
An introduction to nonlinear systems, the use of linearisation techniques and bifurcation theory.

P: MATH 201 or MATH 264 or (MATH 261 and MATH 262) or EMTH 202 or EMTH 204 or EMTH 210 and a further 15 points from (EMTH 211, EMTH 271, MATH 202, MATH 203, MATH 240, MATH 270).
R: EMTH 415

MATH363-13S2 (C) **Semester 2**

MATH 365 Applications of Complex Variables
15 Points 0.1250 EFTS
Applications of complex variable theory in the physical and engineering sciences. Contour integration. Conformal mappings.

P: MATH 264, EMTH 204, (MATH 261 and MATH 262), EMTH 202, MATH 243, MATH 202 or MATH 240; or, a high level of achievement in EMTH 210 with Head of Department approval.
R: MATH 342

MATH365-13S2 (C) **Semester 2**

MATH 380 Mathematics in Perspective
15 Points 0.1250 EFTS
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.

P: 30 points in Mathematics or Statistics or Engineering Mathematics at 100 level. 45 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.

MATH380-13S1 (D) **Semester 1**
MATH380-13S1 (C) **Semester 1**

'Many students say that you know their names. I know it might sound like a small thing, but it shows that you really care!'

Student feedback

MATH 391 Special Topic
15 Points 0.1250 EFTS
This special topic will allow flexibility to offer new or one-off courses of strategic importance to the Department. Its potential uses include: new staff developing a course in their areas of research specialisation; visiting Erskine fellows offering courses covering exciting new developments.

P: Head of Department approval

MATH391-13S1 (C) Semester 1

MATH 392 Special Topic
15 Points 0.1250 EFTS
This special topic will allow flexibility to offer new or one-off courses of strategic importance to the Department. Its potential uses include: new staff developing a course in their areas of research specialisation; visiting Erskine fellows offering courses covering exciting new developments.

P: Head of Department approval

MATH392-13S2 (C) Semester 2

MATH 393 Independent Course of Study
15 Points 0.1250 EFTS
P: Head of Department approval

MATH393-13S1 (C) Semester 1

MATH 394 Independent Course of Study
15 Points 0.1250 EFTS
P: Head of Department approval

MATH394-13S2 (C) Semester 2

MATH 395 Mathematics Project
15 Points 0.1250 EFTS
This 150 hour course provides students with an opportunity to develop mathematical research skills to extend and strengthen their understanding of an area of mathematics. Note: This course cannot be included as part of the 300 level requirement for a Mathematics or Statistics major.

P: 45 points from MATH 210-294, and approval of Head of Department
R: MATH 305

MATH395-12SU2 (C) Summer (Nov 12)

STAT 312 Sampling Methods
15 Points 0.1250 EFTS
Sampling techniques and designs. Special sampling designs for surveys of animal populations.

P: 15 points from STAT 201, STAT 202, STAT 213, and, a further 15 points from STAT 200 to STAT 299.

STAT312-13S1 (C) Semester 1

STAT 313 Computational Statistics
15 Points 0.1250 EFTS
Not offered in 2013
Data analysis and statistical inference based on permutation methods, EDF methods, bootstrap and resampling methods, kernel methods and Markov chain methods.

P: STAT 211, STAT 213, STAT 221, EMTH 210, EMTH 271 or at least B+ in (MATH 103 or EMTH 119).

STAT 314 Bayesian Inference
15 Points 0.1250 EFTS
This course explores the Bayesian approach to statistics by considering the theory, methods for computing Bayesian solutions, and examples of applications.

P: One of the following: 1) (MATH 103 or MATH 199 or EMTH 119) and (15 points at 200-level MATH or STAT (or other quantitative 200 level courses by approval of the Head of Department)); 2) STAT 211 or STAT 213 or STAT 221.

STAT314-13S2 (C) Semester 2

STAT 315 Multivariate Statistical Methods
15 Points 0.1250 EFTS
Detailed study of multivariate methods. Application of multivariate methods, test statistics and distributions.

P: 15 points from (STAT 202 or STAT 213) and a further 15 points from STAT 200-299, or, subject to Head of Department approval.

STAT315-13S1 (C) Semester 1

STAT 316 Applied Stochastic Modelling
15 Points 0.1250 EFTS
Not offered in 2013
Theory and applications of Markov processes. Applications to population dynamics, queuing and reliability.

P: 15 points from STAT 211, STAT 212, STAT 221 or MATH 201.
R: MATH 376

STAT 317 Time Series Methods
15 Points 0.1250 EFTS
Analysis of sequentially collected data including data modelling and forecasting techniques.

P: 15 points from STAT 201, STAT 202, STAT 213 and a further 15 points from STAT 200-299, ECON 213, MATH 103, MATH 199 or EMTH 119.

STAT317-13S2 (C) Semester 2

STAT 318 Data Mining
15 Points 0.1250 EFTS
Parametric and non-parametric statistical methodologies and algorithms for data mining.

P: i) 15 points from STAT 200 to STAT 299 and ii) a further 15 points from STAT 200 to STAT 299 or COSC 200-299 or any other relevant subject with Head of Department approval.

STAT318-13S2 (C) Semester 2

STAT 319 Generalised Linear Models
15 Points 0.1250 EFTS
STAT319 is a course in Generalised Linear Models (GLM), suited to anyone with an interest in analysing data. In this course we introduce the components of GLM and other advanced data analysis techniques. We use the free-ware package R. R is becoming the preferred computer package for many statisticians. In this course we will show you how to use the package, enter, manipulate and analyse data in R.

P: 30 points from STAT 200-299 or Head of Department approval

STAT319-13S1 (C) Semester 1

‘I still see myself more as a biologist than a statistician, but I think that there is a huge need for biologists with good statistical skills, so I wanted to do my PhD in Statistics.’

Peter Jaksons
Studying towards a PhD in Statistics

STAT 391 Special Topic
15 Points 0.1250 EFTS
This special topic will allow flexibility to offer new or one-off courses of strategic importance to the Department. Its potential uses include: new staff developing a course in their areas of research specialisation; visiting Erskine fellows offering courses covering exciting new developments.

P: Subject to the approval of the Head of Department

STAT391-13S1 (C) Semester 1

STAT 392 Special Topic
15 Points 0.1250 EFTS
This special topic will allow flexibility to offer new or one-off courses of strategic importance to the Department. Its potential uses include: new staff developing a course in their areas of research specialisation; visiting Erskine fellows offering courses covering exciting new developments.

P: Head of Department approval

STAT392-13S2 (C) Semester 2

STAT 393 Independent Course of Study
15 Points 0.1250 EFTS
P: Head of Department approval.

STAT393-13S1 (C) Semester 1

STAT 394 Independent Course of Study
15 Points 0.1250 EFTS
P: Head of Department approval.

STAT394-13S2 (C) Semester 2

STAT 395 Statistics Project
15 Points 0.1250 EFTS
This 150 hour course provides students with an opportunity to develop statistical research skills to extend and strengthen their understanding of an area of statistics. Note: This course cannot be included as part of the 300 level requirement for a Mathematics or Statistics major.

P: 30 points from STAT 210-294, and approval of Head of Department

STAT395-12SU2 (C) Summer (Nov 12)

Department of Mathematics and Statistics
College of Engineering
T: +64 3 364 2600
T: 0800 VARSITY (0800 827 748)
E: enquiries@math.canterbury.ac.nz

University of Canterbury
Te Whare Wānanga o Waitaha
Private Bag 4800
Christchurch 8140
New Zealand

www.math.canterbury.ac.nz