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WELCOME TO MATHEMATICS, STATISTICS AND OPERATIONS RESEARCH

Students majoring in Mathematics and in Statistics develop a range of skills and attributes that are highly sought after in the workplace. Our graduates find work in research, analysis, policy and management roles in science, IT, finance and government sectors. Employers value our graduates’ critical, logical and abstract thinking and their ability to work with and communicate complex ideas. Graduates can go on to successful careers in the academic world as well as in teaching.

This prospectus indicates a number of pathways within each of these majors. These will allow you to develop your own strengths and interests within the mathematical sciences. There is a great deal in common between the major subjects and some pathways, notably operations research, draw strongly on both. Other disciplines require knowledge of more advanced statistics and mathematics—actuarial science, engineering, physics and chemistry, biological sciences, psychology, economics and finance, computer science, geophysics and many more. If you are taking any of these subjects, you will find courses here that you may require and which are of value. You may consider taking a second major, or a minor, in mathematics or statistics alongside your first major.

IMPORTANT DATES 2015

<table>
<thead>
<tr>
<th>Event</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>University re-opens for Trimester 3 and Summer School</td>
<td>5 January</td>
</tr>
<tr>
<td>Wellington Anniversary</td>
<td>19 January</td>
</tr>
<tr>
<td>Enrolment closes for 2015 courses</td>
<td>10 February</td>
</tr>
<tr>
<td>Trimester 3 and Summer School examinations</td>
<td>16–21 February</td>
</tr>
<tr>
<td>Trimester 1 begins</td>
<td>2 March</td>
</tr>
<tr>
<td>Easter/Mid-trimester break</td>
<td>3 April–19 May</td>
</tr>
<tr>
<td>Anzac Day</td>
<td>25 April (public holiday 27 April)</td>
</tr>
<tr>
<td>Graduation</td>
<td>12–14 May</td>
</tr>
<tr>
<td>Queen’s Birthday</td>
<td>1 June</td>
</tr>
<tr>
<td>Examinations</td>
<td>12 June–1 July</td>
</tr>
<tr>
<td>Mid-year break</td>
<td>2 July–12 July</td>
</tr>
<tr>
<td>Trimester 2 begins</td>
<td>13 July</td>
</tr>
<tr>
<td>Mid-trimester break</td>
<td>24 August–6 September</td>
</tr>
<tr>
<td>Examinations</td>
<td>23 October–14 November</td>
</tr>
<tr>
<td>Labour Day</td>
<td>26 October</td>
</tr>
<tr>
<td>Trimester 3 begins</td>
<td>16 November</td>
</tr>
<tr>
<td>Graduation</td>
<td>9–10 December</td>
</tr>
<tr>
<td>Christmas break</td>
<td>22 December–2 January 2016</td>
</tr>
</tbody>
</table>

TIMETABLE

The timetable is online at www.victoria.ac.nz/timetables
School of Mathematics, Statistics and Operations Research
Te Kura Mātai Tatauranga, Rangahau Pūnaha

Location: Cotton Building, PO Box 600, Gate 6, Kelburn Parade, Wellington
School Office: Cotton Building, Floor 3, Room 358
Staff members: Cotton Building, Floors 3, 4 & 5
Office hours: Mon–Fri 8:30am to 5:00pm
Telephone: 04-463 5341 from NZ, +64-4-463 5341 from overseas
Fax: 04-463-5045 from NZ, +64-4-463 5045 from overseas
Email: msor-office@vuw.ac.nz
Staff Email List: www.victoria.ac.nz/smsor/about/staff
Website: http://msor.victoria.ac.nz

STAFF CONTACTS

<table>
<thead>
<tr>
<th>STAFF</th>
<th>ROOM</th>
<th>CONTACT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Head of School</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr Peter Donelan</td>
<td>360</td>
<td>463 5659</td>
</tr>
<tr>
<td><strong>Deputy Head of School</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr Ivy (I-Ming) Liu</td>
<td>424</td>
<td>463 5648</td>
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<tr>
<td><strong>Programme Directors</strong></td>
<td></td>
<td></td>
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<tr>
<td><em>Mathematics</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prof Rod Downey</td>
<td>324</td>
<td>463 5067</td>
</tr>
<tr>
<td><em>Statistics and Operations Research</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr Richard Arnold</td>
<td>540</td>
<td>463 5668</td>
</tr>
<tr>
<td><strong>Disability Liaison Advisor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prof Matt Visser</td>
<td>321</td>
<td>463 5115</td>
</tr>
<tr>
<td><strong>Advisor to Māori and Pacific Nation Students</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr Adam Day</td>
<td>442</td>
<td>463 5658</td>
</tr>
<tr>
<td><strong>Advisor to International Students</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr Petros Hadjicostas</td>
<td>425</td>
<td>463 6734</td>
</tr>
<tr>
<td><strong>Advisor to Women Students</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ginny Whatarau</td>
<td>357</td>
<td>463 5666</td>
</tr>
<tr>
<td><strong>Administration</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ginny Whatarau</td>
<td>357</td>
<td>463 5666</td>
</tr>
<tr>
<td>Prema Ram</td>
<td>358</td>
<td>463 5341</td>
</tr>
<tr>
<td>Nathan Bramley</td>
<td>358</td>
<td>463 9542</td>
</tr>
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</table>
## Mathematics

<table>
<thead>
<tr>
<th>Name</th>
<th>Role / Research Interests</th>
<th>Room</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr Steven Archer</td>
<td>Senior Tutor</td>
<td>363</td>
<td>463 8316</td>
</tr>
<tr>
<td>Dr David Balduzzi</td>
<td>Machine Learning, Computational Neuroscience</td>
<td>362</td>
<td>463 5275</td>
</tr>
<tr>
<td>Dr George Barmpalias</td>
<td>Networks, Population Models, Logic</td>
<td>426</td>
<td>463 6744</td>
</tr>
<tr>
<td>Prof Rod Downey</td>
<td>Computability, Complexity, Combinatorics, Algebra</td>
<td>324</td>
<td>463 5067</td>
</tr>
<tr>
<td>Dr Adam Day</td>
<td>Algorithmic Randomness</td>
<td>442</td>
<td>463 5658</td>
</tr>
<tr>
<td>Dr Peter Donelan</td>
<td>Machine Learning, Invariant Theory, Robotics</td>
<td>360</td>
<td>463 5659</td>
</tr>
<tr>
<td>Prof Rob Goldblatt§†</td>
<td>Mathematical Logic, General Algebra</td>
<td>438</td>
<td>463 5660</td>
</tr>
<tr>
<td>A/Prof Noam Greenberg</td>
<td>Analysis, Topology</td>
<td>443</td>
<td>463 9695</td>
</tr>
<tr>
<td>Dr Sharon Hollander</td>
<td>Number Theory, Arithmetic Geometry</td>
<td>434</td>
<td>463 5665</td>
</tr>
<tr>
<td>Dr Byoung Du (BD) Kim†</td>
<td>Functional Analysis</td>
<td>440</td>
<td>463 6732</td>
</tr>
<tr>
<td>Dr Hung Le Pham†</td>
<td>Matroids, Complexity, Combinatorics, Graph Theory</td>
<td>435</td>
<td>463 5155</td>
</tr>
<tr>
<td>Dr Dimitrios Mitsokakis</td>
<td>Numerical Analysis, Differential Equations, Nonlinear Waves</td>
<td>361</td>
<td>463 6739</td>
</tr>
<tr>
<td>Prof Mark McGuinness†</td>
<td>Industrial Applied Maths, Modelling</td>
<td>323</td>
<td>463 5059</td>
</tr>
<tr>
<td>Dr Ken Pledger</td>
<td>Geometry, History of Mathematics</td>
<td>439</td>
<td>463 6780</td>
</tr>
<tr>
<td>Dr Alexander Usvyatsov</td>
<td>Analysis, Logic, Model Theory</td>
<td>427</td>
<td>463 9543</td>
</tr>
<tr>
<td>Prof Matt Visser</td>
<td>Black Holes, General Relativity, Cosmology</td>
<td>321</td>
<td>463 5115</td>
</tr>
<tr>
<td>Prof Geoff Whittle</td>
<td>Combinatorics, Matroids, Graph Theory</td>
<td>320</td>
<td>463 5650</td>
</tr>
</tbody>
</table>

§ Postgraduate Coordinator in Mathematics – for postgraduate study enquiries
† On leave or unavailable for part of this year

## Statistics and Operations Research

<table>
<thead>
<tr>
<th>Name</th>
<th>Role / Research Interests</th>
<th>Room</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr Steven Archer</td>
<td>Senior Tutor</td>
<td>363</td>
<td>463 8316</td>
</tr>
<tr>
<td>Dr Richard Arnold</td>
<td>Biostatistics, Bayesian Statistics, Statistics in Geophysics</td>
<td>540</td>
<td>463 5668</td>
</tr>
<tr>
<td>A/Prof Stefanka Chukova†</td>
<td>Warranty Analysis and Reliability</td>
<td>537</td>
<td>463 6786</td>
</tr>
<tr>
<td>Dr Petros Hadjicostas</td>
<td>Bayesian Statistics, Special Functions, Production Theory</td>
<td>425</td>
<td>463 6734</td>
</tr>
<tr>
<td>Dr John Haywood</td>
<td>Time Series, Forecasting, Seasonal Adjustment, Statistical Modelling</td>
<td>534</td>
<td>463 5673</td>
</tr>
<tr>
<td>Dr Yuichi Hirose§</td>
<td>Estimation Theory, Model Selection, Sampling Methods</td>
<td>529</td>
<td>463 6421</td>
</tr>
<tr>
<td>Prof Estate Khmaladze</td>
<td>Asymptotic Statistics, Random Processes, Martingale Methods</td>
<td>536</td>
<td>463 5652</td>
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<tr>
<td>Dr Ivy (I-Ming) Liu</td>
<td>Categorical Data Analysis</td>
<td>424</td>
<td>463 5648</td>
</tr>
<tr>
<td>Dr Nokuthaba Sibanda§†</td>
<td>Biomedical Statistics, Statistical Process, Control, Applications of Bayesian Statistics</td>
<td>532</td>
<td>463 6779</td>
</tr>
</tbody>
</table>

§ Postgraduate Coordinator in Statistics – for postgraduate study enquiries:
Yuichi Hirose (January–June) and Nokuthaba Sibanda (July–December).
† On leave or unavailable for part of this year
THE VICTORIA BACHELOR OF SCIENCE

Victoria’s Bachelor of Science (BSc) degree provides the depth of a strong science education in one or two specialised science subjects—majors—combined with the breadth of subjects from outside your science major or outside science altogether to the extent of a second major or minor or a variety of interest subjects.

Year 1: EXPLORATION

<table>
<thead>
<tr>
<th>Major</th>
<th>Major</th>
<th>Major</th>
<th>Major</th>
<th>Elective</th>
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<th>Minor</th>
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</table>

Workload: 120 points

Year 2: CONSOLIDATION

<table>
<thead>
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<th>Major</th>
<th>Major</th>
<th>Major</th>
<th>Major</th>
<th>Elective</th>
<th>Elective</th>
<th>Minor</th>
<th>Minor</th>
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</table>

Workload: 120 points

Year 3: SPECIALISATION

<table>
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<th>Major</th>
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<th>Major</th>
<th>Elective</th>
<th>Elective</th>
<th>Minor</th>
<th>Minor</th>
</tr>
</thead>
</table>

Workload: 120 points

GRADUATION: BSc in Major

BSC REGULATIONS

These regulations apply to all new, returning or transferring students taking up a BSc degree:

- Minimum of 360 approved points:
  - 210 points above 100-level of which 150 points must be science
  - 75 science points at 300-level.
- At least one science major.
- 90 points may be from outside science with an additional 30 points permitted if specified in the major.
- A second major may be from any other first degree with a maximum of 150 points permitted from outside science.

SCIENCE MAJOR REGULATIONS

For specific requirements please see the relevant prospectus. A major indicates your prime area of study in your BSc degree and you need to achieve:

- 60 points at 300-level
- 60–80 points at 200-level
- 45–60 points at 100-level.

Note: For regulations of majors from outside science you need to meet the requirements identified in that degree where the major or subject area is specified.
**SCIENCE MINOR REGULATIONS**

A minor demonstrates an area of interest which is recorded on your academic transcript and you need:

- 60 points above 100-level specified in the major, of which
- 15 points must be at 300-level.

**MINOR IN FORENSIC SCIENCE**

A Forensic Science minor is available to students undertaking a semester of exchange at the National University of Singapore (NUS) who meet the pre-requisite requirements. You must:

- be selected as suitable for a trimester of international exchange
- include two core courses in 300-level Forensic Science at NUS (30 Victoria points)
- Have passed CHEM 114 and one of BIOL/BMSC 241, 244 or CHEM 201 prior to acceptance.

Please visit [http://vicoe.dotnous.com/#Singapore](http://vicoe.dotnous.com/#Singapore) for more information.

**MINOR IN SCIENCE IN CONTEXT**

A Science in Context minor is available to students from all disciplines, enabling them to develop their scientific literacy and appreciation of the role of science in society. The Science in Context minor includes a core 300-level course in Science Communication and a range of other courses often run online, intensively over summer, or face-to-face. See page 39 or [www.victoria.ac.nz/scps/research/research-groups/science-in-context](http://www.victoria.ac.nz/scps/research/research-groups/science-in-context) for more details.

**CONJOINT REGULATIONS FOR ANY TWO VICTORIA DEGREES**

Any two Victoria degrees can be completed under conjoint regulations provided that a B-grade point average is maintained each year. This means that fewer points are required than for two degrees not completed under conjoint regulations. For example, under conjoint regulations, two (three year) degrees should be able to be completed in four years and a four year degree and a three year degree should be able to be completed in five years.

**CONJOINT BSC/BTEACH**

This is a special conjoint programme for science or mathematics students wishing to teach in primary and secondary schools. See [www.vuw.ac.nz/education](http://www.vuw.ac.nz/education) for more information.

The programme requires:

- B- average maintained throughout the programme
- 540 total points
- 240 science points of which 135 are above 100-level
- 280 BTeach points of which 190 are above 100-level.

**Note:** All BSc graduates require completion of at least 15 points in MATH/STAT/PHYS if not already specified in the major.
COURSE STUDY REQUIREMENTS

In a trimester of study, to ensure success you must:

- hand in any required work
- attend compulsory laboratory, field, tutorial or workshop sessions
- sit key tests.

Otherwise you may be considered for suspension for one trimester from the university after your first or any trimester of study. You will then have to reapply for admission.

If you achieve an academic progress grade below one over three trimesters of study you may be recommended for suspension from university for one year.

Note: Pulling out of courses after two weeks without due cause will be registered on your academic record as a fail grade.

At Victoria we care about the academic progress of our students, and want you to succeed and achieve your potential. The Faculty of Science invites students who are not making good progress to talk to the Associate Dean (Academic), Shona de Sain. Together we decide what support is appropriate and on a suitable programme of study. You can also talk to the student advisers, academic staff and the university student services staff.

Email science-faculty@vuw.ac.nz for an appointment with the Associate Dean.

The Faculty has a number of well-established, effective initiatives that focus on students working collectively to succeed and working with communities to improve secondary and tertiary educational outcomes. Te Rōpū Āwhina offers help, mentoring and a whānau environment for study to Māori, Pacific and other students. The Faculty also offers equity-help sessions for core 100-level science courses. For more details see www.victoria.ac.nz/science/study/equity
GRADUATE DIPLOMA IN SCIENCE

The Graduate Diploma in Science (GDipSc) is a flexible programme that caters for students from a wide variety of backgrounds. It enables those with a Bachelor’s degree or appropriate work experience in one discipline to transition to postgraduate study in a new area. Alternatively it can provide a refresher course or a short programme of study in an area of interest.

The diploma is an ideal opportunity to specialise at an advanced level in areas not included in your first degree or, if you have been away from study for a while, to learn about new developments in your original discipline.

A GDipSc may be endorsed with the name of one subject (e.g. a Graduate Diploma in Science in Chemistry) if the course of study meets the 300-level major requirements for that subject.

DURATION

One year full time or up to four years part time.

ENTRY REQUIREMENTS

A Bachelor’s degree in any discipline.

COURSE REQUIREMENTS

The GDipSc course is essentially a Bachelor of Science major in a different discipline to your first degree. You can choose your own programme of study—in consultation with the Associate Dean (Academic)—from a wide range of 200- and 300-level courses.

The programme must include:

- 120 science points from 200- and 300-level courses
- At least 75 points at 300-level.

POSTGRADUATE STUDY

As the top New Zealand university for research performance, Victoria is the obvious choice if you are considering studying at postgraduate level.

For specific programmes check the relevant postgraduate prospectus and the Victoria postgraduate study website www.victoria.ac.nz/home/study/postgrad
MATHEMATICS, STATISTICS AND OPERATIONS RESEARCH

The School offers the following majors or specialisations for the Bachelor of Science (BSc) degree:

- Mathematics
- Statistics.

Subject to approval, a new major in Actuarial Science will also be offered from 2015.

In addition there are majors available in the Bachelor of Arts (BA), and a number of conjoint degree programmes. Details of these can be obtained from the relevant School or Faculty, or in the Victoria University Calendar online at www.victoria.ac.nz/home/study/calendar.aspx

Many of the School's courses form an integral part of other degrees and majors. For full details of those programmes, see the relevant School or Faculty.

The School also offers a range of postgraduate programmes. For more information, see the Postgraduate Study Prospectus at http://msor.victoria.ac.nz or collect one from the School Office.

ACADEMIC PRIZES

A number of prizes are awarded annually to the top performing undergraduate students in the School. There is no application process for these prizes—the winners are selected by a School committee.

**Mathematics**

- John P. Good Memorial Prize: Best first year student taking at least 45 points of mathematics
- Rotary Club of Wellington Science Prizes: Best student taking at least 30 points of first year Mathematics
- MacMorran Prize for Mathematics: Best student completing 45 points of 200-level mathematics
- Jenny Whitmarsh Award for Mathematics: Best female student completing 45 points of 200-level mathematics, and proceeding to 300-level mathematics
- David Payne Memorial Prize: Best student in applied mathematics
- W.H. (Bill) Vaughan Prize for Mathematics: Best student completing the mathematics major
- Geoffrey A. Rowan Memorial Bursary: Best student in 300-level mathematics who then enrolls for an Honours degree in mathematical sciences.

**Statistics**

- Shayle Searle Prize in Statistics: Best student in STAT 193
- J.T. Campbell Prize for Statistics: Best student in MATH 277
- Rotary club of Wellington Science prizes: Students with best overall performance in first year Statistics
- Health and Disability Intelligence Prize in Statistics: Best student in STAT 392.
COURSE CODES, TRIMESTERS AND CRNS

Course codes include a 4-letter subject code and a 3-digit number—the first digit denotes the level of the course. The University has three trimesters each year. Most courses are offered in just one of the three trimesters, but some are offered more than once and some may be spread over two trimesters. Each offering of a course has a unique Course Reference Number (CRN) which is needed for enrolment forms and finding information online. The general dates for the trimesters, including the examination periods, are:

- 1st trimester (1/3): March–June
- 2nd trimester (2/3): July–October/November
- 3rd (or summer) trimester (3/3): November–February
- Note: Some summer courses are taught as so-called block courses, with six or more hours a week, in just part of the summer trimester.
- 1st and 2nd trimesters (1+2/3): March–October/November

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course reference number</th>
<th>Title</th>
<th>Points</th>
<th>Trimester</th>
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</thead>
<tbody>
<tr>
<td>MATH 151</td>
<td>CRN 17161</td>
<td>ALGEBRA</td>
<td>15 PTS</td>
<td>1/3</td>
</tr>
</tbody>
</table>

HELP AND ADVICE

You are welcome to approach staff members for advice. If it is a matter concerning a particular course, you should first contact the course coordinator. For more general advice on planning, first contact the School Office, room 358, telephone 04-463 5341 or email msor-office@vuw.ac.nz and the staff there will direct you to the relevant advisor.

If a problem arises for which you would rather not approach the course coordinator or lecturer, feel free to consult the Head of School.

Some members of staff are designated as advisors to women students, to Māori and Pacific nations students, to international students, and to students with disabilities, about any specific concerns—they are listed in the staff directory at the front of this prospectus.

WHAT IS MEANT BY RESTRICTIONS

A number of courses in the prospectus show one or more Restrictions against other courses. The listed course may not be credited to a degree if any of the restricted courses have already been passed and credited or are being taken at the same time. For example, MATH 141 is restricted against MATH 142, QUAN 111 and ENGR 122, therefore you cannot enrol in MATH 141 this year at the same time as, say, QUAN 111, or if you have already passed QUAN 111 or ENGR 122. Likewise you could not take MATH 141 the following year if you pass MATH 142 this year. MATH 141 is not, however, in the Restrictions list for MATH 142 so you can proceed from 141 to 142.
DEGREE PLANNING (FIRST YEAR STUDENTS)

Plan your course of study as a coherent programme over the three or more years required. First-year students can usually only enrol in 100-level courses. In choosing your courses it is important to take account of:

- the overall requirements of the degree(s) you have chosen
- the specific requirements of your major subject(s)
- entry criteria for 100-level courses (see below for NCEA entry requirements, or their equivalent)
- prerequisites for courses you plan to take in the future, especially prerequisites in other subject areas
- workload constraints: 60 points per trimester represents standard full-time study—most full-time first-year students take seven or eight courses (105/120 points per year)
- timetable constraints: draw up your own timetable to ensure you do not have any clashes.

There is usually some choice about which courses you take, especially in your first year. This choice enables you to build a programme that can keep options open.

It is possible to take a degree with a ‘double major’ by satisfying the requirements of two subject areas, or to take a ‘double degree’ by taking two degrees from different faculties.

Some sharing is permitted, so a double degree requires fewer points than the two degrees separately.

The official degree statutes are set out in the Victoria University Calendar (www.victoria.ac.nz/home/study/calendar.aspx), which you should refer to if you are in doubt.

ENTRY REQUIREMENTS 100-LEVEL MATHEMATICS AND STATISTICS

At present there are four levels of entry to Mathematics and Statistics courses at Victoria University.

- Well-prepared calculus students may enrol directly in MATH 142, Calculus 1B. You will need to have passed NCEA Level 3 achievement standards 3.3 (trigonometry, AS91575), 3.6 (differentiation, AS91578) and 3.7 (integration, AS91579) and at least two should be with merit or excellence. Equivalent qualifications will be acceptable. Otherwise MATH 141 Calculus 1A is required for entry into MATH 142. If you enrol for MATH 142 but do not achieve the required standards you will be advised by the university to enrol in MATH 141 or discuss your enrolment with a member of academic staff in the School.

- Reasonably well-prepared students who have gained 16 NCEA Level 3 AS credits in mathematics (not statistics) (or some equivalent qualification) are given direct entry to MATH 141, Calculus 1A; MATH 151, Algebra; and MATH 161, Discrete Mathematics and Logic. Entry to MATH 177, Probability and Decision Modelling, requires 16 NCEA Level 3 AS credits in mathematics or statistics, including achievement standards 3.6 (differentiation, AS91578) and 3.7 (integration, AS91579), or equivalent qualifications. Otherwise MATH 141 Calculus 1A is required for entry into MATH 177.
• *Less well-prepared students* may enter MATH 132, Introduction to Mathematical Thinking, and STAT 193, Statistics for the Natural and Social Sciences, provided they have met university entrance numeracy requirements, preferably with NCEA 2.6 as well. A pass in MATH 132 gives entry into MATH 141, MATH 151 and MATH 161. Although less well-prepared students are allowed to enter STAT 193 and MATH 132, those with very weak preparation may find that much work is required. Support is available to assist students in this position.

• In addition to the three entry levels already mentioned, advanced and gifted students may be granted direct entry to 200-level courses. This applies to very few students. Entry is at the discretion of the appropriate programme director.

There are three courses in Engineering Mathematics, specifically intended for students enrolling in BE(Hons). Entry requirements are as follows:

• Entry to ENGR 121, Engineering Mathematics Foundations, requires 16 NCEA Level 3 AS credits in Mathematics or Statistics, or MATH 132. A pass in ENGR 121 is needed for entry to ENGR 122, Engineering Mathematics with Calculus and ENGR 123, Engineering Mathematics with Logic and Statistics.

For further advice on entry to Mathematics or Statistics courses, contact the School Office, or a relevant academic staff member (see staff contact details).
PLANNING A PROGRAMME IN MATHEMATICS

The BSc in Mathematics is a three-year qualification. The regulations for the degree are summarised on page 4. Here, we describe the regulations concerning the MATH major within the degree. You may specialise in pure or applied branches of the subject within the major. Employers in a wide variety of work environments place a high value on a Mathematics major.

The requirements for the MATH major presented below apply to students who enrolled for the first time in 2009 or later. Students who enrolled earlier but have not yet completed their designated major should take advice how best to do so, since all courses have now been standardised at 15 points.

To major in Mathematics you need:

- MATH 142, MATH 151, and MATH 161
- 60 points from MATH 300–399
- 60 further points from MATH 200–399.

You must pass MATH 142, 151 and 161 (or be exempted because you have already passed something equivalent elsewhere) to major in mathematics. You also need at least 60 points of 300-level mathematics and 120 points altogether from 200-level and 300-level mathematics. For example, you could do 45 points of 200-level mathematics and 75 points of 300-level mathematics.

PLANNING A FIRST-YEAR PROGRAMME

The core first-year courses MATH 142, 151 and 161 require a good mathematics background (see page 10 for more detailed NCEA entry requirements).

To enrol in MATH 151, Algebra, or MATH 161, Discrete Mathematics and Logic, you should have at least 16 NCEA Level 3 Mathematics credits. Otherwise you should first enrol in and pass MATH 132, Introduction to Mathematical Thinking.

MATH 141, Calculus 1A, is designed partly as a transitional course to MATH 142, Calculus 1B, but it is also an independent calculus course. To enrol in MATH 141 you should have at least 16 NCEA Level 3 Mathematics credits. Otherwise you should enrol in and pass MATH 132, Introduction to Mathematical Thinking.

MATH 132, Introduction to Mathematical Thinking, is intended as a transitional course to all our other first-year courses except MATH 142 and MATH 177. Although no specific entry qualifications are required, it does expect students to have a mathematical competence around NCEA Level 2 (Year 12). Assistance is available for those who find the course difficult, but prospective students whose mathematics is very weak or rusty are recommended to discuss their options with an academic advisor beforehand.
SECOND YEAR

We offer six 15 point courses at 200-level. In very broad terms, MATH students with an interest in any kind of calculus or applied mathematics should take at least MATH 244, MATH 243 and MATH 251; those with a more theoretical bent towards algebra, analysis, or the more abstract aspects of various sciences should take at least 211, 243 and 251; whilst those more interested in discrete mathematics or computer science should take at least 211, 251 and 261. However, to achieve a MATH major with only 45 points at 200-level, you need 75 points at 300-level, and your choice may not be very wide.

The more 200-level courses you pass, the more options you have later on. In considering your choice of 200-level courses, it is wise to take into account the prerequisites for 300-level courses you may subsequently wish to take. Notice that MATH 211, 243, and 251 are stated as prerequisites for several courses.

THIRD YEAR

There is a wide choice of courses at 300-level. Many courses offered have substantial prerequisites and you need to make some allowance for this in your previous study. The Applied Mathematics courses MATH 321/2/3 have no specific prerequisites as the appropriate preparation depends on the modules in question; you must discuss your choice of modules with the course coordinator.

COMPUTING FACILITIES AND REGULATIONS

Calculators are frequently valuable for Mathematics courses. Although calculators are not required you are advised to have at least a basic scientific calculator. A calculator with graphic or symbolic capabilities is permitted in most (though not all) examinations (the calculator must not have user-stored material in its memory). Many courses make use of mathematical software packages, particularly Maple and Matlab, which are available in the School’s computing laboratories. Course coordinators can advise you about the availability of student editions of Maple and Matlab.

All users of computing laboratories should familiarise themselves with the Information Systems Statute found at www.victoria.ac.nz/about/governance/strategy and see the rules posted in the Laboratories.
SUMMARY OF MATHEMATICS COURSES

MATH 141
- OR
- ENGR 121*

MATH 142^*

MATH 177^^

MATH 141 or NCEA Achievement Standards in differentiation (91578), integration (91579) and trigonometry (91575), including at least two standards with merit or excellence

MATH 141 or NCEA Achievement Standards in differentiation (91578) and integration (91579)

Possibly a prerequisite for second year MATH courses; at present determined on a case by case basis

Or by permission of Head of School

AND
- OR
- AND

16 Credits
NCEA Level
3 Maths or
MATH 132

MATH 132

MATH 211

MATH 244

MATH 243

MATH 251

MATH 261

MATH 277

MATH 308
- MATH 311**
- MATH 312**
- MATH 313
- MATH 301
- MATH 309
- MATH 377

MATH 321
- MATH 322
- MATH 323
- MATH 324
- MATH 335
- MATH 353

AND

require 30 approved 200-level MATH points, not including MATH 261

requires 15 200-level MATH points

requires 15 points from MATH 211, MATH 51, MATH 261

requires MATH 142 and MATH 151; 15 points from MATH 243, 244, 251, 261; 15 further 200- level MATH or OPRE points
SUMMER COURSE

See page 10 for more details on entry requirements for this course.

<table>
<thead>
<tr>
<th>MATH 132</th>
<th>CRN 17286</th>
<th>INTRODUCTION TO MATHEMATICAL THINKING</th>
<th>15 PTS</th>
<th>3/3</th>
</tr>
</thead>
</table>

Restrictions: MATH 100–199; QUAN 103, 111
Coordinator: Dr Dillon Mayhew

This course provides an introduction to or review of fundamental skills and ideas for students who require some mathematics in their degree. Topics will include elementary arithmetic, algebra, geometry, functions, and an introduction to the basic ideas of differential calculus. There will be an emphasis on the history of mathematical ideas and how they have evolved: the goal is not only to apply mathematical tools correctly, but to understand them.

This course (CRN 17286) will run in January and February 2016.
### 100-LEVEL COURSES

See page 10 for more details on entry requirements for these courses.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>CRN</th>
<th>Course Title</th>
<th>Points</th>
<th>Credit</th>
<th>Coordinator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MATH 132</strong></td>
<td>17150</td>
<td><strong>INTRODUCTION TO MATHEMATICAL THINKING</strong></td>
<td>15</td>
<td>1/3</td>
<td>Dr Dillon Mayhew</td>
</tr>
</tbody>
</table>

Restrictions: MATH 100–199; QUAN 103, 111

This course provides an introduction to or review of fundamental skills and ideas for students who require some mathematics in their degree. Topics will include elementary arithmetic, algebra, geometry, functions, and an introduction to the basic ideas of differential calculus. There will be an emphasis on the history of mathematical ideas and how they have evolved: the goal is not only to apply mathematical tools correctly, but to understand them.

The summer offering of this course (CRN 17286) will run in January and February 2016.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>CRN</th>
<th>Course Title</th>
<th>Points</th>
<th>Credit</th>
<th>Prerequisites</th>
<th>Restrictions</th>
<th>Coordinator</th>
<th>Recommended Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MATH 141</strong></td>
<td>17151</td>
<td><strong>CALCULUS 1A</strong></td>
<td>15</td>
<td>1/3</td>
<td>16 AS credits NCEA Level 3 Mathematics or MATH 132</td>
<td>ENGR 122, MATH 142, QUAN 111</td>
<td>Prof Matt Visser</td>
<td>Anton, H., Bivens, I., and Davis, S., <em>Calculus – Early Transcendentals</em>, 9th or 10th Ed., Wiley, 2009 or later. Older editions of the same book (for instance by Anton alone) are generally satisfactory.</td>
</tr>
</tbody>
</table>

The properties of functions of one variable and their use for modelling continuous phenomena, including ideas and applications of differential and integral calculus.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>CRN</th>
<th>Course Title</th>
<th>Points</th>
<th>Credit</th>
<th>Prerequisites</th>
<th>Coordinator</th>
<th>Recommended Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MATH 142</strong></td>
<td>17160</td>
<td><strong>CALCULUS 1B</strong></td>
<td>15</td>
<td>2/3</td>
<td>MATH 141 or a comparable background in Calculus (see page 100)</td>
<td>Dr Adam Day</td>
<td>Anton, H., Bivens, I., and Davis, S., <em>Calculus – Early Transcendentals</em>, 9th or 10th Ed., Wiley, 2009 or later. Older editions of the same book (for instance by Anton alone) are generally satisfactory.</td>
</tr>
</tbody>
</table>

Further topics in differential and integral calculus, including the Riemann integral, techniques of integration, differential equations, l'Hôpital's Rule, Taylor polynomials, implicit, parametric and polar representation of curves, and functions of two variables and their properties.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>CRN</th>
<th>Course Title</th>
<th>Points</th>
<th>Credit</th>
<th>Prerequisites</th>
<th>Coordinator</th>
<th>Recommended Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MATH 151</strong></td>
<td>17161</td>
<td><strong>ALGEBRA</strong></td>
<td>15</td>
<td>1/3</td>
<td>16 AS credits NCEA Level 3 Mathematics (or equivalent) or MATH 132</td>
<td>Prof Rob Goldblatt</td>
<td>D. Easdown, <em>A First Course in Linear Algebra</em></td>
</tr>
</tbody>
</table>

An introduction to linear algebra, including matrices and vectors, complex numbers, eigenvectors, and algebraic structures.
### MATH 161 CRN 17162 DISCRETE MATHEMATICS AND LOGIC 15 PTS 2/3

**Prerequisites:** 16 AS credits NCEA Level 3 Mathematics (or equivalent) or MATH 132

**Coordinator:** Prof Geoff Whittle

**Recommended reading:** Grimaldi R. P., *Discrete and Combinatorial Mathematics*

Logic underlies all of mathematics. In this course we will introduce the basic notions of logic, and discuss what makes some arguments good (or valid), while other arguments are invalid. This leads to a definition of a mathematical proof, particularly mathematical induction. Other topics include sets, relations, functions, elementary counting principles, properties of divisibility of the integers, and polynomials. The second half of the course introduces the fundamental concepts of graph theory, which is the study of networks.

### MATH 177 CRN 19803 PROBABILITY AND DECISION MODELLING 15 PTS 2/3

**Prerequisites:** 16 AS credits NCEA level 3 Mathematics or Statistics, including AS 3.6 (differentiation, AS91578) and 3.7 (integration, AS91579), or MATH 141 or equivalent background in Mathematics.

**Coordinator:** Dr John Haywood

**Course materials:** A suitable scientific calculator. Course notes from Vic Books, approximately $15.

An introduction to probability models in statistics, decision making and operations research, including key concepts of probability, random variables and their distributions, decision theory and queueing systems. Goodness-of-fit tests are used to check the validity of fitted models.

### ENGR 121 CRN 26052 ENGINEERING MATHEMATICS FOUNDATIONS 15 PTS 1/3

**Prerequisites:** 16 AS credits NCEA level 3 Mathematics or Statistics or MATH 132

**Restrictions:** Any pair (MATH 141 or QUAN 111) and (MATH 151 or 161 or 177)

**Coordinator:** TBA


An introduction to the range of mathematical techniques employed by engineers, including functions and calculus, linear algebra and vector geometry, probability and statistics. There is an emphasis on applications and modelling.
### ENGR 122  CRN 26053  ENGINEERING MATHEMATICS WITH CALCULUS

<table>
<thead>
<tr>
<th>Prerequisites:</th>
<th>ENGR 121 or MATH 141</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restrictions:</td>
<td>The pair MATH 142 and MATH 151</td>
</tr>
<tr>
<td>Coordinator:</td>
<td>Dr Dimitrios Mitsotakis</td>
</tr>
</tbody>
</table>

Further mathematical techniques employed by electronic and computer systems engineers, with emphasis on methods of calculus, differential equations and linear algebra. There is an emphasis on engineering applications and use of software.

### ENGR 123  CRN 27044  ENGINEERING MATHEMATICS WITH LOGIC AND STATISTICS

<table>
<thead>
<tr>
<th>Prerequisites:</th>
<th>ENGR 121</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restrictions:</td>
<td>The pair MATH 161 and (MATH 177 or QUAN 102 or STAT 193)</td>
</tr>
<tr>
<td>Coordinator:</td>
<td>Dr David Balduzzi</td>
</tr>
<tr>
<td>Recommended reading:</td>
<td>TBA</td>
</tr>
</tbody>
</table>

Mathematical techniques employed by network and software engineers, including methods of combinatorics, logic, probability and decision theory. The course emphasises engineering applications of these techniques.
200-LEVEL COURSES

MATH 211  CRN 18322  FOUNDATIONS OF ALGEBRA, ANALYSIS AND TOPOLOGY  15 PTS  1/3

Prerequisites:  MATH 142; MATH 151 or 161
Coordinator:   Dr Alex Usyatsov

An introduction to some fundamental structures and spaces, and their study by the axiomatic method. One half of the course will discuss groups, including permutation groups, groups of matrices, and symmetry groups. The other half will study concepts of continuity and analysis in Euclidean spaces and metric spaces.

MATH 243  CRN 18323  MULTIVARIABLE CALCULUS  15 PTS  2/3

Prerequisites:  MATH 142,151
Coordinator:   Dr Peter Donelan
Recommended reading: Anton, Calculus, in any of its editions (as for MATH 142)

The calculus of vector-valued functions of one variable (curves in the plane and in space), of scalar-valued functions of several variables, and of vector-valued functions of several variables (vector fields); double and triple integrals, line and surface integrals.

MATH 244  CRN 18324  MODELLING WITH DIFFERENTIAL EQUATIONS  15 PTS  1/3

Prerequisites:  (MATH 142, 151) or (ENGR 121, 122)
Coordinator:   Dr David Balduzzi

Types of ordinary differential equations and methods of solution (analytical methods, numerical algorithms, Fourier series, Laplace transforms); boundary-value and initial-value problems; systems of equations; qualitative analysis of solutions; applications.

MATH 251  CRN 18325  LINEAR ALGEBRA  15 PTS  2/3

Prerequisites:  MATH 151
Coordinator:   Prof Geoff Whittle
Recommended reading: Anton H., Elementary Linear Algebra

Fields, vector spaces, linear transformations, eigenvectors, spectral decomposition, quadratic forms.
### MATH 261  CRN 18326  DISCRETE MATHEMATICS 2  15 PTS  1/3

**Prerequisites:** MATH 161  
**Coordinator:** Prof Rod Downey  
**Recommended reading:** Grimaldi R. P., *Discrete and Combinatorial Mathematics*

Enumerative combinatorics (binomial coefficients, the inclusion-exclusion principle, generating functions) and algorithmic graph theory (shortest paths, matchings, flows).

### MATH 277  CRN 19804  MATHEMATICAL STATISTICS  15 PTS  1/3

**Prerequisites:** MATH 142, 151  
**Restrictions:** STAT 231, 233  
**Coordinator:** Dr Yuichi Hirose  
**Laboratories:** Computer laboratory times TBA  
**Course materials:** A suitable scientific calculator

Topics will be chosen from: basic probability theory; introduction to random variables and expectation; joint distributions, correlation and linear combinations of random variables; introductory estimation and hypothesis testing; nonparametric methods; one-way analysis of variance; linear regression; goodness-of-fit tests and contingency tables. The statistical software R will be used.
300-LEVEL COURSES

MATH 301 CRN 3505 DIFFERENTIAL EQUATIONS 15 PTS 2/3
Prerequisites: MATH 243, 244
Recommended: MATH 251
Coordinator: Dr Dimitrios Mitsotakis

Exact solution and qualitative analysis of systems of ordinary differential equations; partial differential equations; applications.

MATH 308 CRN 7527 GEOMETRY 15 PTS 2/3
Prerequisites: MATH 142
Corequisites: MATH 251
Coordinator: Dr Ken Pledger
Text: Either the course notes, Extracts from Euclid, available from the Vic Books (approximately $9), or any edition of Euclid's Elements

The mathematics of shapes, rather than formulae. A broad survey of major ideas in geometry from ancient times up to this century.

MATH 309 CRN 7528 MATHEMATICAL LOGIC 15 PTS 2/3
Prerequisites: One course from (MATH 211, 251, 261)
Coordinator: Dr Adam Day
Recommended reading: Burris, Logic for Mathematics and Computer Science, approximately $90

An introduction to the semantics and proof theory of symbolic languages, explaining the role of logic in describing mathematical structures and formalising reasoning about them. Topics covered include propositional logic; first-order logic of quantifiers and predicates; and the beginnings of model theory, including completeness and compactness theorems.

MATH 311 CRN 9591 ALGEBRA 15 PTS 1/3
Prerequisites: MATH 211 or permission of Head of School
Coordinator: Dr Alex Usvyatsov
Recommended reading: Fraleigh, J.B., A First Course in Abstract Algebra, Addison-Wesley, 2002, approximately $100

The basic algebraic structures, especially groups, rings and fields, with emphasis on general concepts, such as subgroups, homomorphisms, and factorization; some applications.
Mathematics, Statistics and Operations Research

**MATH 312** CRN 9592  REAL AND COMPLEX ANALYSIS  15 PTS  1/3
Prerequisites: MATH 211 or permission of Head of School
Coordinator: Dr Hung Le Pham

An introduction to real analysis and to complex analysis up to the residue theorem.

**MATH 313** CRN 19904  TOPOLOGY  15 PTS  1/3
Prerequisites: MATH 211
Coordinator: Prof Rob Goldblatt

An introduction to topological spaces and their continuous transformations, emphasizing their visual and 'rubber sheet geometry' aspects, and proofs of theorems about them. Topics include the basic concepts of general topology; construction of new spaces from old; and description of special spaces like the torus, Klein bottle, and Möbius band.

**MATH 321** CRN 19910 CRN 19911  APPLIED MATHEMATICS I  15 PTS  1/3
CRN 19740 CRN 19741  APPLIED MATHEMATICS II  15 PTS  2/3
Prerequisites: 30 approved 200-level MATH points, not including MATH 261
Coordinator: Prof Matt Visser

Two topics in applied mathematics, not including any taken by the same candidate in MATH 322 or MATH 323. Topics may include: Cartesian tensors and applications, seismology, classical mechanics, fluid mechanics, meteorology, fractals, quantum mechanics, special relativity.

**MATH 322** CRN 19740 CRN 546  APPLIED MATHEMATICS II  15 PTS  1/3
Prerequisites: 30 approved 200-level MATH points, not including MATH 261
Coordinator: Prof Matt Visser

Two topics in applied mathematics, not including any taken by the same candidate in MATH 321 or MATH 323. Topics may include: Cartesian tensors and applications, seismology, classical mechanics, fluid mechanics, meteorology, fractals, quantum mechanics, special relativity.

**MATH 323** CRN 19741 CRN 8584  MATHEMATICS FOR EARTH SCIENCES  15 PTS  1/3
Prerequisites: 30 approved 200-level MATH points, not including MATH 261
Coordinator: Prof Matt Visser

Two topics in applied mathematics, chosen from the following, and not including any taken by the same candidate in MATH 321 or MATH 322: fluid mechanics, Cartesian tensors and
applications, differential equations for earth sciences, meteorology project, meteorology coursework, fractals, classical mechanics.

**MATH 324  CRN 15668  CODING AND CRYPTOGRAPHY  15 PTS  2/3**

| Prerequisites: | 15 200-level MATH points |
| Coordinator: | Dr Byoung Du Kim |

The main ideas of modern coding theory (finite vector spaces, linear codes, coding bounds, perfect codes, cyclic codes) and cryptography (classical ciphers, the one-time pad, Shannon's Theorem, linear shift registers, public key cryptography, one-way functions, the RSA cryptosystem, key distribution and digital signatures).

**MATH 335  CRN 19902  COMPUTABILITY AND COMPLEXITY  15 PTS  1/3**

| Prerequisites: | 15 points from (MATH 211, 251, 261) |
| Coordinator: | Prof Rod Downey |
| Recommended reading: | *Computability Theory*, Rebecca Weber, AMS Student Mathematical Library, and *Computers and Intractability* by Garey and Johnson |

The basic theory of the algorithmic content of mathematics. Models of computation. Undecidability and computational calibration via reducibilities and hierarchies. Applications (word problems, Conway games, etc.), Basic complexity. NP, SPACE and P. Combinatorial reductions and probabilistic and parametrized complexity.

**MATH 353  CRN 19903  OPTIMISATION  15 PTS  1/3**

| Prerequisites: | MATH 142, 151; 15 points from (MATH 243, 244, 251, 261); 15 further 200-level MATH or OPRE points |
| Restrictions: | OPRE 351 |
| Coordinator: | TBA |

A course in the theory, algorithms and applications of optimisation, including the use of a computer package to formulate, solve and interpret optimisation problems.

**MATH 377  CRN 19805  PROBABILITY AND RANDOM PROCESSES  15 PTS  1/3**

| Prerequisites: | MATH 243; MATH 277 or STAT 232 |
| Restrictions: | STAT 333 |
| Coordinator: | Prof Estate Khmaladze |

The course provides a firmer foundation in probability theory and an introduction to random processes. Introductory topics: continuity of probability measures; Stieltjes integrals; almost sure convergence. Main topics: conditional distributions and effects of conditioning; martingales in discrete time; Poisson point processes; birth and death processes; renewal processes.
PLANNING A PROGRAMME IN STATISTICS

The Statistics major can have a theoretical (mathematical statistics) emphasis, an applied emphasis, or incorporate Operations Research, depending on the courses you take. Example pathways of courses through the Statistics major are provided below.

Note: For students enrolled for the first time in 2010 or earlier, the School offered majors in Applied Statistics and Management Science. Students enrolled for the first time in 2014 or earlier could enrol in the Operations Research major. These majors have all now been replaced by the single Statistics major. Students enrolled in 2014 or earlier who intended completing a major in Applied Statistics, Management Science or Operations Research should see the Programme Director for advice on completing their desired major.

The requirements for a major in Statistics are:

- 30 points from MATH 100–199 and STAT 100–199
- either STAT 292 or MATH 277, 15 further 200-level points from MATH or STAT, and 30 further 200–level points from the Science Schedule or other approved courses
- 30 points from STAT 300–399, and 30 further points from MATH 300–399, STAT 300–399, or OPRE 300–399, provided that 15 points may be replaced by an approved 300-level course from another subject.

Note: These requirements are minimal rules to help guide your course selection. To ensure a sensible degree structure, starting in your first year, you need to consider prerequisites for all 200- and 300-level courses. If necessary, see a member of academic staff for advice on planning your degree.

PLANNING A FIRST YEAR PROGRAMME

Although it is not explicitly stated in the majoring requirements, all students should include either (or both) of MATH 177 or STAT 193 in their first year programme:

- MATH 177 is needed for a major in Statistics (with a Mathematical Statistics or Operations Research emphasis) and for a major in Actuarial Science.
- STAT 193 is highly recommended for a major in Statistics (with an Applied Statistics emphasis).
- MATH 177 and STAT 193 can be successfully combined.

MATH 177 (Probability and Decision Modelling) is intended mainly for students following through to higher level Mathematical Statistics, Actuarial Science, Operations Research, Mathematics, Physics, Geophysics, Engineering or Computer Science, or those intending to study other quantitative disciplines.

MATH 177 is for students with at least 16 Level 3 AS credits in mathematics or statistics including achievement standards 3.6 (differentiation, AS91578) and 3.7 (integration, AS91579), or equivalent qualifications. Otherwise students are advised to take STAT 193.
Students need to take MATH 142 and MATH 151 to proceed to some of the second year STAT and OPRE courses. See page 10 for more details on Mathematics entry requirements.

STAT 193 (Statistics for the Natural and Social Sciences) gives a suitable basis for students following through to higher-level applied statistics. It also provides a suitable statistical background for students majoring in the natural and social sciences, especially Psychology, Ecology and Biodiversity and Marine Biology or those who plan a career in social policy formulation. *Preferred entry level: at least Year 12 Mathematics.*

The Student Learning Support Service offers workshops during the year for students with a limited mathematical background. The Science Faculty provides Whanau Support tutorials for Māori and Pacific students and equity help sessions for Science, Engineering and Architecture and Design students relating to MATH 177 and STAT 193—contact Liz Richardson, Deputy Dean (Equity), liz.richardson@vuw.ac.nz

**SECOND AND THIRD YEAR**

Example pathways are shown below for MATH, STAT and OPRE courses that students can take during and after their first year as part of the Statistics major.

**Note:** Please see a member of the academic staff for advice if you have questions about planning your degree.

**Statistics with a Mathematical Statistics emphasis**

<table>
<thead>
<tr>
<th>Year</th>
<th>Trimester 1</th>
<th>Trimester 2</th>
</tr>
</thead>
</table>
| Year 1 | MATH 141: Calculus 1A  
MATH 151: Algebra | MATH 142: Calculus 1B  
MATH 177: Probability and Decision Modelling |
|        | + 60 further points | |
| Year 2 | MATH 277: Mathematical Statistics | MATH 243: Multivariable Calculus  
MATH 251: Linear Algebra |
|        | + 15 further 200-level points from the Science Schedule or other approved courses  
+ 60 further points | |
| Year 3 | MATH 377: Probability and Random Processes | STAT 332: Statistical Inference  
STAT 393: Linear Models  
STAT 394: Multivariate Statistics |
|        | + 60 further points | |
### Statistics with an Applied Statistics emphasis

<table>
<thead>
<tr>
<th>Year</th>
<th>Trimester 1</th>
<th>Trimester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MATH 132: Introduction to Mathematical Thinking</td>
<td>STAT 193: Statistics for the Natural and Social Sciences</td>
</tr>
<tr>
<td></td>
<td>+ 90 further points</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ 30 further 200-level points from the Science Schedule or other approved courses</td>
<td>+ 60 further points</td>
</tr>
<tr>
<td>3</td>
<td>STAT 391: Mathematical Methods for Applied Statistics</td>
<td>STAT 393: Linear Models</td>
</tr>
<tr>
<td></td>
<td>STAT 392: Sample Surveys</td>
<td>STAT 394: Multivariate Statistics</td>
</tr>
<tr>
<td></td>
<td>+ 60 further points</td>
<td></td>
</tr>
</tbody>
</table>

### Statistics with an Operations Research emphasis

<table>
<thead>
<tr>
<th>Year</th>
<th>Trimester 1</th>
<th>Trimester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MATH 141: Calculus 1A</td>
<td>MATH 142: Calculus 1B</td>
</tr>
<tr>
<td></td>
<td>MATH 151: Algebra</td>
<td>MATH 177: Probability and Decision Modelling</td>
</tr>
<tr>
<td></td>
<td>COMP 102: Introduction to Computer Program Design</td>
<td></td>
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<tr>
<td></td>
<td>+ 45 further points</td>
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</tr>
<tr>
<td>2</td>
<td>OPRE 253: Operations Research</td>
<td>MATH 243: Multivariable Calculus</td>
</tr>
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<td></td>
<td>MATH 277: Mathematical Statistics</td>
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<td></td>
<td>+ 15 further 200-level points from the Science Schedule or other approved courses</td>
<td>+ 60 further points</td>
</tr>
<tr>
<td>3</td>
<td>MATH 353: Optimization</td>
<td>STAT 393: Linear Models</td>
</tr>
<tr>
<td></td>
<td>OPRE 354: Simulation and Stochastic Models</td>
<td>STAT 394: Multivariate Statistics</td>
</tr>
<tr>
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<td>+ 60 further points</td>
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</tr>
</tbody>
</table>

See pages 19–23 and 29–33 for prerequisites for each of the 200 and 300-level MATH, STAT and OPRE courses.
SUMMARY OF STATISTICS COURSES

Computing Facilities

Calculators are required in all STAT and OPRE courses. The undergraduate courses at 200 and 300-level in Statistics and Operations Research make use of statistical and other computer packages such as R, SAS, Python and SimPy. The Operations Research courses also use special-purpose optimisation packages.
100-LEVEL COURSES

See page 10 for more detailed entry requirements for these courses.

MATH 177  CRN 19803  PROBABILITY AND  DECISION MODELLING  15 PTS  2/3

Prerequisites:  16 credits NCEA level 3 Mathematics or Statistics, including AS 3.6 (differentiation, AS91578) and 3.7 (integration, AS91579), or MATH 141

Coordinator:  Dr John Haywood

Course materials:  A suitable scientific calculator. Course notes, from Vic Books, approximately $15

An introduction to probability models in statistics, decision making and operations research, including key concepts of probability, random variables and their distributions, decision theory and queueing systems. Goodness-of-fit tests are used to check the validity of fitted models.

STAT 193  CRN 193 (SEE STREAMS)  STATISTICS FOR THE NATURAL  AND SOCIAL SCIENCES  15 PTS  1/3

(SEE STREAMS)  MATH 277, QUAN 102

Coordinator:  Dr Richard Arnold

Lecturers:  Dr Yuichi Hirose, Dr Ivy (I-Ming) Liu, Dr Nokuthaba Sibanda

Streams:  1/3: Stream A (CRN 1791)

                     Stream B (CRN 11333)

2/3: Stream A (CRN 4442)

                     Stream B (CRN 6164)

Tutorials:  1 hour per week, TBA, including one Tagata Pasifika tutorial for Māori and Pacific students.

10 hours per week of help sessions (at times to be advised) will be available for individual assistance.

Assignments:  An alternation of ordinary and practical data assignments

Course materials:  An approved graphics calculator is required—the Casio fx-9750Gii is recommended (approximately $130)


An applied statistics course for students who will be advancing in other disciplines as well as those majoring in Statistics. It is particularly suitable for students majoring in Biological Science subjects, Geography, Linguistics, Psychology, social sciences such as Education, and is also suitable for BCom students. This course assumes no previous knowledge of statistics, but mathematics to Year 12 is preferred.

Topics covered include estimation, confidence intervals and hypothesis testing, comparison of means and proportions, simple regression and correlation, and analysis of variance.
200-LEVEL COURSES

MATH 277  CRN 19804  MATHEMATICAL STATISTICS  15 PTS  1/3
Prerequisites:  MATH 142, 151
Restrictions:  STAT 231, 233
Coordinator:  Dr Yuichi Hirose
Tutorials:  One of the four lecture times will be used for a tutorial
Laboratories:  Computer laboratory times TBA
Course materials:  A suitable scientific calculator

Topics will be chosen from: basic probability theory; introduction to random variables and expectation; joint distributions, correlation and linear combinations of random variables; introductory estimation and hypothesis testing; nonparametric methods; one-way analysis of variance; linear regression; goodness of fit tests and contingency tables. The statistical software R will be used.

OPRE 253  CRN 18328  OPERATIONS RESEARCH  15 PTS  1/3
Prerequisites:  One course from (MATH 141, 142, 151, 161, 177) or a comparable background in Mathematics
Restrictions:  OPRE 251
Coordinator:  TBA
Tutorials:  One of the four lecture times will be used for a tutorial
Laboratories:  Computer laboratory times TBA
Course materials:  A suitable scientific calculator

Operations research is decision-making, based on the formulation, analysis and optimisation of decision models. Topics will be chosen from: decision making under uncertainty, utility theory, game theory, inventory models, forecasting, project management, network models, linear, integer, dynamic and stochastic programming and modelling of optimisation problems. A computer package will be used. No previous computer programming experience is required.
### STAT 292 CRN 18331 APPLIED STATISTICS 2A 15 PTS 1/3

<table>
<thead>
<tr>
<th>Prerequisites:</th>
<th>STAT 193 or a comparable background in Statistics</th>
</tr>
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<tbody>
<tr>
<td>Restrictions:</td>
<td>STAT 291</td>
</tr>
<tr>
<td>Coordinator:</td>
<td>Dr Ivy (I-Ming) Liu</td>
</tr>
<tr>
<td>Tutorials:</td>
<td>1 hour per week, TBA</td>
</tr>
<tr>
<td>Laboratories:</td>
<td>Students choose their times for computing, 1–3 hours per week</td>
</tr>
<tr>
<td>Course materials:</td>
<td>STAT 292 Lecture Notes 2015 from Vic Books, approximately $30. An approved graphics calculator is required—the Casio fx-9750Gii is recommended (approximately $130).</td>
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</table>

This course is central to the Applied Statistics stream. Topics are statistical methods and their application in the biological, environmental, health and social sciences, including non-parametric tests, design of experiments, one-way and multi-way ANOVA and t-tests for difference of means, regression, analysis of covariance, binomial and Poisson distributions, two-way contingency tables, models for binary response variables, and log-linear models for two-way contingency tables. Examples from the biological, environmental, health, behavioural and social sciences are used for illustration, using the statistical computing package SAS Enterprise Guide. No previous experience with computers is assumed.

### STAT 293 CRN 18332 APPLIED STATISTICS 2B 15 PTS 2/3

<table>
<thead>
<tr>
<th>Prerequisites:</th>
<th>STAT 292</th>
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</thead>
<tbody>
<tr>
<td>Restrictions:</td>
<td>STAT 291</td>
</tr>
<tr>
<td>Coordinator:</td>
<td>Dr Nokuthaba Sibanda</td>
</tr>
<tr>
<td>Tutorials:</td>
<td>1 hour per week, TBA</td>
</tr>
<tr>
<td>Laboratories:</td>
<td>Students choose their times for computing, 1–2 hours per week</td>
</tr>
<tr>
<td>Course materials:</td>
<td>An approved graphics calculator is required—the Casio fx-9750Gii is recommended (approximately $130).</td>
</tr>
</tbody>
</table>

This course presents further topics in ANOVA and regression with examples in the biological, environmental, health and social sciences. Topics will be selected from algebra of expectations and variances, one-way ANOVA theory, randomised block designs, nested designs, multiple linear regression, data exploration, introduction to likelihood, use of AIC for model comparisons in exploratory studies, Poisson regression models. Illustrative examples use the statistical software R. No previous experience with R is assumed.
300-LEVEL COURSES

MATH 353  CRN19903  OPTIMISATION  15 PTS  1/3
Prerequisites: MATH 142, 151; 15 points from (MATH 243, 244, 251, 261); 15 further 200-level MATH or OPRE points
Restrictions OPRE 351
Coordinator: TBA
Tutorials: One of the four lecture times will be used for a tutorial
Course materials: A suitable scientific calculator

A course in the theory, algorithms and applications of optimisation, including the use of a computer package to formulate, solve and interpret optimisation problems.

MATH 377  CRN 19805  PROBABILITY AND RANDOM PROCESSES  15 PTS  1/3
Prerequisites: MATH 243; MATH 277 or STAT 232
Restrictions: STAT 333
Coordinator: Professor Estate Khmaladze
Tutorials: One of the three lecture times will be used for a tutorial

The course provides a firmer foundation in probability theory and an introduction to random processes. Introductory topics: continuity of probability measures; Stieltjes integrals; almost sure convergence. Main topics: conditional distributions and effects of conditioning; martingales in discrete time; Poisson point processes; birth and death processes; renewal processes.

OPRE 354  CRN 19806  SIMULATION AND STOCHASTIC MODELS  15 PTS  1/3
Prerequisites: COMP 102 or 112, one course from (MATH 177, 277, STAT 232, 292); 15 further 200-level COMP, MATH, NWEN, OPRE or SWEN points
Double-labelled: COMP 312
Restrictions: OPRE 352
Coordinator: A/Prof Stefanka Chukova

Simulation and modelling of stochastic systems, covering examples from operations research and computer science, including queues, networks and computer systems. Design, analysis and validation of simulation experiments. Previous experience with computer programming is required before starting this course. This course is co-taught with COMP 312.
STAT 332 CRN 19809  STATISTICAL INFERENC E  15 PTS  2/3
Prerequisites: MATH 243, 277
Restrictions: STAT 331
Coordinator: Dr Petros Hadjicostas
Tutorials: One of the three lecture times will be used for a tutorial

This course covers distribution theory; estimation including minimum variance unbiased estimators and sufficiency; hypothesis testing and an introduction to order statistics. The topics of estimation and hypothesis testing met in MATH 277 will be looked at in greater depth. Optimal estimation procedures and tests will be developed.

STAT 335 CRN 27136  STATISTICAL MODELS FOR ACTUARIAL SCIENCE  15 PTS  1/3
Prerequisites: MATH 277
Coordinator: Dr Yuichi Hirose
Tutorials: One of the three lecture times will be used for a tutorial

This course introduces a range of models used in actuarial science, including Markov chains, Markov processes and transition, survival models and estimation with graduation methods and binomial models for mortality.

STAT 391 CRN 19810  MATHEMATICAL METHODS FOR APPLIED STATISTICS  15 PTS  1/3
Prerequisites: STAT 292
Restrictions: MATH 243, the pair (ENGR 122/MATH 142, 251)
Coordinator: Dr Petros Hadjicostas
Tutorials: One of the three lecture times will be used for a tutorial

This course covers key mathematical methods used in the construction and maximisation of likelihoods, analyses of experimental data and general linear models, and exploration of probability distributions. Topics will include differentiation and optimisation of functions, matrices and their properties, probability distributions and integration. The statistical software R will be used.

STAT 392 CRN 3048  SAMPLE SURVEYS  15 PTS  1/3
Prerequisites: STAT 193 (or equivalent), 30 approved points from 201-399
Restrictions: APST 439, STAT 439
Coordinator: Dr Richard Arnold
Tutorials: One of the three lecture times will be used for a tutorial
Recommended reading: Sharon L. Lohr, *Sampling: Design and Analysis*; Robert Groves et al, *Survey Methodology*

An introduction to practical aspects of survey sampling, including writing a survey proposal, costing, non-sampling errors, rudiments of sampling theory, questionnaire design, fieldwork, basic analytic techniques, and report writing. This course is co-taught with STAT 439.
### STAT 393 CRN 19811 LINEAR MODELS 15 PTS 2/3

**Prerequisites:** (MATH 243; MATH 277 or STAT 233) or (STAT 293, 391)

**Restrictions:** STAT 331

**Coordinator:** Dr Ivy (I-Ming) Liu

**Tutorials:** One of the three lecture times will be used for a tutorial.

**Recommended reading:**

This course will cover general linear models: theory and applications, including maximum likelihood estimation, model selection, AIC, tests of hypotheses, confidence intervals, and residual diagnostics. It includes longitudinal analysis for continuous responses using fixed or random effects methods. The course covers the theory of generalised linear models and gives examples for binary and count data. The statistical software R will be used.

### STAT 394 CRN 19808 MULTIVARIATE STATISTICS 15 PTS 2/3

**Prerequisites:** MATH 277 or STAT 233 or (STAT 292, 391)

**Restrictions:** STAT 338

**Coordinator:** Dr John Haywood

**Tutorials:** One of the three lecture times will be used for a tutorial

General concepts and various practical analysis techniques are introduced for multivariate data. Topics will be chosen from: principal component analysis, cluster analysis, factor analysis, discriminant analysis, canonical correlations, the multivariate general linear model and multidimensional scaling. The statistical software SAS Enterprise Guide will be used to apply the techniques to multivariate data.
ACTUARIAL SCIENCE

Subject to approval, the Actuarial Science major will be offered from 2015.

The role of an actuary is to quantify risk and uncertainty to help businesses manage those risks. Actuaries are employed by banks, insurance companies, investment firms and other companies. They give advice on insurance, pension schemes, company mergers, the management of financial projects and investments.

The Actuarial Science major introduces students to the technical and professional aspects of actuarial science and may enable students to gain accreditation towards qualifying as an actuary with one of the internationally recognised actuarial institutes.

Following a BSc, the major may lead to BCom (Hons) in Economics or Finance or BSc (Hons) in Mathematics or Statistics and Operations Research.

Graduates will be qualified to work in the fields of actuarial work, risk management, financial and statistical analysis.

The requirements for a major in Actuarial Science are:

- ACCY 111, ECON 130, 141, MATH 142, 151, 177
- ECON 201, FINA 201, FINA 202, MATH 277
- ACTS 301, (FINA 306 or 307), STAT 335; one further course from (ECON 301, 314, 339, FINA 305, 306, 307, MATH 377, STAT 332, 393).

School contact: Dr Richard Arnold richard.arnold@vuw.ac.nz 04-463 5668
Faculty contact: Shona de Sain, Associate Dean (Academic) shona.desain@vuw.ac.nz 04-463 5092
PLANNING A DEGREE IN ACTUARIAL SCIENCE:

<table>
<thead>
<tr>
<th>Trimester 1</th>
<th>Trimester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 1</strong></td>
<td></td>
</tr>
<tr>
<td>ACCY 111: Accounting</td>
<td>ECON 141: Macroeconomic Principles</td>
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<tr>
<td>ECON 130: Microeconomic Principles</td>
<td>MATH 142: Calculus 1B</td>
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<td>MATH 177: Probability and Decision Modelling</td>
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<tr>
<td>ECON 201: Intermediate Microeconomics</td>
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<tr>
<td>FINA 201: Introduction to Corporate Finance</td>
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<tr>
<td>MATH 277: Mathematical Statistics</td>
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<table>
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<th>Year 3</th>
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<tr>
<td><strong>Year 2</strong></td>
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<tr>
<td>ECON 201: Intermediate Microeconomics</td>
<td>MATH 377: Probability and Random Processes</td>
</tr>
<tr>
<td>FINA 201: Introduction to Corporate Finance</td>
<td>STAT 335: Statistical Models for Actuarial Science</td>
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<tr>
<td>MATH 277: Mathematical Statistics</td>
<td>ACTS 301: Actuarial Science</td>
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<td>FINA 307: Risk Management and Insurance</td>
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<td>STAT 332: Statistical Inference</td>
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<td>+ 45 further points</td>
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</table>

**STAT 335** | **CRN 27136** | **STATISTICAL MODELS FOR ACTUARIAL SCIENCE** | 15 PTS | 1/3 |
---|---|---|---|---|
Prerequisites: | MATH 277 |
Coordinator: | Dr Yuichi Hirose |
Tutorials: | One of the three lecture times will be used for a tutorial |

This course introduces a range of models used in actuarial science, including Markov chains, Markov processes and transition, survival models and estimation with graduation methods and binomial models for mortality.

**ACTS 301** | **CRN 27135** | **ACTUARIAL SCIENCE** | 15 PTS | 2/3 |
---|---|---|---|---|
Prerequisites: | ECON 201, FINA 201, MATH 277 |
Coordinator: | TBA |
Tutorials: | One of the three lecture times will be used for a tutorial |

This is a capstone course for the Actuarial Science major that brings together skills and knowledge from prior courses to develop an understanding of their practical application in the actuarial profession. It provides grounding in the mathematical techniques that can be used to model risks and contingencies.
ENVIROMENTAL SCIENCE

Environmental Science is a science major which may be taken only in conjunction with another approved science major. It is for students wishing to acquire the mathematical and scientific background necessary to become environmental scientists.

A BSc graduate in ENSC will have the following attributes:

- a broad understanding of the general principles of environmental science across a range of sciences
- expertise about how their other major links with and is informed by Environmental Science
- an ability to analyse critically and understand environmental issues; a capability of working in teams and preparing information for a wide range of audiences
- an ability to undertake basic research in an area of Environmental Science
- an ability to contribute to the analysis of an issue in Environmental Science.

The ENSC major is overseen from the School of Geography, Environment and Earth Sciences and requires the following:

- must be linked to a partner Science Major from Biological (BIOL, BMAR, EBIO), Physical (CHEM, APHS, PHYS), Mathematical (MATH, OPRE, STAT) or Earth Sciences (GEOG, GEOL, GPHS, PHYG)
- a 300-level independent research project (ENSC 302 or 303)
- a 300-level modular course (ENSC 301) on a variety of environmental science topics that will allow students to link in the partner major to an environment science context.

Specific major requirements are:

- STAT 193, 15 points from MATH courses and 30 further points from 100-level BIOL, CHEM, PHYS, GEOG, ESCI, MATH, STAT
- ENVI 214, *40 points at 200-level from an approved list of courses not required by the partner major
- ENSC 301, (302 or 303) and further approved 300-level courses to achieve at least 60 points.

*Note: with approval, up to 30 points may be shared at 200-level with the partner major.

School contact: Dr Richard Arnold Richard.arnold@vuw.ac.nz 04-463 5668
Faculty contact: Shona de Sain, Associate Dean (Academic) shona.desain@vuw.ac.nz 04-463 5092
<table>
<thead>
<tr>
<th>Course Code</th>
<th>CRN</th>
<th>Course Title</th>
<th>Points</th>
<th>Workload</th>
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<tbody>
<tr>
<td>ENSC 301</td>
<td>18345</td>
<td>Topics in Environmental Science</td>
<td>20</td>
<td>1/3</td>
</tr>
</tbody>
</table>

**Prerequisites:**
90 points of 200-level study in approved subjects from the science schedule

**Corequisites:**
ENSC 302 or 303 and admission to the major in environmental science

**Workload:**
The workload should average 16 hours per week in total of which up to 7 hours will be scheduled lectures, tutorials or labs

**Coordinator:**
Dr John Collen, SGEES

**Text:**
Material will be provided during the course

The aim of this course is to enable students to integrate their primary science discipline into an environmental framework in order to discuss, analyse and apply a range of concepts important in environmental science. This is done through a lecture course taught by experts from across the faculty and external organisations and covers a range of subjects including energy use and supply (including nuclear energy), the physics of climate change, resource use including natural waters, pollution and environmental management. The tutorial, seminar and lab content compliments the lectures and links them to the student’s primary science major, and allows the introduction of other relevant material.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>CRN</th>
<th>Course Title</th>
<th>Points</th>
<th>Workload</th>
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<tbody>
<tr>
<td>ENSC 302/303</td>
<td>18346/18347</td>
<td>Directed Individual Study</td>
<td>20/15</td>
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</table>

**Prerequisites:**
Permission of Head of School

**Workload:**
The workload should average 16/13 hours per week in total

**Coordinator:**
Dr John Collen, SGEES

Students will pursue a programme of individual research focused on an aspect of environmental science and agreed with the course coordinator.
### For MATH major with ENSC major

<table>
<thead>
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<th>Year 1</th>
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<th>Year 3</th>
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<td>OPRE 253</td>
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### For STAT major with ENSC major

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<th>Points</th>
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<td>MATH 243</td>
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<td>STAT 332</td>
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<td>ENSC 303</td>
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<td><strong>Points</strong></td>
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</tbody>
</table>
SCIENCE IN CONTEXT

Enhance your degree with a minor in Science in Context

A minor in Science in Context requires SCIE 311 plus 45 points from SCIE 201, 211, 302, 310, ESCI 201, CREW 352 or other approved points (e.g. MAOR 317 or PHIL 318) above 100-level.

Science in Context interdisciplinary courses explore the relationships between science and technology, scientists and society, the history and philosophy of science, and the communication of scientific ideas and issues to different audiences and through a range of media. These courses provide science students with a broader perspective on their discipline and provide non-science students with an introduction to scientific concepts and issues. Most courses are fully online and feature pre-recorded lectures and online discussion forums, allowing students to work at their own pace, and from wherever they want. For more information please contact Rhian Salmon (rhian.salon@vuw.ac.nz) or Rebecca Priestley (rebecca.priestley@vuw.ac.nz).

SCIE 101 CRN 15470 17043 SPECIAL TOPIC: SCIENCE IN EVERYDAY LIFE 15 PTS 2/3
Assessment: Online quizzes 60%, short written assignments and blogs 40%
Coordinator: Dr Rebecca Priestley

This fully online course examines the science that is part of everyday life. Students will gain an understanding in a broad range of contemporary scientific concepts relevant to everyday life. This course will integrate social, cultural and historical perspectives around the scientific concepts presented in this course.

SCIE 201 CRN 25133 SPECIAL TOPIC: ENERGY, SOCIETY AND THE FUTURE 15 PTS 2/3
Prerequisite: 60 points
Assessment: Online quizzes and short assignments 55%, blog posts 25%, essay 20%
Coordinator: Dr Rebecca Priestley

This fully online course overviews different energy sources, past, present (including thermal, gravity and fluid, and solar) and future and examines associated scientific, environmental and social issues. On completion, students will be able to assess energy-related issues and arguments with reference to sound scientific and historical information.

SCIE 211 CRN 25172 (SEE STREAMS) CONTEMPORARY ISSUES IN SCIENCE AND SOCIETY 15 PTS 3/3
Prerequisite: 60 points
Restrictions: SCIE 201 in 2011–12
Streams: Stream A (CRN 25172) 5 January 2015–22 February 2015
Stream B (CRN 26250) 17 November 2014–22 February 2015
Assessment: Online quizzes and short assignments 50%, blog posts 25%, essay 20%, library 5%
Coordinator: Dr Rhian Salmon

This **fully online** course provides an introduction to a range of contemporary science research areas and examines associated scientific and social issues. Modules include philosophy of science, nature’s patterns and ingredients, climate change, genes and gene therapy, and the psychology of everyday life.

<table>
<thead>
<tr>
<th>SCIE 310</th>
<th>CRN 26078</th>
<th>INNOVATION AND ENTREPRENEURSHIP IN SCIENCE</th>
<th>20 PTS</th>
<th>2/3</th>
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<tbody>
<tr>
<td>Prerequisite:</td>
<td>60 points of science above 100-level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment:</td>
<td>Course logs 36%, case study report 24%, final examination 40%</td>
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<td></td>
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<tr>
<td>Coordinator:</td>
<td>A/Prof Paul Teesdale-Spittle</td>
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</table>

This **classroom-based** course covers the generic processes in the development of a technology or technological products and connects scientific and technological perspectives with business perspectives such as economic analysis, entrepreneurship, project management, marketing and an introduction to tools for business planning. The course incorporates lectures, workshops and tutorials.

<table>
<thead>
<tr>
<th>SCIE 311</th>
<th>CRN 26112</th>
<th>SCIENCE COMMUNICATION</th>
<th>15 PTS</th>
<th>2/3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite:</td>
<td>60 points including at least 30 science points above 100-level or approval of the course coordinator</td>
<td></td>
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<tr>
<td>Assessment:</td>
<td>In-class tests 30%, two pieces of science communication 50%, reflective contribution 20%</td>
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<tr>
<td>Coordinators:</td>
<td>Dr Rhian Salmon and Dr Rebecca Priestley</td>
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This **classroom-based** course covers theoretical and practical aspects of science communication. In the theoretical strand, students will learn about the purpose of science communication and the different audiences for science communication, and will assess and evaluate different forms of science communication, with an emphasis on the written form. In the practical strand, students will develop their own science communication skills through a range of exercises involving communicating to different audiences and using different media.

<table>
<thead>
<tr>
<th>SCIE 312</th>
<th>CRN 27046</th>
<th>REVOLUTIONS IN SCIENCE</th>
<th>15 PTS</th>
<th>1/3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite:</td>
<td>60 points of 200-level study</td>
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<tr>
<td>Restriction:</td>
<td>SCIE 302 in 2013–14</td>
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<tr>
<td>Assessment:</td>
<td>Online quizzes and short assignments 40%, blog posts 10%, essays 50%</td>
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<tr>
<td>Coordinator:</td>
<td>Dr Rebecca Priestley</td>
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</table>

This course reviews major theories in science history, from classical Greek science to the European enlightenment to 20th century revolutions in physics, biology and earth sciences including New Zealand science history. On completion, students will be able to put current scientific events, and their own academic or professional field, in historical context.
GENERAL INFORMATION

Students are encouraged to visit www.victoria.ac.nz for current information.

CLASS FORMATS

Lectures: Each course usually includes weekly lectures at which new material is presented. Lectures starting before 1pm start on the hour and last 50 minutes or 1 hour 50 minutes; lectures from 1pm start 10 minutes after the hour and finish on the hour.

Tutorials: These generally last 50 minutes and involve small groups of students meeting with a staff member or graduate student tutor. Tutorials provide the opportunity to discuss course content, course work and readings, to exchange ideas and become acquainted with other course members.

Field trips: Field trips may constitute one entire course or be only a part of it and visit a variety of locations and sites. Extra costs are normally included in the course materials fee. However, students may have to contribute towards the costs for some trips.

Laboratory sessions: Many courses in science have laboratory sessions. Laboratory session information can be found at www.victoria.ac.nz/timetables and will also be provided to students at the start of the trimester.

COMPUTER USE

All enrolled students receive a computer username and password (details are printed on Confirmation of Study forms), and an email address which is used for all official electronic correspondence from the University. Students may redirect their student email to another email address if preferred.

ITS-Student provides all enrolled students with access to electronic resources that support communication, learning and research needs. Most resources are accessible on- and off-campus using www.my.victoria.ac.nz, the student portal. The website provides secure access to:

- student email
- Workspace (an allocated space quote for storage of personal files)
- Blackboard (online teaching and learning tool)
- Student Records Library Catalogue and Databases.

COURSE INFORMATION

Course readings: Textbooks may either be bought from Vic Books or from other bookshops. Student notes (otherwise known as course materials) are available from Vic Books and are sold at both the Kelburn and Pipitea stores.

A second-hand book sale is held by VUWSA in the first week of March. Second-hand books may be bought and sold through www.vicbooks.co.nz/secondhand-textbooks

Course outlines: At the beginning of each course, students receive a course outline. This contains information about the course including the number of class meetings, their types and
times, booklists, assignments, tests and examinations and mandatory course requirements (minimum class work in order to complete the course).

EXAMS

Students enrolled in courses with a final examination are expected to be available to sit their exams during the relevant examination period. Examination timetables are normally published after the mid-term break and can be viewed at www.victoria.ac.nz/timetables

LIBRARY SERVICES FOR SCIENCE

The library supports the learning and research needs of students at all levels in the Faculty of Science. Services offered by the library can be accessed via their website at http://library.victoria.ac.nz/library-v2/

PRIZES AND SCHOLARSHIPS

Information about prizes and scholarships available to students studying at Victoria is available at www.victoria.ac.nz/study/student-finance/scholarships

Āwhina also offers scholarships to Māori and Pasifika students for postgraduate study. See www.victoria.ac.nz/science/awhina

SUMMER SCHOLARS SCHEME

Summer Research Scholarships offer a unique opportunity for students to gain experience in research and get an insight into what studying for a research degree entails. Each scholarship gives a student the experience of working with established researchers on a specified project.

Students are expected to conduct a research project of approximately 10 weeks duration (400 hours) under the supervision of an academic staff member or a research team.

Students interested in applying for a Summer Research Scholarship should contact margot.neas@vuw.ac.nz for further information.

VICTORIA UNIVERSITY OF WELLINGTON CALENDAR

The Victoria University Calendar contains the official statutes which govern degrees and courses. It can be viewed at www.victoria.ac.nz/about/publications/calendar

VICTORIA ABROAD

Victoria Abroad is a student exchange programme offering students the opportunity to broaden their horizons while studying towards their Victoria University degree at one of 100 partner universities around the world.

If you are interested in applying for Victoria Abroad you must:
- complete a year of full-time study by the date of your intended departure
- achieve a B average overall in your studies at Victoria
- demonstrate that you would be a good ambassador for Victoria.

Information on how to apply, who to contact, timelines and exchange partners is available at www.victoria.ac.nz/exchange
WHO TO CONTACT

Victoria University offers a range of services that covers all student-related matters from applications/enrolment to graduation.

STUDENT AND ACADEMIC SERVICES—FACULTY OF SCIENCE

Te Wāhanga Pūtaiao
Address: Level 1, Cotton Building
Phone: 04-463 5101
Email: science-faculty@vuw.ac.nz
Web: www.victoria.ac.nz/science
Hours: 8.30am–5pm Monday, Wednesday, Thursday, Friday
9.30am–5pm Tuesday

At the Faculty of Science Student Administration Office, student advisers can help with admission requirements, degree planning, changing courses and transfer of credit from other tertiary institutions. They also deal with other aspects of student administration such as enrolment, exams organisation and the maintenance of student records.

<table>
<thead>
<tr>
<th>Area</th>
<th>Student Advisor</th>
<th>Email</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>UG</td>
<td>Nique Nacu</td>
<td><a href="mailto:nique.nacu@vuw.ac.nz">nique.nacu@vuw.ac.nz</a></td>
<td>04-463 5101</td>
</tr>
<tr>
<td>UG</td>
<td>Annemarie Thorby</td>
<td><a href="mailto:annemarie.thorby@vuw.ac.nz">annemarie.thorby@vuw.ac.nz</a></td>
<td>04-463 5983</td>
</tr>
<tr>
<td>UG</td>
<td>Cristina Sebold</td>
<td><a href="mailto:cristina.sebold@vuw.ac.nz">cristina.sebold@vuw.ac.nz</a></td>
<td>04-463 5981</td>
</tr>
</tbody>
</table>

Johan Barnard  Manager, Student and Academic Services  04-463 5980
Shona de Sain   Associate Dean (Academic)  04-463 5092

TE RŌPŪ ĀWHINA

Address: Cotton Building, Kelburn Parade, Room 148,
Phone: 04-463 5987
Email: teropuawhina@gmail.com
Web: www.victoria.ac.nz/science/awhina

Te Rōpū Āwhina whānau in the Faculties of Science, Engineering and Architecture and Design at Victoria University was established in 1999. Āwhina is about people and collective success. The kaupapa of Āwhina is to produce Māori and Pacific science, engineering, architecture and design professionals to contribute to Māori and Pacific community and leadership development. Anyone who assists the building of Āwhina is part of the whānau.
STUDENT SUPPORT SERVICES

ACCOMMODATION SERVICE
Advice on our Halls of Residence, renting and other accommodation options.
www.victoria.ac.nz/accommodation

CAMPUS CARE
24/7 campus security.
0800 VIC 8888 (if calling from outside University)
8888 (if calling from within University)

CAREER DEVELOPMENT AND EMPLOYMENT
Vic Careers—find out what you need to know to get a job, what career options are open to you and what your ideal future might look like.
www.victoria.ac.nz/careers

CAREER HUB
24/7 access to part time jobs, graduate jobs, contract work, tutoring positions, internships, work experience opportunities and a CV building tool. Use your student computing account to log in.
www.victoria.ac.nz/careerhub

COUNSELLING SERVICE
Professional, confidential counselling available at all campuses for any issue that is impacting on your personal or academic success.
www.victoria.ac.nz/counselling

DISABILITY SERVICES
If you have a temporary or ongoing impairment you can access coaching and advice, liaison with academic staff, adaptive equipment, technology and training, sign language interpreting, note-taking assistance, mobility parking, ergonomic furniture and access to rest and study rooms.
www.victoria.ac.nz/disability

EARLY CHILDHOOD SERVICES
Victoria Kids has been providing excellent childcare for families for more than 30 years and offer a range of childcare options to suit your needs.
www.victoriakids.co.nz

ENROLMENT OFFICE
If you are a prospective student, you can get information, advice and support with enrolment.
www.victoria.ac.nz/2015

If you are a current student go to www.victoria.ac.nz/reenrol for information on how to re-enrol for 2015.
FEES AND PAYMENTS
Get information and advice related to fees, payments, student levies, scholarships and liaising with StudyLink.
www.victoria.ac.nz/fees

FINANCIAL SUPPORT AND ADVICE
Get information on all money matters, and in particular, StudyLink. Financial Support and Advice also manages the Hardship Fund.
www.victoria.ac.nz/finadvice

HEALTH SERVICES
Get access to a full range of general practice medical services.
www.victoria.ac.nz/studenthealth

INFORMATION TECHNOLOGY SERVICES
ITS supports the use of technology for learning, research and administration across all campuses. ITS also provides access to student focused applications, shared computer suites, personal laptop clinics and Office 365, the student email and collaboration service.
www.victoria.ac.nz/its

LANGUAGE LEARNING CENTRE
Self-study facilities, resources and friendly advice on independent language learning.
www.victoria.ac.nz/llc

MARAE
Te Herenga Waka Marae, the University marae on our Kelburn campus, is a gathering place as well as a teaching facility. Resources, support and activities include Te Whanake Mauri Tū Computer Suite, lunches in the wharekai (Tuesday to Thursday) and whānau housing.
www.victoria.ac.nz/marae

OVERSEAS EXCHANGE
See page 42.

PHYSIOTHERAPY CLINIC
The on-campus physiotherapy clinic is run by Willis Street Physiotherapy. Appointments are available at Kelburn campus, Pipitea campus and at 57 Willis Street, Wellington. Our experienced physiotherapists specialise in treating all kinds of pain, discomfort and injury. No GP referral necessary. Same day/next day appointments are usually available. Freephone 0800 842 749.
www.victoria.ac.nz/physio

VICTORIA RECREATION SERVICES
Get access to recreation, fitness and sports, to stay healthy and happy during your studies.
www.victoria.ac.nz/recreation
STUDENT INTEREST AND DISPUTE ADVISOR
If you need support or guidance on any matter involving safety, conflict or misconduct, make contact to discuss what assistance is available to deal with the problem.
www.victoria.ac.nz/disputes-advice

STUDENT LEARNING SUPPORT SERVICE
Group and one-to-one academic support—useful at any stage of your study.
www.victoria.ac.nz/slss

STUDENT RECRUITMENT, ADMISSION AND ORIENTATION
If you are a prospective or new student, get course advice and your admission questions answered.
www.victoria.ac.nz/study

VIC BOOKS AND STUDENT NOTES
Buy your textbooks (new and used), and student notes online or in store.
www.vicbooks.co.nz

VICTORIA CLUBS
There are over 130 clubs at Victoria providing a unique extracurricular community for students to get involved.
www.victoria.ac.nz/clubs

VICTORIA INFO IHONUI
Victoria Info Ihonui are places where you can ask questions and get the information you need. They are located in the Hunter Building and at the Kelburn Library entrances on Levels 1 and 2 of the Hub. Friendly staff will answer your questions and refer you to the right place as needed.

VICTORIA INTERNATIONAL
If you are an international student, Victoria International is here to help while you are studying and living in Wellington. We can help with personal, cultural adjustment or academic support, connecting with other students, advice of university services, specialised scholarship support, student visa renewal, insurance claims and advocacy.
www.victoria.ac.nz/students/international

VICTORIA UNIVERSITY OF WELLINGTON STUDENTS’ ASSOCIATION (VUWSA)
Victoria University of Wellington Students’ Association (VUWSA) is a Victoria student association that provides advocacy, support and advice for all students.
www.vuwsa.org.nz