WELCOME TO WAIKATO

In 2014, the University of Waikato celebrated 50 years of teaching and research excellence. From very modest beginnings in 1964, the University of Waikato is now one of the world’s leading universities, and the university of choice for more than 12,000 students annually.

In 2015, the University enters a new era with the appointment of our fifth Vice-Chancellor following the retirement of Professor Roy Crawford who held the position for 10 years.

Moving forward, we are constantly developing our campus to further enhance the learning environment of our students. This is evident with the construction of the new multi-million dollar Law and Management building, which will create a trio of iconic campus facilities including the Gallagher Academy of Performing Arts and the Student Centre.

Research is our lifeblood at the University and we punch above our weight in research commercialisation. The University is one of New Zealand’s major research organisations, playing a key role in the local economy and making a significant contribution to the national innovation system. We have six research institutes, and postgraduate students who are continually contributing to regional, national and global research.

Businesses and organisations today need innovative people and the University of Waikato is dedicated to graduating outstanding students who are committed to “making a difference”.

To prepare students for the job market we provide work experience while they study, and many courses have components that mirror real-life situations so they are prepared for the challenges they face in the workplace.

The University of Waikato provides a dynamic, culturally diverse and inspiring environment for our student population so that when you leave this university you will be well prepared for the challenges that lie ahead.
WELCOME TO SCIENCE & ENGINEERING

The decision to study in the field of science and engineering is often based on: the prospect of an exciting and rewarding career, a real interest in wanting to know how things work, or a fascination with the natural world.

As we become increasingly reliant on innovative science and technology, many of the world’s environmental, economic and social problems are being solved through effective, responsible, more extensive use of science and engineering.

At Waikato our science and engineering graduates are trained to be innovative, multi-skilled, and adaptable; ready for much more than life in the laboratory. Consequently, their career prospects are limited only by their interests and imagination, and graduates find themselves employed throughout New Zealand and overseas in a wide range of well-paid, interesting and stimulating occupations. This is enhanced by the knowledge that they are making a positive difference to the lives of others.

Our science and engineering degrees are a foundation for the future, a key to a secure and rewarding career, and a new step along the pathway of lifelong learning.

Professor Bruce Clarkson
DEAN, FACULTY OF SCIENCE & ENGINEERING
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CONTACT DETAILS

The Faculty Office FG.G.04

The Faculty Office can help you with the following:
» Information about your papers and your qualification,
» Enrolment and programme advice,
» Entry and re-entry decisions,
» Degree planning,
» Student orientation,
» Academic support for Māori and international students, and
» Dealing with other parts of the University and outside organisations such as StudyLink.

Office Administrator
Helen Eschenbruch
Room: FG.G.04
Phone: 07 838 4625
Email: science@waikato.ac.nz

Faculty Registrar
Fiona Hurst
Room: FG.G.06
Phone: 07 838 4290
Email: fionaw@waikato.ac.nz

Associate Dean (Teaching and Learning)
Dr Alison Campbell
Email: a.campbell@waikato.ac.nz

Associate Dean (Engineering)
Professor Janis Swan
Room: E.G.04C
Phone: 07 838 4049
Email: j.swan@waikato.ac.nz

Associate Dean (Research)
Professor Craig Cary
Room: TRU.G.23
Phone: 07 838 4593
Email: caryc@waikato.ac.nz

Associate Dean (International)
To be advised
Phone: 07 838 4625
Email: science@waikato.ac.nz

Cooperative Education Unit
Director
Dr Karsten Zegwaard
Email: k.zegwaard@waikato.ac.nz

Chair of Coastal Science
Professor Chris Battershill
Phone: 07 557 0481
Email: cbatters@waikato.ac.nz

Māori Science Support Officer
Kevin Eastwood
Room: R.1.07
Phone: 07 838 8187
Email: keastwood@waikato.ac.nz

We have endeavoured to ensure that the information in this publication is accurate at the time of printing. Readers should be aware that the online 2015 University of Waikato Calendar takes precedence.
## CONTACT DETAILS

### School Offices
School Offices can provide specialised help. Through these offices you can contact the lecturers and co-ordinators for each of your papers, collect handouts and hand in assignments as directed. The programme convenor of your major subject can advise you on your choice of advanced papers.

<table>
<thead>
<tr>
<th>School of Science</th>
<th>Room: F.1.07</th>
<th>Phone: 07 838 4148</th>
<th>Email: <a href="mailto:sciadmin@waikato.ac.nz">sciadmin@waikato.ac.nz</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>The School of Science administers the majors of Animal Behaviour, Biochemistry, Biological Sciences, Biotechnology, Chemistry, Earth Sciences and Environmental Sciences.</td>
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</table>

<table>
<thead>
<tr>
<th>School of Engineering</th>
<th>Room: E.G.04</th>
<th>Phone: 07 838 4266 or 07 838 4026</th>
<th>Email: <a href="mailto:engineering@waikato.ac.nz">engineering@waikato.ac.nz</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>The School of Engineering administers the specified programmes in the BE(Hons) degrees and also the majors in Electronics, Materials and Processing and Physics in the BSc and BSc(Tech) degrees.</td>
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<tr>
<th>Psychology</th>
<th>Room: K.1.12</th>
<th>Phone: 07 838 4032</th>
<th>Email: <a href="mailto:psychology@waikato.ac.nz">psychology@waikato.ac.nz</a></th>
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<tr>
<th>Cooperative Education</th>
<th>Room: E.2.20</th>
<th>Phone: 07 838 4035</th>
<th>Email: <a href="mailto:co-opworkplacements@waikato.ac.nz">co-opworkplacements@waikato.ac.nz</a></th>
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<tr>
<td>– Work Placements</td>
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First Year Mentors

The first-year mentors for the Faculty of Science & Engineering are available to answer questions and give advice to first-year students. They can help with the transition to university life and help you with any questions you might have about the papers you have selected and how they prepare you for your future career.

<table>
<thead>
<tr>
<th>Biological Sciences</th>
<th>Room: R.1.06</th>
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</thead>
<tbody>
<tr>
<td>Ms Brydget Tulloch</td>
<td>Phone: 07 838 6542</td>
</tr>
<tr>
<td></td>
<td>Email: <a href="mailto:btulloch@waikato.ac.nz">btulloch@waikato.ac.nz</a></td>
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<table>
<thead>
<tr>
<th>Chemistry</th>
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<tbody>
<tr>
<td>Dr Joseph Lane</td>
<td>Phone: 07 838 8549</td>
</tr>
<tr>
<td></td>
<td>Email: <a href="mailto:jlane@waikato.ac.nz">jlane@waikato.ac.nz</a></td>
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<table>
<thead>
<tr>
<th>Earth Sciences</th>
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<tbody>
<tr>
<td>Dr Hazel Needham</td>
<td>Phone: 07 838 4383</td>
</tr>
<tr>
<td></td>
<td>Email: <a href="mailto:hneedham@waikato.ac.nz">hneedham@waikato.ac.nz</a></td>
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<table>
<thead>
<tr>
<th>Engineering</th>
<th>Room: E.G.04</th>
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<tbody>
<tr>
<td>To be advised</td>
<td>Phone: 07 838 4266</td>
</tr>
<tr>
<td></td>
<td>Email: <a href="mailto:engineering@waikato.ac.nz">engineering@waikato.ac.nz</a></td>
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</table>

<table>
<thead>
<tr>
<th>Physics</th>
<th>Room: DE.2.01</th>
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</thead>
<tbody>
<tr>
<td>Associate Professor</td>
<td>Phone: 07 838 4340</td>
</tr>
<tr>
<td>Alistair Steyn-Ross</td>
<td>Email: <a href="mailto:asr@waikato.ac.nz">asr@waikato.ac.nz</a></td>
</tr>
</tbody>
</table>

HOW TO ENROL

To complete an application now:

» Visit the University of Waikato website: www.waikato.ac.nz
» An application to enrol may be completed online at www.waikato.ac.nz/enrol/
» Call 0800 WAIKATO (0800 924 528) for an application pack.

If you wish to discuss your application, programme of study or would like further information about studying at the University of Waikato, please contact the Faculty Office. We are happy to discuss your options. See contact details on page 4.
## DEGREES

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<td>Bachelor of Science (Technology)</td>
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<tr>
<td>Conjoint Degrees</td>
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<tr>
<td>Other Programmes</td>
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</tr>
</tbody>
</table>
ENTRY REQUIREMENTS

Guaranteed Admission

You are guaranteed a place in the Faculty of Science & Engineering if you:

» Apply online or submit an Application to Enrol, and

» Meet the requirements for the University Entrance standard (or equivalent), and

» Meet any additional requirements for the qualification you have selected.

Bachelor of Science and Bachelor of Science (Technology) (BSc and BSc(Tech))

Many of the subjects offered at Waikato have prerequisites on their core papers. If you have not achieved the specified prerequisites through your study at Level 2 and Level 3 NCEA, you may be required to take additional papers or foundation courses to satisfy these prerequisites. Applicants in this situation are advised that not all papers undertaken may count toward the completion of the degree and that their programme of study may take additional time. Other applications will be treated on a case by case basis.

Bachelor of Engineering (Honours) (BE(Hons))

If you do not meet the Guaranteed Admission requirements for the BE(Hons) specified programmes set out below, but your University Entrance includes the required subjects (ie physics and mathematics), we strongly recommend that you contact the Faculty Office to discuss a programme of study.

If you have not completed the appropriate subjects at school, please contact the School of Engineering to discuss pathway options.

Electronic Engineering and Mechanical Engineering

You must gain University Entrance, including a minimum of 16 credits in NCEA at Level 3 in Mathematics with Calculus (from standards 3.1, 3.2, 3.3, 3.5, 3.6, 3.7, or 3.15), and 14 credits in Physics at Level 3.

Chemical and Biological Engineering, and Materials and Process Engineering

You must gain University Entrance, including a minimum of 16 credits in NCEA at Level 3 in Mathematics with Calculus (from standards 3.1, 3.2, 3.3, 3.5, 3.6, 3.7, or 3.15), and at least 16 credits in Chemistry and 14 credits in Physics at Level 3.

Software Engineering

You must gain University Entrance, including a minimum of 16 credits in NCEA at Level 3 in Mathematics with Calculus (from standards 3.1, 3.2, 3.3, 3.5, 3.6, 3.7, or 3.15) and at least 14 credits in NCEA at Level 3 in two other approved subjects.
ENTRY REQUIREMENTS

Discretionary Entrance (Entry from NCEA)

Applicants will normally be granted Discretionary Entrance if they have gained a total of at least 80 credits in four subjects at Level 2 NCEA with a minimum grade of merit in at least half of the achievement standards for each subject. Applicants must also have satisfied the numeracy and literacy requirements for University Entrance. Applications must be supported by the applicant’s school principal or the University’s student recruitment officers.

Special Admission

Students over the age of 20 are eligible to apply for admission to all of the Faculty’s programmes. Most first-year science papers assume some prior knowledge and some students may be required to complete bridging study such as Science Foundation (see page 81) or the Certificate of University Preparation (see page 83).

Admission with Credit for Previous Study

You can apply for credit for degree level study completed at another tertiary institution. Any credit awarded depends on the type of qualification studied and the level, content and number of papers passed. Details are also available on the Tertiary Education Alliance website at www.tea.ac.nz

To apply for credit, tick the relevant box on the Application to Enrol form and supply a verified copy of your official academic record of your previous study. Details are also available at www.waikato.ac.nz/study/transfer-credit If you have any further questions about credit, the Faculty Office or the Student Information Centre in the Student Centre can help.
BACHELOR OF ENGINEERING (HONOURS) BE(Hons)

Engineers seek to build useful products and services using the understanding of the laws governing natural processes. The BE(Hons) is a four-year, full-time degree designed to prepare you to apply advanced scientific knowledge in a constructive and effective way. There are five specified programmes: Chemical and Biological Engineering, Electronic Engineering, Materials and Process Engineering, Mechanical Engineering and Software Engineering. Our Cooperative Education Unit will help you find the work experience to complete 800 hours of paid relevant workplace experience to prepare you for professional registration.

Degree Length

The BE(Hons) requires four years of full-time study or the equivalent in part-time study. Students must also complete at least 800 hours of work experience.

Requirements

» 480 points at 100, 200, 300 and 400 Levels in papers outlined by the chosen specified programme (equivalent to four years full-time study),
» No more than 120 points at 100 Level,
» Complete the requirements of one of the specified engineering programmes, and
» 800 hours of work experience.

BE(Hons) Work Placement Papers

Work Placements are a compulsory component of the BE(Hons). Please refer to page 133 for details of BE(Hons) Work Placement Papers.

Refer to page 78 for contact details of Work Placement Co-ordinators.
## BACHELOR OF ENGINEERING (HONOURS) BE(Hons)

### General Structure of the BE(Hons) Degrees

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<td>SPECIFIED</td>
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<td>DESIGN PROJECT</td>
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</table>

- **Specified** – These papers are specified by the programme and are given in the subjects and papers section of this handbook.
- **Design Project** – A major design project (60 points) is undertaken in Year 4.

*ENGG371 and ENGG372 are usually completed in the summer break and can also be taken in Year 4.

**PHYS103 is compulsory for all specified programmes except Software Engineering, where it is one of four electives.*
## BE(Hons) PROGRAMMES

- Chemical and Biological Engineering  page 12
- Electronic Engineering  page 15
- Materials and Process Engineering  page 18
- Mechanical Engineering  page 20
- Software Engineering  page 22
CHEMICAL AND BIOLOGICAL ENGINEERING

The Chemical and Biological Engineering programme has a core of process engineering plus a set of papers that are specific to biological processing, chemical processing, materials, or environmental processing. This programme covers processing and producing a diverse range of biochemicals, chemicals and materials, or environmental treatment, and provides an excellent basis for a career in bioprocessing, food and pharmaceutical industries, materials and chemical industries and environmental treatment. A major focus is on processing and developing high-value products. There is a major research, design and development project in the fourth year of the programme.

This specified engineering programme has full IPENZ accreditation, making the Bachelor of Engineering (Honours) a nationally and internationally recognised degree.

CONTACTS FOR THE SCHOOL OF ENGINEERING

| Enrolment Contact Person and First Year Mentor | Room: E.G.04 |
| To be advised | Phone: 07 838 4266 |
| Convenor | Email: engineering@waikato.ac.nz |
| Dr Johan Verbeek | Room: EF.2.03 |
| | Phone: 07 838 4947 |
| | Email: jverbeek@waikato.ac.nz |
### General Structure of the Chemical and Biological Engineering Programme

<table>
<thead>
<tr>
<th>YEAR 1</th>
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<td>STREAM *</td>
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- **Design Project** – A major design project (60 points).
- *Stream specific elective.
- **Choose 20 points from any subject(s) at 200 level or above.**

### Streams for the Chemical and Biological Engineering Programme

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<tr>
<th>Biological Processing</th>
<th>Chemical Processing</th>
<th>Materials</th>
<th>Environmental</th>
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</table>

| YEAR 2                |                     |           |               |
| ENMP322               | ENMP325             | ENMP311   | ENMP421       |
| 20 points             | 20 points           | 20 points | 20 points     |
| ENMP322               | ENMP325             | ENMP311   | ENMP421       |
| 20 points             | 20 points           | 20 points | 20 points     |
| ENMP311               | ENMP311             | ENMP313   | ENMP341       |
| 20 points             | 20 points           | 20 points | 20 points     |
| ENMP411               | ENMP411             | ENMP407   | ENMP442       |
| 10 points             | 10 points           | 10 points | 20 points     |
| ENMP427               | ENMP427             | ENMP407   | ENMP442       |
| 20 points             | 20 points           | 10 points | 20 points     |
CHEMICAL AND BIOLOGICAL ENGINEERING

Year 1 – Papers are worth 15 points.
» COMP103A/B/C – Introduction to Computer Science
» ENGG180A – Foundations of Engineering
» ENMP102B – Introduction to Materials Science and Engineering
» MATH101A/B/S – Introduction to Calculus
» MATH102A/B – Introduction to Algebra
» PHYS103B – Physics for Scientists and Engineers 1
» CHEM112B – Chemical Reactivity

Plus 15 points from Stream appropriate papers

Year 2 – Papers are worth 20 points unless specified.
» ENGG279B – Preparation for the Professional Work Place (0 points)
» ENGG282B – Engineering Design (10 points)
» ENGG283A – Linear Algebra for Engineers (10 points)
» ENGG284B – Differential Equations for Engineers (10 points)
» ENGG371C – Engineering Work Placement 1 (0 points)
» ENMP221A – Engineering Thermodynamics
» ENMP223B – Thermofluids
» ENMP282A – Science and Engineering Management A (10 points)

Plus 40 points from Stream appropriate papers.

Year 3 – Papers are worth 20 points unless specified.
» ENGG285A – Multivariable Calculus for Engineers (10 points)
» ENGG372C – Engineering Work Placement 2 (0 points)
» ENGG379A – Reflection on Professional Workplace Experience (0 points)
» ENGG381A – Engineering Statistics
» ENMP321B – Process Engineering and Design
» ENMP323A – Transport Processes and Unit Operations
» MATH257A – Computational Mathematics (10 points), OR
  MATH259B – Mathematical modelling (10 points)

Plus 40 points from Stream appropriate papers.

Year 4 – Papers are worth 20 points unless specified.
» ENGG492A/B/C/Y – Honours Research and Management Project (60 points)
» ENMP422A – Advanced Process Simulation and Control

Plus 20 points from Stream appropriate papers.
Plus 20 points from papers at 200 Level or above.

Note(s): For descriptions of individual papers refer to the following paper codes in the Papers Section (page 84): CHEM Chemistry; ENGG Engineering; ENMP Materials and Processing; PHYS Physics. For descriptions of papers with the subject codes COMP, MATH or STAT, refer to the Computing & Mathematical Sciences Handbook, or the 2015 University of Waikato Calendar.
ELECTRONIC ENGINEERING

Electronic engineering is concerned with the design, development, manufacture and application of electronic devices, circuits and systems. The ideas electronic engineers have turned into reality gave us, for example, personal computers, mobile telephones, pacemakers, radio, television, industrial control and satellite communication systems. New Zealand’s electronics manufacturing industry is one of the fastest growing industries in the country. Companies are targeting niche markets, such as telecommunications, and export their products all over the world.

The programme offers papers in design and a major electronic engineering project in the fourth year of study. Extensive experience is attained in electronic laboratories. Economic and professional training elements are also included.

This specified engineering programme has full IPENZ accreditation, making the Bachelor of Engineering (Honours) a nationally and internationally recognised degree.

Electronics is available as a major subject for the Bachelor of Science or Bachelor of Science (Technology) degrees. See page 49 for more details. Papers in electronics are available at all levels of study from undergraduate degrees through to postgraduate and doctoral studies. See page 106 for details of electronics papers.

CONTACTS FOR THE SCHOOL OF ENGINEERING

<table>
<thead>
<tr>
<th>Enrolment Contact Person</th>
<th>Room: E.G.04</th>
</tr>
</thead>
<tbody>
<tr>
<td>and First Year Mentor</td>
<td>Phone: 07 838 4266</td>
</tr>
<tr>
<td>To be advised</td>
<td>Email: <a href="mailto:engineering@waikato.ac.nz">engineering@waikato.ac.nz</a></td>
</tr>
<tr>
<td>Convenor</td>
<td>Room: CD.1.03</td>
</tr>
<tr>
<td>Professor Jonathan Scott</td>
<td>Phone: 07 838 4909</td>
</tr>
<tr>
<td></td>
<td>Email: <a href="mailto:scottj@waikato.ac.nz">scottj@waikato.ac.nz</a></td>
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Programme Details

Structure of the Electronic Engineering Programme

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<th>YEAR 1</th>
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<td>ENEL212 10 points</td>
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<td>ENEL317 20 points</td>
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</tbody>
</table>

Work Placement – Work experience in an appropriate and approved industry or applied field (0 points).
Design Project – A major design project (60 points).

Year 1 – Papers are worth 15 points.
» COMP103A/B – Introduction to Computer Science 1
» ENEL111A – Introduction to Electronics
» ENGG180A – Foundations of Engineering
» ENMP102B – Introduction to Materials Science and Engineering
» MATH101A/B/S – Introduction to Calculus
» MATH102A/B – Introduction to Algebra
» PHYS103B – Physics for Scientists and Engineers 1

*Choose 15 points from: 100 Level Science papers (excluding COMP123, MATH165, MATH166, MATH168, PHYS100)

Recommended papers
» BIOL101B – Cellular and Molecular Biology
» CHEM100A – Chemistry in Context
» CHEM111A – Structure and Spectroscopy
» COMP104B/S – Introduction to Computer Science 2
Year 2 – Papers are worth 20 points unless specified.

» COMP200A – Computer Systems (10 points)
» ENEL205B – Analog Electronics and Circuit Analysis
» ENEL212A – Electronics for Digital Systems (10 points)
» ENEL284B – Electricity and Magnetism (10 points)
» ENEL285A – Quantum and Solid State Physics (10 points)
» ENGG279B – Preparation for the Professional Workplace (0 points)
» ENGG282B – Engineering Design (10 points)
» ENGG283A – Linear Algebra for Engineers (10 points)
» ENEL284B – Differential Equations for Engineers (10 points)
» ENEL285A – Multivariable Calculus for Engineers (10 points)
» ENGG287A – Engineering Applications (10 points)
» ENMP215B – Manufacturing Technology (10 points)
» ENGG371C – Engineering Work Placement 1 (0 points)

Year 3 – Papers are worth 20 points unless specified.

» ENEL312A – Electromagnetic Waves
» ENEL317B – Microprocessor Applications and Control
» ENEL321B – Application Specific Integrated Circuits
» ENEL324A – Optoelectronics
» ENEL382B – High Speed Communications
» ENGG372C – Engineering Work Placement 2 (0 points)
» ENEL379C – Reflection on Professional Workplace Experience (0 points)
» ENMP282A – Science and Engineering Management A (10 points)
» MATH257A – Computational Mathematics (10 points)

Year 4 – Papers are worth 20 points unless specified.

» ENGG492A/B/C/Y – Honours Research and Management Project (60 points)
» ENGG381A – Engineering Statistics

**Choose 40 points from:

» ENEL301A/B/C/Y – Special Topics in Electronics
» ENEL417A – Mechatronics
» ENEL423B – Electro-optical Instrumentation
» ENEL485B – Power Electronics
» ENGG401A – Control Theory and Image Processing

Note(s): For descriptions of individual papers refer to the following paper codes in the Papers Section (page 84): BIOL Biological Sciences; ENEL Electronics; ENGG Engineering; ENMP Materials and Processing; PHYS Physics. For descriptions of papers with subject codes COMP or MATH, refer to the Computing & Mathematical Sciences Handbook or the 2015 University of Waikato Calendar.
MATERIALS AND PROCESS ENGINEERING

This specified engineering programme contains two overlapping engineering disciplines: process engineering and materials engineering. Materials engineers make critical decisions in selecting the best materials for a particular function; process engineers make critical decisions in the processes and utilities required to manufacture the product. Examples include converting trees into paper and fibre board, iron sand into steel, effluent into drinkable water and producing solar panels for electricity.

This specified engineering programme has full IPENZ accreditation, making the Bachelor of Engineering (Honours) a nationally and internationally recognised degree.

Materials and Processing is available as a major subject for the Bachelor of Science or Bachelor of Science (Technology) degrees. See page 65 for more details. Papers in materials and processing are available at all levels of study from undergraduate degrees through to postgraduate and doctoral studies. See page 116 for details of materials and processing papers.

CONTACTS FOR THE SCHOOL OF ENGINEERING

Enrolment Contact Person
Room: E.G.04
Phone: 07 838 4266
Email: engineering@waikato.ac.nz

Convenor
Room: EF.2.02
Phone: 07 838 4701
Email: walmsley@waikato.ac.nz

Programme Details

Structure of the Materials and Process Engineering Programme – BE(Hons)

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<td>ENMP371 0 points</td>
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<td>ENMP422 20 points</td>
<td>DESIGN PROJECT 60 points</td>
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</table>

* Work Placement – Work experience in an appropriate and approved industry or applied field (0 points).
* Design Project – A major design project (60 points) is undertaken in Year 4.
Year 1 – Papers are worth 15 points.
  » CHEM111A – Structure and Spectroscopy
  » CHEM112B – Chemical Reactivity
  » COMP103A – Introduction to Computer Science 1
  » ENGG180A – Foundations of Engineering
  » ENMP102B – Introduction to Materials Science and Engineering
  » MATH101A/B/S – Introduction to Calculus
  » MATH102A/B – Introduction to Algebra
  » PHYS103B – Physics for Scientists and Engineers 1

Year 2 – Papers are worth 20 points unless specified.
  » ENGG279B – Preparation for the Professional Workplace (0 points)
  » ENGG282B – Engineering Design (10 points)
  » ENGG283A – Linear Algebra for Engineers (10 points)
  » ENGG284B – Differential Equations for Engineers (10 points)
  » ENMP211A – Materials 1
  » ENMP213B – Mechanics of Materials 1
  » ENMP221A – Engineering Thermodynamics
  » ENMP223B – Thermofluids
  » ENMP282A – Science and Engineering Management A (10 points)
  » ENGG371C – Engineering Work Placement 1 (0 points)

Year 3 – Papers are worth 20 points unless specified.
  » ENGG285A – Multivariable Calculus for Engineers (10 points)
  » ENGG287A – Engineering Applications (10 points)
  » ENGG379A – Reflection on Professional Workplace Experience (0 points)
  » ENMP214B – Manufacturing Processes (10 points)
  » ENMP215B – Manufacturing Technology (10 points)
  » ENMP311B – Materials 2
  » ENMP313A – Mechanics of Materials 2
  » ENMP321B – Process Engineering and Design
  » ENMP323A – Transport Processes and Unit Operations

Year 4 – Papers are worth 20 points unless specified.
  » ENGG492A/B/C/Y – Honours Research and Management Project (60 points)
  » ENGG381A – Engineering Statistics
  » ENMP411A – Advanced Materials Engineering (10 points)
  » ENMP422A – Advanced Process Simulation and Control

*Choose a further 10 points from papers at 200 Level or above.

Note(s): For descriptions of individual papers refer to the following paper codes in the Papers Section (page 84): CHEM Chemistry; ENEL Electronics; ENGG Engineering; ENMP Materials and Processing; PHYS Physics. For descriptions of papers with subject codes COMP, MATH or STAT, refer to the Computing & Mathematical Sciences Handbook or the 2015 University of Waikato Calendar.
MECHANICAL ENGINEERING

The Mechanical Engineering programme combines papers in mechanical engineering, general engineering, science and mathematics, to give graduates a good balance between intellectual rigour and engineering practice. This prepares graduates typically for employment in industry and a wide range of other careers. During the first three years, the curriculum includes engineering design as a major theme. In the final year, students undertake a major design project.

This specified engineering programme has full IPENZ accreditation, making the Bachelor of Engineering (Honours) a nationally and internationally recognised degree.

CONTACTS FOR THE SCHOOL OF ENGINEERING

Enrolment Contact Person and First Year Mentor
Room: E.G.04
Phone: 07 838 4266
Email: engineering@waikato.ac.nz

To be advised

Convenor
Room: EF.2.04
Associate Professor Mike Duke
Phone: 07 838 4522
Email: dukemd@waikato.ac.nz

Programme Details

<table>
<thead>
<tr>
<th>Structure of the Mechanical Engineering Programme</th>
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</tr>
<tr>
<td><strong>YEAR 3</strong></td>
</tr>
<tr>
<td><strong>YEAR 4</strong></td>
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</table>

- Work Placement – Work experience in an appropriate and approved industry or applied field (0 points).
- Design Project – A major design project (60 points) is undertaken in Year 4.
Year 1 – Papers are worth 15 points.
  » CHEM100A – Chemistry in Context OR CHEM111A – Structure and Spectroscopy OR CHEM112B – Chemical Reactivity
  » COMP103A/B – Introduction to Computer Science 1
  » ENEL111A – Introduction to Electronics
  » ENGG180A – Foundations of Engineering
  » ENMP102B – Introduction to Materials Science and Engineering
  » MATH101A/B/S – Introduction to Calculus
  » MATH102A/B – Introduction to Algebra
  » PHYS103B – Physics for Scientists and Engineers 1

Year 2 – Papers are worth 20 points unless specified.
  » ENGG279B – Preparation for the Professional Workplace (0 points)
  » ENGG282B – Engineering Design (10 points)
  » ENGG283A – Linear Algebra for Engineers (10 points)
  » ENGG284B – Differential Equations for Engineers (10 points)
  » ENMP211A – Materials 1
  » ENMP213B – Mechanics of Materials 1
  » ENMP214B – Manufacturing Processes (10 points)
  » ENMP215B – Manufacturing Technology (10 points)
  » ENMP221A – Engineering Thermodynamics
  » ENMP282A – Science and Engineering Management A (10 points)
  » ENGG371C – Engineering Work Placement 1 (0 points)

Year 3 – Papers are worth 20 points unless specified.
  » ENGG285A – Multivariable Calculus for Engineers (10 points)
  » ENGG287A – Engineering Applications (10 points)
  » ENGG379A – Reflection on Professional Workplace Experience (0 points)
  » ENME351A – Dynamics and Mechanisms
  » ENME352B – Machine Dynamics and Control
  » ENME380B – Mechanical Engineering Design
  » ENMP223B – Thermofluids
  » ENMP311A – Mechanics of Materials 2

Year 4 – Papers are worth 20 points unless specified.
  » ENGG492A/B/C/Y – Honours Research and Management Project (60 points)
  » ENGG381A – Engineering Statistics
  » ENME480A – Advanced Product Development (10 points)
*Choose a further 30 points from the following:
  » ENGG301A/B/C/Y – Special Topics in Engineering
  » ENME440A – Finite Element Analysis and Applications
  » ENME451B – Mechanics of Vibration (10 points)
  » ENMP311B – Materials 2
  » ENMP407A/B – Materials and Process Engineering Elective (10 points)
  » ENMP413B – Materials Performance in Service (10 points)
  » ENMP422A – Advanced Process Simulation and Control

Note(s): For descriptions of individual papers refer to the following paper codes in the Papers Section (page 84): CHEM Chemistry; ENEL Electronics; ENGG Engineering; ENMP and ENME Materials and Processing; PHYS Physics. For descriptions of papers with subject codes COMP or MATH, refer to the Computing & Mathematical Sciences Handbook or the 2015 University of Waikato Calendar.
SOFTWARE ENGINEERING

Software Engineers design the software that we increasingly rely on. Industrial robots, mobile phones, cars, trains, planes, DVD players, washing machines, computer games, energy networks, security systems – all these are driven by software that must be reliable and flexible, usable and cost-effective.

The Software Engineering starts with programming and basic engineering ideas in the first year, progresses through more advanced design and programming techniques in the second year, then branches out into a wide variety of design and implementation challenges in the third and fourth years.

This specified engineering programme has full IPENZ accreditation, making the Bachelor of Engineering (Honours) a nationally and internationally recognised degree.

CONTACTS FOR SOFTWARE ENGINEERING
Software Engineering is administered by the Faculty of Computing & Mathematical Sciences.

Faculty of Computing & Mathematical Sciences

Phone: 07 838 4322
Email: cms@waikato.ac.nz

Convenor
Professor Steve Reeves
Phone: 07 838 4398
Email: stever@waikato.ac.nz

Programme Details

General Structure of the Software Engineering Programme

<table>
<thead>
<tr>
<th>Year 1</th>
<th>COMP103 15 points</th>
<th>COMP104 15 points</th>
<th>MATH101 15 points</th>
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<th>ENGG180 15 points</th>
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<td>COMP241 10 Points</td>
<td>COMP219 20 points</td>
<td>ENMP282 10 points</td>
<td>COMP235 20 points</td>
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<td>COMP317 20 points</td>
<td>COMP340 20 points</td>
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<td>COMP321 20 points</td>
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<tr>
<td>Year 4</td>
<td>At least one of: COMP424 15 points (if needed)</td>
<td>COMP439 20 points</td>
<td>COMP452 20 points</td>
<td>COMP4XX 15 points (if needed)</td>
<td>COMP4XX 15 points (if needed)</td>
<td>DESIGN PROJECT ENGG492 60 points</td>
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</tr>
</tbody>
</table>

- Work Placement – Work experience in an appropriate and approved industry or applied field (0 points).
- Design Project – A major design project (60 points) is undertaken in Year 4.
Year 1 – Papers are worth 15 points.
» COMP103A/B – Introduction to Computer Science 1
» COMP104B/S – Introduction to Computer Science 2
» ENMP102B – Introduction to Materials Science and Engineering
» MATH101A/B/S – Introduction to Calculus
» MATH102A/B – Introduction to Algebra
*Choose a further 30 points from:
» CHEM100A – Chemistry in Context OR
CHEM111A – Structure and Spectroscopy OR
CHEM112B – Chemical Reactivity
» ENEL111A – Introduction to Electronics
» PHYS103B – Physics for Scientists and Engineers 1
» STAT111B – Statistics for Science OR
STAT121A/S – Introduction to Statistical Methods

Year 2 – Papers are worth 20 points unless specified.
» COMP200A – Computer Systems (10 points)
» COMP202B – Computer Communications (10 points)
» COMP219A – Database Practice and Experience
» COMP235B – Logic and Computation
» COMP241A – Software Engineering Development (10 points)
» COMP242B – Software Engineering Process (10 points)
» ENGG279B – Preparation for Professional Workplace (0 points)
» ENGG282B – Engineering Design (10 points)
» ENGG283A – Linear Algebra for Engineers (10 points)
» ENMP282A – Science and Technology Management 1 (10 points)
» ENGG371C – Engineering Work Placement 1 (0 points)

Year 3 – Papers are worth 20 points unless specified.
» COMP314B – Software Engineering Project
» COMP317A – Design and Analysis of Algorithms
» COMP325B – Human-Computer Interaction
» COMP340A – Reasoning about Programs
» ENGG372C – Engineering Work Placement 2 (0 points)
» ENGG379A – Reflection on Professional Workplace Experience (0 points)
» ENGG381A – Engineering Statistics OR
COMP321B – Practical Data Mining

**Choose a further 20 points from:
» COMP301B – Operating Systems
» COMP311 – Computer Systems Architecture †
» COMP312A – Communications and Systems Software
» COMP313A – Topics in Programming Languages

† Not offered in 2015.
SOFTWARE ENGINEERING

Year 4 – Papers are worth 15 points unless specified.
  » ENGG492A/B/C/Y – Honours Research and Management Project (60 points)
  
  Choose at least one of:
  » COMP424A – Interaction Design
  » COMP439A – Usability Engineering
  » COMP448A – Developing Mobile Applications
  
  Choose at least one of:
  » COMP426A – Engineering Interactive Systems
  » COMP452A – Model Checking

***Choose from the Computer Science papers listed below. Together with the papers above, you must take a total of 120 points of 400 Level Computer Science papers.

Recommended:
  » COMP401A – Topics in Operating Systems
  » COMP413A – Topics in Computer Networks
  » COMP414B – Carrier and ISP Networks
  » COMP440B – Software Engineering Methodologies
  » COMP453A – Extremely Parallel Programming

Note(s): For descriptions of individual papers refer to the following paper codes in the Papers Section (page 84): CHEM Chemistry; ENEL Electronics; ENGG Engineering; ENMP Materials and Processing; PHYS Physics. For descriptions of papers with subject codes COMP, MATH or STAT, refer to the Computing & Mathematical Sciences Handbook or the 2015 University of Waikato Calendar.
## BACHelor of science BSc

The Bachelor of Science (BSc) is an internationally-recognised general science degree. Graduates are eagerly sought by industry and public bodies in New Zealand and overseas. The BSc allows wide flexibility in the choice of the papers students can take, allowing you to combine papers to suit your strengths and abilities. You can construct a general degree and major in the subject of your choice, or choose to complete a specialisation within that major.

### Degree Length

The BSc requires three years of full-time study or the equivalent in part-time study.

### Requirements

- 360 points at 100, 200 and 300 Levels (equivalent to three years full-time study)
- No more than 120 points at 100 Level
- 105 points at 100 Level must be in Science, of which 60 points must be across four different Science subjects
- A minimum of 80 points at 300 Level
- Satisfy the requirements for a major subject (see next page)
- A maximum of 75 points may be taken outside Science (unless taking a double major), and
- At least 40 points at 200 Level or higher outside the major subject.

### Majors

To meet the requirements of a major, you must pass at least 120 points above 100 Level in that subject, including 60 points above 200 Level. The same number of points in a second subject must be passed if you elect to pursue a double major. The major subjects for the degree are:

<table>
<thead>
<tr>
<th>Major</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal Behaviour</td>
<td>31</td>
</tr>
<tr>
<td>Biochemistry</td>
<td>34</td>
</tr>
<tr>
<td>Biological Sciences</td>
<td>36</td>
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<tr>
<td>Biotechnology</td>
<td>41</td>
</tr>
<tr>
<td>Chemistry</td>
<td>43</td>
</tr>
<tr>
<td>Earth Sciences</td>
<td>46</td>
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<tr>
<td>Electronics</td>
<td>49</td>
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<tr>
<td>Environmental Planning</td>
<td>51</td>
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<tr>
<td>Environmental Sciences</td>
<td>54</td>
</tr>
<tr>
<td>Materials and Processing</td>
<td>65</td>
</tr>
<tr>
<td>Physics</td>
<td>68</td>
</tr>
<tr>
<td>Psychology</td>
<td>70</td>
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</tbody>
</table>
BACHELOR OF SCIENCE BSc

Specialisations
Specialisations are areas of interest that can be taken alongside a major. Most specialisations can only be taken alongside a specific major subject. Please refer to the page numbers below for more information on each available specialisation.

- Environmental Microbiology page 57
- Environmental Modelling page 59
- Land and Freshwater Environments page 61
- Marine Sciences page 63
- Restoration Ecology page 39
- Science International page 73
- Te Pūtaiao me ngā take Māori page 75

General Structure of the BSc Degree

| YEAR 1 | 100 Level | 100 Level | 100 Level | 100 Level | 100 Level | 100 Level | 100 Level |
|--------|-----------|-----------|-----------|-----------|-----------|-----------|
| SCIENCE MAJOR | SCIENCE MAJOR | SCIENCE | SCIENCE | SCIENCE | SCIENCE | SCIENCE | ELECTIVE |
| 100 Level | 100 Level | 100 Level | 100 Level | 100 Level | 100 Level | 100 Level |
| YEAR 2 | 200 Level | 200 Level | 200 Level | 200 Level | 200 Level | 200 Level | 200 Level |
| SCIENCE MAJOR | SCIENCE MAJOR | SCIENCE | ELECTIVE | ELECTIVE | ELECTIVE | ELECTIVE |
| 200 Level | 200 Level | 200 Level | 200 Level | 200 Level | 200 Level | 200 Level |
| YEAR 3 | 300 Level | 300 Level | 300 Level | 200 or 300 Level | 200 or 300 Level | 200 or 300 Level | 200 or 300 Level |
| SCIENCE MAJOR | SCIENCE MAJOR | SCIENCE | SCIENCE | ELECTIVE | ELECTIVE | ELECTIVE |
| 300 Level | 300 Level | 300 Level | 300 Level | 300 Level | 300 Level | 300 Level |

- Science Major
- Science – These papers should be recognised science papers, which are all papers offered by the Faculties of Science & Engineering and Computing & Mathematical Sciences (except MATH168), and selected philosophy and psychology papers. A list of all recognised 100 Level science papers can be found on page 86 of this handbook.
- Elective – These papers may be chosen from science or non-science papers.
BACHELOR OF SCIENCE (TECHNOLOGY) BSc(Tech)

A BSc(Tech) puts you on the first step of the career ladder, giving you valuable paid work experience alongside practicing scientists and technologists. Our Cooperative Education Unit arranges and oversees the work placement component of your degree, which will ensure the quality of your work placement. The contacts made and the experience gained means that graduates are very successful in finding jobs within a few months of completing this degree; many in the company where they completed their work experience. Research has shown that BSc(Tech) graduates who had been actively seeking employment have an extremely high success rate of finding paid employment within six months of finishing their degree.

Degree Length

The BSc(Tech) requires four years of full-time study or the equivalent in part-time study. The work experience component of the degree is offered in two blocks. The first block occurs at the end of your second year during the summer vacation and consists of three months of paid work with associated assessment items during the placement. The second block generally occurs at the end of the third year and consists of six to nine months (November to July) of work experience.

Requirements

- 480 points at 100, 200 and 300 Levels (equivalent to four years full-time study),
- No more than 120 points at 100 Level,
- 105 points at 100 Level must be in Science, of which 60 points must be across 4 different Science subjects,
- A minimum of 80 points at 300 Level (not including placement papers),
- Satisfy the requirements for a major subject (see page 29),
- At least 40 points at 200 Level or higher outside the major subject,
- A minimum of 35 points from Management papers must be completed,
- 80 points of work placement-related papers, of which 60 points must be at 300 Level, and
- A maximum of 120 points can be taken outside Science including the Management papers (unless taking a double major).

BSc(Tech) Work Placement Papers

Work Placement Papers are a compulsory component of the BSc(Tech). Please refer to page 133 for details of BSc(Tech) Work Placement Papers.

Refer to page 79 for contact details of Work Placement Co-ordinators.
BACHELOR OF SCIENCE (TECHNOLOGY) BSc(Tech)

Majors
To meet the requirements of a major, you must pass at least 120 points above 100 Level in that subject, including 60 points above 200 Level. The same number of papers in a second subject must be passed if you elect to pursue a double major. The major subjects for the degree are:

» Animal Behaviour page 31
» Biochemistry page 34
» Biological Sciences page 36
» Biotechnology page 41
» Chemistry page 43
» Computer Science *
» Earth Sciences page 46
» Electronics page 49
» Environmental Planning page 51
» Environmental Sciences page 54
» Materials and Processing page 65
» Physics page 68

*Enrolment in this major should be completed in consultation with the Faculty of Computing & Mathematical Sciences.

Specialisations
Specialisations are areas of interest that can be taken alongside a major. Most specialisations can only be taken alongside a specific major subject. Please refer to the page numbers below for more information on each available specialisation.

» Environmental Microbiology page 57
» Environmental Modelling page 59
» Land and Freshwater Environments page 61
» Marine Sciences page 63
» Restoration Ecology page 39
» Science International page 73
» Te Pūtaiao me ngā take Māori page 75
## General Structure of the BSc(Tech) Degree

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
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</thead>
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<tr>
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<td>SCIENCE MAJOR 200 Level</td>
<td>SCIENCE MAJOR 300 Level</td>
<td>SCIENCE 200 or 300 Level</td>
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<tr>
<td>SCIENCE 100 Level</td>
<td>SCIENCE MAJOR 200 Level</td>
<td>SCIENCE MAJOR 300 Level</td>
<td>ELECTIVE 200 or 300 Level</td>
</tr>
<tr>
<td>SCIENCE 100 Level</td>
<td>ELECTIVE 200 Level</td>
<td>ELECTIVE 200 or 300 Level</td>
<td>PLACEMENT SCIE371 or COMP371</td>
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<tr>
<td>SCIENCE 100 Level</td>
<td>SCIENCE 200 Level</td>
<td>MANAGEMENT **</td>
<td>SCIE279</td>
</tr>
<tr>
<td>SCIENCE 100 Level</td>
<td>ELECTIVE 200 or 300 Level</td>
<td>MANAGEMENT ***</td>
<td>SCIE379</td>
</tr>
<tr>
<td>SCIENCE 100 Level</td>
<td>PLACEMENT SCIE372 or COMP372</td>
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</tbody>
</table>

- **Science Major**
  - Science – These papers should be recognised science papers, which are all papers offered by the Faculties of Science & Engineering and Computing & Mathematical Sciences (except MATH168), and selected philosophy and psychology papers. A list of all recognised 100 Level science papers can be found on page 86 of this handbook.
  - Elective – These papers may be chosen from science or non-science papers.
  - Management – Recommended Management papers:
    - **ENMP282 (10 pts) and ENMP283 (10 pts)**
    - ***ENMP381 (20 pts)**

*Applies to students who enrol from 2010 onwards. Students enrolled in previous years should refer to the handbook from their year of enrolment.
BSc/BSc(Tech) MAJORS

» Animal Behaviour  page 31
» Biochemistry  page 34
» Biological Sciences  page 36
» Biotechnology  page 41
» Chemistry  page 43
» Computer Science  page *
» Earth Sciences  page 46
» Electronics  page 49
» Environmental Planning  page 51
» Environmental Sciences  page 54
» Materials and Processing  page 65
» Physics  page 68
» Psychology  page 70

*Enrolment in this major should be completed in consultation with the Faculty of Computing & Mathematical Sciences.
Animal behaviour is the study of behaviour patterns in animals (including humans), and of how the behaviour of individuals helps to determine the density and distribution of populations. Knowledge of animal behaviour is of increasing importance in areas such as evolutionary biology, conservation, and the efficient and humane management of farm animals.

Graduates in animal behaviour will be able to use both biological and psychological approaches to address issues in the fields of animal conservation, wildlife management, animal welfare and the fundamental study of behaviour. They will find employment in the behavioural sciences at local, national and international levels in the agricultural, conservation, and animal management industries.

CONTACTS FOR ANIMAL BEHAVIOUR
This subject is jointly taught between Biological Sciences and Psychology.

Convenor
Professor Joe Waas
Room: R.2.21
Phone: 07 838 4286
Email: j.waas@waikato.ac.nz

Animal Behaviour Interdisciplinary Major

<table>
<thead>
<tr>
<th>General Structure of an Animal Behaviour Interdisciplinary Major for the BSc and BSc(Tech) degrees</th>
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<tbody>
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<td>200 LEVEL</td>
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<td>20 points</td>
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</table>

100 Level — Recommended prerequisites: BIOL102 The Biology of Organisms, and PSYC103 General and Experimental Psychology.


300 Level — BIOL333 Advanced Animal Behaviour, BIOL338 Advanced Zoology, and PSYC314 Behavioural Analysis.
ANIMAL BEHAVIOUR

Specialisations
Students may undertake the following specialisations for the BSc and BSc(Tech) major in Animal Behaviour.

» Science International  page 73
» Te Pūtaiao me ngā take Māori  page 75

Choosing Papers

Animal Behaviour Interdisciplinary Major
To complete a major in Animal Behaviour, students must complete 120 points above 100 Level, including 60 points at 300 Level, from compulsory papers.

Please note that the paper PSYC307 Research Methods is a prerequisite for many Psychology graduate papers.

100 Level – Papers are worth 15 points.

Prerequisites
» BIOL102A – The Biology of Organisms
» PSYC103A – General and Experimental Psychology
Students are strongly advised to include the following paper
» BIOL101B – Cellular and Molecular Biology

Highly recommended papers
» CHEM100A – Chemistry in Context OR CHEM111A – Structure and Spectroscopy
» COMP123A/B/S – The Computing Experience
» ENVS101B – Environmental Science
» MATH165A/B – General Mathematics
» PHIL103A/B – Critical Reasoning
» STAT111B – Statistics for Science OR STAT121A/S – Introduction to Statistical Methods
200 Level – Papers are worth 20 points unless specified.

**Compulsory papers**

- BIOL234A – Functional Animal Biology
- PSYC206B – Animal Behaviour: Principles and Applications
- PSYC225A – Behavioural Psychology and Learning (10 points)

Choose one of:

- PSYC226A – The Psychology of Perception (10 points)
- PSYC227A – Foundations of Behavioural Neuroscience (10 points)

**Highly recommended papers**

- BIOL201A – Evolution and Diversity of Life*
- BIOL210B – Introduction to Genetics
- BIOL212A – Ecology
- BIOL235B – Biomedical and Molecular Physiology
- PHIL217S – Environmental Ethics
- PSYC208B – Psychological Research: Analysis, Design and Measurement (prerequisite for students enrolling in PSYC307)

300 Level – Papers are worth 20 points unless specified.

**Compulsory papers**

- BIOL333B – Advanced Animal Behaviour
- BIOL338B – Advanced Zoology*
- PSYC314B – Behaviour Analysis

**Highly recommended papers**

- PSYC307A – Research Methods
- PSYC340A – Applied Cognitive Psychology (10 points)
- PSYC341B – Visual Neuroscience and its Applications (10 points)
- PSYC344A – Physiology of Human Potential and Development (10 points)
- BIOL310A – Advanced Genetics
- BIOL312A – Applied Terrestrial Ecology
- BIOL313B – Applied Freshwater Ecology
- BIOL314A – Marine Biology and Monitoring
- BIOL335A – Mammalian Physiology

*Please note that BIOL201 is one of the prerequisites for BIOL338, and it is strongly recommended that you take this paper.

**Note(s):** For descriptions of individual papers refer to the following paper codes in the Papers Section (page 84): BIOL Biological Sciences; CHEM Chemistry; ENVS Environmental Sciences; PSYC Psychology. For descriptions of papers with subject codes COMP, MATH or STAT, refer to the Computing & Mathematical Sciences Handbook or the 2015 University of Waikato Calendar. For descriptions of papers with the subject code PHIL refer to the Arts & Social Sciences Undergraduate Handbook or the 2015 University of Waikato Calendar.
BIOCHEMISTRY

Biochemistry is the explanation of life in chemical terms. It involves the study of proteins, lipids, carbohydrates and nucleic acids which are the fundamental molecules of life. Biochemists try to understand how these molecules interact in living organisms, in health and disease. Biochemistry is one of the fastest growing areas of modern science. By taking a combination of papers from both biological sciences and chemistry, students will gain a solid grounding in the molecular and chemical principles underlying biochemistry.

CONTACTS FOR BIOCHEMISTRY
This interdisciplinary major is jointly taught between Biological Sciences and Chemistry.

Convenor
Dr Ryan D Martinus
Room: E.3.08
Phone: 07 838 4375
Email: r.martinus@waikato.ac.nz

Biochemistry Interdisciplinary Major

<table>
<thead>
<tr>
<th>General Structure of a Biochemistry Interdisciplinary Major for the BSc and BSc(Tech) degrees</th>
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</thead>
<tbody>
<tr>
<td><strong>100 LEVEL</strong></td>
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<tr>
<td>BIOL101</td>
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<td>15 points</td>
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<tr>
<td><strong>200 LEVEL</strong></td>
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<tr>
<td>BIOL210</td>
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<td>20 points</td>
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<tr>
<td>100 Level – Recommended prerequisites: BIOL101 Cellular and Molecular Biology, and CHEM112 Chemical Reactivity</td>
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<td><strong>300 LEVEL</strong></td>
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<tr>
<td>BIOL310</td>
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<tr>
<td>20 points</td>
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<tr>
<td>200 Level – BIOL210 Introduction to Genetics, BIOL251 Biochemistry, CHEM212 Organic and Physical Chemistry 1.</td>
</tr>
<tr>
<td>300 Level – BIOL310 Advanced Genetics, BIOL351 Advanced Biochemistry, CHEM301 Advanced Organic Chemistry.</td>
</tr>
</tbody>
</table>

Specialisations
Students may undertake the following specialisations for the BSc and BSc(Tech) major in Biochemistry.

» Science International  page 73
» Te Pūtaiao me ngā take Māori  page 75
Choosing Papers

Biochemistry Interdisciplinary Major
To complete a major in Biochemistry, students must complete 120 points above 100 Level, including 60 points at 300 Level, from compulsory papers.

100 Level – Papers are worth 15 points.
Prerequisites
» BIOL101B – Cellular and Molecular Biology
» CHEM112B – Chemical Reactivity
Students are strongly advised to include the following papers:
» BIOL102A – The Biology of Organisms
» CHEM111A – Structure and Spectroscopy
» STAT111B – Statistics for Science OR
  STAT121A/S – Introduction to Statistical Methods

200 Level – Papers are worth 20 points unless specified.
Compulsory papers
» BIOL210B – Introduction to Genetics
» BIOL251A – Biochemistry
» CHEM212B – Organic and Physical Chemistry 1
Students are strongly advised to include the following paper:
» CHEM211A – Analytical and Inorganic Chemistry 1

300 Level – Papers are worth 20 points unless specified.
Compulsory papers
» BIOL310A – Advanced Genetics
» BIOL351B – Advanced Biochemistry
» CHEM301A – Advanced Organic Chemistry
Students are strongly advised to include the following papers:
» BIOL362C – Molecular Biology and Biotechniques
» CHEM306B – Advanced Analytical Chemistry

The remaining papers needed to complete the requirements for the BSc and BSc(Tech) degrees may come from other science subjects or papers from other faculties or schools.

Note(s): For descriptions of individual papers refer to the following paper codes in the Papers Section (page 84): BIOL Biological Sciences; CHEM Chemistry. For descriptions of papers with subject codes COMP, MATH or STATS, refer to the Computing & Mathematical Sciences Handbook or the 2015 University of Waikato Calendar.
BIOLOGICAL SCIENCES

The study of Biological Sciences is for those who love life. Whether you want to stand in a metre of mud, on top of a tree, under the sea or on a kilometre of Antarctic ice, biology is for you. Our students have many opportunities: they can be ecologists with interests in ecosystems, physiologists aiming to understand how organisms function, or geneticists using DNA as the key to identifying diseases of organisms. With biology as a great start to their career, our graduates have secured positions around the world, testimony to the international standing of our degrees.

Biological Sciences covers a wide range of specialist areas including animal behaviour, biochemistry, botany, ecology, marine biology, microbiology, physiology and zoology.

CONTACTS FOR BIOLOGICAL SCIENCES

School of Science Office
Room: F.1.07
Phone: 07 838 4022
Email: biology@waikato.ac.nz

First Year Mentor
Ms Brydget Tulloch
Room: R.1.06
Phone: 07 838 6542
Email: btulloch@waikato.ac.nz

Biological Sciences Major

| General Structure of a Biological Sciences Major for the BSc and BSc(Tech) degrees |
|-------------------------------------|-------------------------------------|
| **100 LEVEL**                      | **200 LEVEL**                      | **300 LEVEL**                      |
| **BIOL101** 15 points              | **BIOL2XX** 20 points               | **BIOL3XX** 20 points              |
| **BIOL102** 15 points              | **BIOL2XX** 20 points               | **BIOL3XX** 20 points              |

100 Level – Prerequisites: BIOL101 Cellular and Molecular Biology and BIOL102 The Biology of Organisms.

200 Level – At least 60 points at 200 Level Biological Sciences.

300 Level – At least 60 points at 300 Level Biological Sciences.
Specialisations
Students may undertake the following specialisations for the BSc and BSc(Tech) major in Biological Sciences.

» Restoration Ecology page 39
» Science International page 73
» Te Pūtaiao me ngā take Māori page 75

General Programmes
Students may undertake the following general programmes for the BSc and BSc(Tech) major in Biological Sciences. Please make an appointment with an adviser to discuss paper options for your selected General Programme.

» Animal Physiology
» Behavioural Ecology and Conservation
» Biochemistry
» Biomedical Sciences
» Botany
» Ecology
» Freshwater Biology
» Genetics
» Microbiology
» Plant Physiology
» Zoology

Choosing Papers
Entry into Biological Sciences Papers
Satisfactory completion of secondary study at Level 3 or higher on the NZQA framework in a relevant area is acceptable for admission to Biological Sciences papers. Students who do not have credits in NCEA Level 3 Biology are advised to discuss their options with the first-year student mentor. The bridging biology classes provide the prior knowledge required for studying first-year papers in Biology. Information on bridging options may be found in the Bridging Programme section.

In some cases, we are able to relax the rules relating to prerequisites. If you would particularly like to take a paper for which you have not satisfied a specified requirement, talk to the paper co-ordinator.
BIOLOGICAL SCIENCES

Biological Sciences Major
To complete a major in Biological Sciences, students must complete 120 points above 100 Level, including 60 points at 300 Level from Biological Sciences papers.

100 Level – Papers are worth 15 points.
Students wishing to major in Biological Sciences or a related field should take the two core papers:
Prerequisites
» BIOL101B – Cellular and Molecular Biology
» BIOL102A – The Biology of Organisms
You should also refer to the specialisations and general programmes that have been designed to allow Biological Sciences majors to develop themes in particular areas.

200 Level – Papers are worth 20 points unless specified.
Students intending to major in Biological Sciences are required to take at least 60 points from 200 Level Biological Sciences papers. Again, the specialisations and general programmes provide a good guide for students interested in particular areas.

300 Level – Papers are worth 20 points unless specified.
Students intending to major in Biological Sciences must also gain at least 60 points at 300 Level from the Biological Sciences papers offered. Please note that BIOL307 – Special Topic may not be counted toward a major at 300 Level.
The remaining papers needed to complete the requirements for the BSc and BSc(Tech) degrees may come from other science subjects or papers from other faculties or schools.

Refer to page 87 for Biological Sciences paper descriptions.
Biological Sciences Specialisations

Restoration Ecology

Restoration ecology is the study of restoring degraded, damaged or destroyed ecosystems through active human intervention. This specialisation is for students who wish to develop a career focussed on ecological restoration or conservation biology. With some 3,000 community-based restoration projects currently being undertaken in New Zealand, there is strong demand for graduates able to address key issues of this field.

Restoration Ecology may be taken as a specialisation of the Biological Sciences major for the BSc or BSc(Tech) degrees. For further information email restoration@waikato.ac.nz

Structure of the Restoration Ecology Specialisation

<table>
<thead>
<tr>
<th>100 LEVEL</th>
<th>BIOL101</th>
<th>BIOL102</th>
<th>ERTH103 or ERTH104</th>
<th>ENVS101</th>
<th>STAT121 or STAT111</th>
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<td>200 LEVEL</td>
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<td>BIOL 212</td>
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<td>BIOL 307</td>
<td>BIOL 312</td>
<td>BIOL 325</td>
<td>BIOL313 or BIOL314</td>
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100 Level – Papers are worth 15 points.

Major prerequisites

» BIOL101B – Cellular and Molecular Biology
» BIOL102A – The Biology of Organisms

Restoration ecology specialisation papers

» ENVS101B – Environmental Science
» STAT111B – Statistics for Science OR
  STAT121A/S – Introduction to Statistical Methods

Choose one of:

» ERTH103B – Discovering Planet Earth
» ERTH104A – Earth and Ocean Environments

Continued over page.
200 Level – Papers are worth 20 points unless specified.

Major papers
» BIOL201A – Evolution and Diversity of Life
» BIOL212A – Ecology
» BIOL226T – Flora of Aotearoa/New Zealand

Restoration ecology specialisation papers
» BIOL223B – Plant Biology and Ecology

300 Level – Papers are worth 20 points unless specified.

Major papers
» BIOL307A/B/C/Y – Special Topic
» BIOL312A – Applied Terrestrial Ecology
» BIOL325A – Plant Function

Restoration ecology specialisation papers
Choose one of:
» BIOL313B – Applied Freshwater Ecology
» BIOL314A – Marine Biology and Monitoring

*May be chosen from 200 or 300 Level papers.

The remaining papers needed to complete the requirements for the BSc and BSc(Tech) degrees may come from other science subjects or papers from other faculties or schools.

Note(s): For descriptions of individual papers refer to the following paper codes in the Papers Section (page 84): BIOL Biological Sciences; ENVS Environmental Sciences; ERTH Earth Sciences. For descriptions of papers with subject codes COMP, MATH or STATS, refer to the Computing & Mathematical Sciences Handbook. For papers with other subject codes refer to the 2015 University of Waikato Calendar.
BIOTECHNOLOGY

Biotechnology is the application of science and engineering to develop useful products from biological materials. Biotechnology is a very broad discipline, ranging from cloning to cheese making, and producing products from antibiotics to beer. This programme examines extraction, recovery, and purification of biochemicals from the meat, dairy, and other industries. It explores technological applications at the industrial level as well as the molecular level.

CONTACTS FOR BIOTECHNOLOGY
Biotechnology is jointly taught between Biological Sciences and Engineering.

Convenor
Professor Janis Swan
Room: E.G.04C
Phone: 07 838 4049
Email: j.swan@waikato.ac.nz

Biotechnology Interdisciplinary Major

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<thead>
<tr>
<th>General Structure of a Biotechnology Interdisciplinary Major for the BSc and BSc(Tech) degrees</th>
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<tbody>
<tr>
<td><strong>100 LEVEL</strong></td>
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<td><strong>200 LEVEL</strong></td>
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<td>BIOL or ENMP*</td>
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<tr>
<td><strong>300 LEVEL</strong></td>
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<td>BIOL or ENMP**</td>
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**100 Level** – Recommended prerequisites: BIOL101 Cellular and Molecular Biology, CHEM112 Chemical Reactivity, and one of: ENGG180 Foundations of Engineering or ENMP102 Introduction to Materials Science and Engineering.

**200 Level** – *Choose from: BIOL241 Microbiology: Form, Function and Metabolism, BIOL251 Biochemistry, ENMP221 Engineering Thermodynamics, and ENMP222 Biotechnology: Food and Bioresources.

**300 Level** – **Choose from: BIOL341 Microbial Physiology and Ecology, BIOL351 Advanced Biochemistry, ENMP321 Process Engineering and Design, and ENMP322 Biotechnology.

Specialisations
Students may undertake the following specialisations for the BSc and BSc(Tech) major in Biotechnology.

- Science International
- Te Pūtaiao me ngā take Māori
Choosing Papers

Biotechnology Interdisciplinary Major

To complete a major in Biotechnology, students must complete 120 points above 100 Level, including 60 points at 300 Level, from the below papers.

100 Level – Papers are worth 15 points.

Prerequisites

» BIOL101B – Cellular and Molecular Biology
» CHEM112B – Chemical Reactivity
And at least one of:
» ENGG180A – Foundations of Engineering
» ENMP102B – Introduction to Materials Science and Engineering

Students are strongly advised to include some of the following papers

» BIOL102A – The Biology of Organisms
» CHEM111A – Structure and Spectroscopy
» MATH101A/B/S – Introduction to Calculus OR MATH102A/B – Introduction to Algebra
» MATH165A/B – General Mathematics
» STAT111B – Statistics for Science OR STAT121A/S – Introduction to Statistical Methods

200 Level – Papers are worth 20 points unless specified.

*Choose 60 points from:

» BIOL241A – Microbiology: Form, Function and Metabolism
» BIOL251A – Biochemistry
» ENMP221A – Engineering Thermodynamics
» ENMP222 – Biotechnology: Food and Bioresources†

Recommended papers

» BIOL210B – Introduction to Genetics
» ENMP241B – Environmental Technology 1

300 Level – Papers are worth 20 points unless specified.

*Choose 60 points from:

» BIOL341B – Microbial Physiology and Ecology
» BIOL351B – Advanced Biochemistry
» ENMP321B – Process Engineering and Design
» ENMP322 – Biotechnology†

Recommended papers

» BIOL362C – Molecular Biology and Biotechniques
» ENMP341A – Environmental Technology 2

The remaining papers needed to complete the requirements for the BSc and BSc(Tech) degrees may come from other science subjects or papers from other faculties or schools.

† Not offered in 2015.

Note(s): For descriptions of individual papers refer to the following paper codes in the Papers Section (page 84): BIOL Biological Sciences; CHEM Chemistry; ENGG Engineering; ENMP Materials and Processing. For descriptions of papers with subject codes COMP, MATH or STATS, refer to the Computing & Mathematical Sciences Handbook or the 2015 University of Waikato Calendar.
Chemistry is the central science and is an integral part of the study required for biochemistry, environmental sciences, Earth sciences, biological sciences and more. At Waikato University we pride ourselves on the quality and extent of the practical experience that our students receive while studying. As a result our graduates are sought after for both their hands-on bench and modern instrumentation skills and their theoretical excellence. Waikato chemistry graduates can expect to find employment in fields ranging from food technology to environmental monitoring.

Knowledge of basic chemical principles is important in all branches of science and for a wide range of industries. Better building materials and textiles, improved medical aids, new alloys, more productive agriculture, better environmental control – all rely on chemical expertise. The basic understanding of how substances are interrelated and transformed provides the framework upon which the other observational sciences are built. The School of Science covers a wide range of specialist areas including the interface between chemistry and the other sciences, such as analytical chemistry, geochemistry, environmental chemistry, forensic science, industrial chemistry, materials chemistry and biochemistry. Chemistry forms a major growth area in modern science for both research and employment.

CONTACTS FOR CHEMISTRY

<table>
<thead>
<tr>
<th>School of Science Office</th>
<th>Room: F.1.07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone: 07 838 4027</td>
<td></td>
</tr>
<tr>
<td>Email: <a href="mailto:chemistry@waikato.ac.nz">chemistry@waikato.ac.nz</a></td>
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<table>
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<th>Undergraduate Convenor</th>
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<tr>
<td>Associate Professor</td>
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<tr>
<td>Room: E.3.19</td>
</tr>
<tr>
<td>Phone: 07 838 4384</td>
</tr>
<tr>
<td>Email: <a href="mailto:manleyha@waikato.ac.nz">manleyha@waikato.ac.nz</a></td>
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<th>First Year Mentor</th>
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<tr>
<td>Phone: 07 838 8549</td>
</tr>
<tr>
<td>Email: <a href="mailto:j.lane@waikato.ac.nz">j.lane@waikato.ac.nz</a></td>
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CHEMISTRY

Chemistry Major

General Structure of a Chemistry Major for the BSc and BSc(Tech) degrees

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<td>CHEM111</td>
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<td>CHEM114</td>
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<tr>
<td>10 points</td>
<td>10 points</td>
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</tbody>
</table>

100 Level – Prerequisites: CHEM111 Structure and Spectroscopy and CHEM112 Chemical Reactivity.

200 Level – At least 60 points at 200 Level Chemistry.

300 Level – At least 60 points at 300 Level Chemistry.

Specialisations

Students may undertake the following specialisations for the BSc and BSc(Tech) major in Chemistry.

» Science International page 73
» Te Pūtaiao me ngā take Māori page 75

Choosing Papers

Entry into Chemistry Papers – Chemistry Major

The normal entry level to 100 Level Chemistry papers is 16 credits at NCEA Level 3 or higher in chemistry. Students may also be admitted at the discretion of the Undergraduate Convenor, on a case by case basis. Discretionary entry may be available to mature students who can show prior learning/work experience in chemistry. These may either be the Certificate of University Preparation (page 83) or, if you have some chemistry background, Science Foundation (page 81). If you are considering either of these options, we strongly recommend that you seek advice from staff in the Dean’s Office of the Faculty of Science & Engineering.

Entry into CHEM100

Students who require some chemistry background for a major other than Chemistry, should consider taking CHEM100 – Chemistry in Context. The entry prerequisite for this paper is NCEA Level 1 Science.
Chemistry Major
To complete a major in Chemistry, students must complete 120 points above 100 Level, including 60 points above 200 Level from compulsory chemistry papers.

Please note that a new chemistry curriculum is currently being phased in. The new 100 and 200 Level papers have now been implemented and 2015 will be the last year that the current 300 Level papers will be offered. In 2016 a new set of 300 Level papers will be offered with the same structure as the current 200 Level papers.

100 Level – Papers are worth 15 points
Students intending to major in Chemistry or a related field should choose the two core papers:

Prerequisites
» CHEM111A – Structure and Spectroscopy
» CHEM112B – Chemical Reactivity

200 Level – Papers are worth either 10 or 20 points
Students intending to major in Chemistry are required to take at least 60 points from 200 Level Chemistry papers, including the following compulsory papers:

» CHEM211A – Analytical and Inorganic Chemistry 1 (20 points)
» CHEM212B – Organic and Physical Chemistry 1 (20 points)
» CHEM213A – Analytical and Inorganic Chemistry Laboratory 1 (10 points)
» CHEM214B – Physical and Organic Chemistry Laboratory 1 (10 points)

300 Level – Papers are worth either 10 or 20 points
Students intending to major in Chemistry in 2015 are required to take at least 60 points from the following 300 Level Chemistry papers:

» CHEM301A – Advanced Organic Chemistry (20 points)
» CHEM302A – Advanced Physical Chemistry (20 points)
» CHEM303B – Advanced Inorganic Chemistry (20 points)
» CHEM306B – Advanced Analytical Chemistry (20 points)

In 2016, students intending to major in Chemistry will be required to take at least 60 points from 300 Level Chemistry papers including the following compulsory papers:

» CHEM311A – Analytical and Inorganic Chemistry 2 (20 points)
» CHEM312B – Organic and Physical Chemistry 2 (20 points)
» CHEM313A – Analytical and Inorganic Chemistry Laboratory 2 (10 points)
» CHEM314B – Physical and Organic Chemistry Laboratory 2 (10 points)

The remaining papers needed to complete the requirements for the BSc and BSc(Tech) degrees may come from other science subjects or papers from other faculties or schools.
An understanding of Earth Sciences is essential if we are to sustainably manage the Earth’s energy, water, mineral, soil and coastal resources. The Earth sciences are also the key to predicting and mitigating natural hazards such as floods, earthquakes, tsunami, landslides and volcanic eruptions. Earth Sciences at the University of Waikato include study of coastal and marine science, climate change, soil science, hydrology, volcanology, sedimentary geology and engineering geology. Our graduates in Earth Sciences go on to a diverse range of careers in environmental and resource management as well as research.

We are situated close to both North Island coasts, a short drive from the active Taupo Volcanic Zone, at the heart of the most productive New Zealand farming region, and have New Zealand’s longest river at our doorstep. The teaching programme provides an opportunity for students in their first year to develop a broad understanding of Earth’s systems, and then in following years to increase the depth of their studies to include topics such as sedimentary geology, soil science and land management, hydrology and water resource management, meteorology, oceanography, volcanology, coastal marine science, engineering geology, georesource exploration, global environmental change, environmental monitoring and management, and natural hazards.

Earth Sciences at Waikato includes and builds upon physical geography.

We offer a learning experience that goes beyond the laboratory and lecture room – out into the world.

CONTACTS FOR EARTH SCIENCES

<table>
<thead>
<tr>
<th>School of Science Office</th>
<th>Room: F.1.07</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Phone: 07 838 4024</td>
</tr>
<tr>
<td></td>
<td>Email: <a href="mailto:earth@waikato.ac.nz">earth@waikato.ac.nz</a></td>
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<thead>
<tr>
<th>Undergraduate Co-ordinator</th>
<th>Room: E.2.06</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr Adrian Pittari</td>
<td>Phone: 07 838 4191</td>
</tr>
<tr>
<td></td>
<td>Email: <a href="mailto:apittari@waikato.ac.nz">apittari@waikato.ac.nz</a></td>
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<table>
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<tr>
<th>First Year Mentor</th>
<th>Room: E.1.09</th>
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<tbody>
<tr>
<td>Dr Hazel Needham</td>
<td>Phone: 07 838 4383</td>
</tr>
<tr>
<td></td>
<td>Email: <a href="mailto:hneedham@waikato.ac.nz">hneedham@waikato.ac.nz</a></td>
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Earth Sciences Major

General Structure of an Earth Sciences Major for the BSc and BSc(Tech) degrees

<table>
<thead>
<tr>
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<td>Discovering Planet Earth</td>
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<tr>
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<td>ERTH104</td>
<td>Earth and Ocean Environments</td>
<td>15</td>
</tr>
<tr>
<td>200</td>
<td>ERTH2XX</td>
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<tr>
<td>300</td>
<td>ERTH3XX</td>
<td>20 points</td>
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</table>

100 Level – Prerequisites: ERTH103 Discovering Planet Earth and ERTH104 Earth and Ocean Environments.

200 Level – At least 60 points at 200 Level Earth Sciences.

300 Level – At least 60 points at 300 Level Earth Sciences.

Specialisations
Students may undertake the following specialisations for the BSc and BSc(Tech) major in Earth Sciences.

» Science International page 73
» Te Pūtaiao me ngā take Māori page 75

General Programmes
Students may undertake the following general programmes for the BSc or BSc(Tech) major in Earth Sciences. Please make an appointment with an adviser to discuss paper options for your selected General Programme.

» Coastal Science
» Engineering Geology
» Environmental Engineering Science
» Hydrology and Water Resources
» Natural Hazards
» Geology: Resources and Hazards
» Soil and Land Resources
Choosing Papers

Entry into Earth Sciences Papers
There are no formal prerequisites for admission to 100 Level Earth Sciences papers. You will, however, be best prepared if you have taken any of biology, chemistry or geography at least through to NCEA Level 2.

In some cases, we are able to relax the rules relating to prerequisites. If you would particularly like to take a paper for which you have not satisfied a specified requirement, please come and speak to Earth Sciences staff about possible options.

Earth Sciences Major
To complete a major in Earth Sciences, students must complete 120 points above Level 100, including 60 points above Level 200 from compulsory Earth Sciences papers.

100 Level – Papers are worth 15 points.
Students wishing to major in Earth Sciences or a related field should choose the two core papers.

Prerequisites
» ERTH103B – Discovering Planet Earth
» ERTH104A – Earth and Ocean Environments

200 Level – Papers are worth either 10 or 20 points.
Choose at least 60 points at 200 Level in Earth Sciences papers.

300 Level – Papers are worth either 10 or 20 points.
Choose at least 60 points at 300 Level in Earth Sciences papers.

The remaining papers needed to complete the requirements for the BSc and BSc(Tech) degrees may come from other science subjects or papers from other faculties or schools.

Refer to page 99 for Earth Sciences paper descriptions.
ELECTRONICS

Electronics is the science and technology concerned with the controlled flow of electrons and other carriers of electric charge. Papers cover theory, design, and construction of electronic devices, circuits, instruments, or systems.

The Electronic Engineering programme is available in the Bachelor of Engineering (Honours) degree. See page 15 for more details. Papers in electronics are available at all levels of study from undergraduate degrees through to postgraduate and doctoral studies. See page 107 for details of electronics papers.

CONTACTS FOR ELECTRONICS
Electronics is administered by the School of Engineering.

<table>
<thead>
<tr>
<th>Convenor</th>
<th>Room: CD.1.02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associate Professor</td>
<td>Phone: 07 838 4630</td>
</tr>
<tr>
<td>Rainer Künnemeyer</td>
<td>Email: <a href="mailto:rainer@waikato.ac.nz">rainer@waikato.ac.nz</a></td>
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</table>

Electronics Major

General Structure of an Electronics Major for the BSc and BSc(Tech) degrees

| 100 LEVEL | ENEL111 15 points |
| 200 LEVEL | ENEL205 20 points  |
|           | ENEL212 10 points  |
|           | ENEL2XX 10 points  |
| 300 LEVEL | * 20 points  |
|           | * 20 points  |
|           | * 20 points  |

100 Level – Prerequisites: ENEL111 Introduction to Electronics. Recommended: PHYS103 Physics for Scientists and Engineers, COMP103 Introduction to Computer Science 1, MATH101 Introduction to Calculus, MATH102 Introduction to Algebra.


300 Level – 60-80 points at Level 300 Electronics.

Specialisations
Students may undertake the following specialisations for the BSc and BSc(Tech) major in Electronics.

» Science International page 73
» Te Pūtaiao me ngā take Māori page 75
ELECTRONICS

Choosing Papers

Electronics Major
To complete a major in Electronics, students must complete 120 points above 100 Level, including at least 60 points above 200 Level in electronics papers.

100 Level – Papers are worth 15 points.
The following papers are recommended to fulfil prerequisites for 200 and 300 Level papers:

Prerequisites
» ENEL111A – Introduction to Electronics
To fulfil prerequisites for other 200 and 300 Level electronics papers, you are highly recommended to also enrol in:
» PHYS103B – Physics for Scientists and Engineers 1
» MATH101A/B/S – Introduction to Calculus
» MATH102A/B – Introduction to Algebra
» COMP103A/B – Introduction to Computer Science 1

Please take care when choosing 100 Level papers as many are required as prerequisites for 200 and 300 Level papers. Failure to complete prerequisites will limit your paper choices.

200 Level – Papers are worth 20 points unless specified.
Choose a further 40 to 60 points at 200 Level Electronics.

Compulsory papers
» ENEL205B – Analog Electronics and Circuit Analysis
» ENEL212A – Electronics for Digital Systems (10 points)

Optional papers
» ENEL213A – Instrumentation (10 points)
» ENEL284B – Electricity and Magnetism (10 points)
» ENEL285A – Quantum and Solid State Physics (10 points)
» COMP200A – Computer Systems (10 points)

300 Level – Papers are worth 20 points unless specified.
Choose a further 60 to 80 points from 300 Level electronics papers to give a total of 120 points at Level 200 and above:

*Choose from:
» COMP311 – Computer Systems Architecture †
» ENEL301A/B/C/Y – Special Topics in Electronics
» ENEL312A – Electromagnetic Waves
» ENEL317B – Microprocessor Applications and Control
» ENEL321B – Application Specific Integrated Circuits
» ENEL324A – Optoelectronics
» ENEL382B – High Speed Communications
» ENEL385B – Power Electronics

† Not offered in 2015.

Refer to page 106 for Electronics paper descriptions.

The remaining papers needed to complete the requirements for the BSc and BSc(Tech) degrees may come from other science subjects or papers from other faculties or schools.
ENVIRONMENTAL PLANNING

The core components of Environmental Planning at the University of Waikato are the interdisciplinary study of planning process and ethics, planning frameworks, environmental impact assessment, and the relationship of people to the environment, with emphasis on the importance of the scientific aspects of environmental planning.

The major’s distinctive core of planning and science facilitates in breaking down traditional barriers between physical science and planning and policy making, producing graduates with skills that are valued by employers in local and central government, environmental consulting and policy development.

CONTACTS FOR ENVIRONMENTAL PLANNING

Environmental Planning is jointly taught between the Faculty of Arts & Social Sciences and the Faculty of Science & Engineering. Students who wish to complete a BSc or BSc(Tech) degree can contact the Faculty of Science & Engineering Registrar for further information.

Students who wish to complete a BSocSc or BEP degree should consult the Faculty of Arts & Social Sciences Handbook for details.

Environmental Planning Interdisciplinary Major

General Structure of an Environmental Planning Interdisciplinary Major for the BSc and BSc(Tech) degrees.

<table>
<thead>
<tr>
<th>100 LEVEL</th>
<th>200 LEVEL</th>
<th>300 LEVEL</th>
<th>100 Level</th>
<th>200 Level</th>
<th>300 Level</th>
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<td>GEOG103 or ENVP106</td>
<td>ERTH103 or ERTH104</td>
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<td>20 points</td>
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<td>ENVP206</td>
<td>ERTH2*</td>
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<td>ENVP306</td>
<td>ERTH3***</td>
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100 Level – Recommended Prerequisites: Choose one of: GEOG103 Resources and Environmental Sustainability, or ENVP106 Introduction to Environmental Planning. Choose one of: BIOL102 The Biology of Organisms or ENVS101 Environmental Science. Choose one of: ERTH103 Discovering Planet Earth or ERTH104 Earth and Ocean Environments.


Specialisations

Students may undertake the following specialisations for the BSc or BSc(Tech) major in Environmental Planning.

» Science International

» Te Pūtaiao me ngā take Māori

【Page】

51
ENVIROMENTAL PLANNING

Choosing Papers

Environmental Planning Interdisciplinary Major
To complete a major in Environmental Planning, students must complete 120 points above 100 Level, including 60 points at 300 Level, from compulsory papers.

100 Level – Papers are worth 15 points.

Prerequisites
Choose:
  » ENVP106A – Introduction to Environmental Planning

Choose one of:
  » BIOL102A – The Biology of Organisms
  » ENVS101B – Environmental Science

Choose one of:
  » ERTH103B – Discovering Planet Earth
  » ERTH104A – Earth and Ocean Environments

200 Level – Papers are worth 20 points unless specified.

Compulsory papers
  » BIOL212A – Ecology
  » ENVP206A – Principles of Environmental Planning

*Choose 20 points from the following 200 Level Earth Sciences papers:
  » ERTH221B – Earth Materials and Processes
  » ERTH222A – Stratigraphy, Structure and Field Methods
  » ERTH233A – Soils in the Landscape (10 points)
  » ERTH234A – Soil Properties and their Management (10 points)
  » ERTH242B – Oceanography
  » ERTH245A – Weather and Climate (10 points)
  » ERTH246B – Introduction to Hydrology (10 points)
  » ERTH251B – Engineering Geomorphology (10 points)
  » ERTH284B – Introduction to Environmental Monitoring (10 points)

300 Level – Papers are worth 20 points unless specified.

Compulsory papers
  » ENVP306A – Planning in Aotearoa/New Zealand

**Choose 20 points from the following 300 Level Biological Sciences papers:
  » BIOL312A – Applied Terrestrial Ecology
  » BIOL313B – Applied Freshwater Ecology
  » BIOL314A – Marine Biology and Monitoring

***Choose 20 points from the following 300 Level Earth Sciences papers:
  » ERTH322B – Sedimentary and Petroleum Geology
  » ERTH333A – Pedology and Land Evaluation (10 points)
  » ERTH334B – Soil and Land Management (10 points)
  » ERTH343B – Coastal Geomorphology and Management
  » ERTH344A – Coastal Oceanography and Engineering
  » ERTH345A – Catchment Hydrology (10 points)
  » ERTH346B – Freshwater Resources and Hazards (10 points)
  » ERTH352A – Engineering Geology (10 points)
  » ERTH384B – Advanced Environmental Monitoring (10 points)

Recommended elective paper
  » ENVP307B – Planning for Sustainability
  » ENVP308B – Planning methods (restricted against ERTH284 – Environmental Monitoring)
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<th>ENVIRONMENTAL PLANNING</th>
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**Level 200 Core Papers**

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**Level 300 Core Papers**

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The remaining papers needed to complete the requirements for the BSc and BSc(Tech) degrees may come from other science subjects or papers from other faculties or schools.

**Note(s):** For descriptions of individual papers refer to the following paper codes in the Papers Section (page 84): BIOL Biological Sciences; ENVS Environmental Sciences; ERTH Earth Sciences. For papers with other subject codes refer to the 2015 University of Waikato Calendar.
If we are to achieve environmental sustainability, we need to understand how the environment works and ensure we leave the world in a healthy functioning state for future generations.

Environmental Sciences at the University of Waikato is the interdisciplinary and systematic study of our environment as well as our role in its management. Pressures and impacts on our environment are increasing as the human population grows and we seek to utilise natural resources in ever increasing amounts.

Environmental science can provide the scientific basis for understanding environmental problems, and finding solutions to them. By studying environmental science and becoming qualified to work as an environmental scientist or technician, you can become directly involved in solving our environmental problems. A comprehensive understanding of environmental science is also necessary for those entering industries, consulting companies, and government agencies to ensure that they wisely manage the resources.

**CONTACTS FOR ENVIRONMENTAL SCIENCES**

Environmental Sciences is jointly taught between Biological Sciences, Chemistry and Earth Sciences.

**Convenor**

Room: E.2.13

Associate Professor Karin Bryan

Phone: 07 838 4123

Email: k.bryan@waikato.ac.nz

### Environmental Sciences Interdisciplinary Major

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**100 Level** — Recommended prerequisites: BIOL102 The Biology of Organisms and ERTH104 Earth and Ocean Environments.


**300 Level** — **Choose from: BIOL312 Applied Terrestrial Ecology, BIOL313 Applied Freshwater Ecology, and BIOL314 Marine Biology and Monitoring, **Choose from: ERTH333 Pedology and Land Evaluation, ERTH334 Soil and Land Management, ERTH343 Coastal Geomorphology and Management, ERTH344 Coastal Oceanography and Engineering ERTH345 Catchment Hydrology, and ERTH346 Freshwater Resources and Hazards. **Choose from the 300 Level papers listed above or CHEM361 Applied Environmental Geochemistry.
Specialisations
Students may undertake the following specialisations for the BSc or BSc(Tech) major in Environmental Sciences.

» Environmental Microbiology  
   » Environmental Modelling  
   » Land and Freshwater Environments  
   » Marine Sciences  
   » Science International  
   » Te Pūtaiao me ngā take Māori

Choosing Papers

Environmental Sciences Interdisciplinary Major
To complete a major in Environmental Sciences, students must complete 120 points above 100 Level, including 60 points about 200 Level, from compulsory papers.

100 Level – Papers are worth 15 points.

Prerequisites

» BIOL102A – The Biology of Organisms
» ERTH104A – Earth and Ocean Environments

Students are strongly advised to consider taking some of the following papers

» CHEM100A – Chemistry in Context OR
   CHEM111A – Structure and Spectroscopy
» ERTH103B – Discovering Planet Earth
» ENVS101B – Environmental Science
» GEOG103A – Resource and Environmental Sustainability
» MATH165A/B – General Mathematics
» STAT111B – Statistics for Science OR
   STAT121A/S – Introduction to Statistical Methods
ENVIRONMENTAL SCIENCES

200 Level – Papers are worth 20 points unless specified.
Students should seek advice when selecting 200 Level papers to ensure they select appropriate papers to cover prerequisites for the 300 Level papers they may wish to pursue.

Compulsory papers
» BIOL212A – Ecology
*Choose a further 40 points from:
» CHEM261B – Environmental Chemistry and Geochemistry
» ERTH233A – Soils in the Landscape (10 points)
» ERTH234A – Soil Properties and their Management (10 points)
» ERTH242B – Oceanography
» ERTH245A – Weather and Climate (10 points)
» ERTH246B – Introduction to Hydrology (10 points)

Students are strongly advised to consider taking further papers from the list above.
Other papers to consider including are any other ERTH or BIOL papers, or:
» CHEM211A – Analytical and Inorganic Chemistry 1
» ENMP241B – Environmental Technology 1
» ENVP206A – Principles of Environmental Planning
» ERTH251B – Engineering Geomorphology
» ERTH284B – Introduction to Environmental Monitoring
» GEOG219A – Māori Lands and Communities
» GEOG228A – Information Technology and Cartography

300 Level – Papers are worth 20 points unless specified.
**Choose 20 points from the following 300 Level Biological Sciences papers
» BIOL312A – Applied Terrestrial Ecology
» BIOL313B – Applied Freshwater Ecology
» BIOL314A – Marine Biology and Monitoring

***Choose 20 points from the following 300 Level Earth Sciences papers:
» ERTH333A – Pedology and Land Evaluation (10 points)
» ERTH334B – Soil and Land Management (10 points)
» ERTH343B – Coastal Geomorphology and Management
» ERTH344A – Coastal Oceanography and Engineering
» ERTH345A – Catchment Hydrology (10 points)
» ERTH346B – Freshwater Resources and Hazards (10 points)

****Choose a further 20 points from the 300 Level papers listed above or CHEM361A – Applied Environmental Geochemistry.

Students are strongly advised to consider taking further papers from the lists above.
Other papers to consider including are any other ERTH or BIOL papers, or:
» CHEM306B – Advanced Analytical Chemistry
» ENMP341A – Environmental Technology 2
» GEOG306A – Disasters and Developments
» GEOG328B – Geographical Information Systems

The remaining papers needed to complete the requirements for the BSc and BSc(Tech) degrees may come from other science subjects or papers from other faculties or schools.

Note(s): For descriptions of individual papers refer to the following paper codes in the Papers Section (page 84): BIOL Biological Sciences; CHEM Chemistry; ENMP Materials and Processing; ENVS Environmental Sciences; ERTH Earth Sciences. For papers with other subject codes refer to the 2015 University of Waikato Calendar.
Environmental Sciences Specialisations

The Faculty of Science & Engineering has a strong environment-related focus with a range of specialisations for students interested in pursuing careers in environmental management, environmental planning, environmental engineering, and research related to the environment. These programmes draw on a range of subject areas including biology, chemistry, Earth sciences, engineering, geography, mathematics and physics.

Environmental Microbiology

Environmental microbiology focuses on the understanding and manipulation of microbial pathways that influence the natural environment. Students will gain an understanding of the important role microorganisms play in underpinning the environmental process, their role in nutrient and carbon cycling and their importance in bioremediation, soil fertility, eutrophication and waste disposal.

Environmental microbiology may be taken as a specialisation of the Environmental Sciences major for the BSc or BSc(Tech) degrees.

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**100 Level – Papers are worth 15 points.**

*Major prerequisites*

» BIOL102A – The Biology of Organisms
» ERTH104A – Earth and Ocean Environments

*Environmental microbiology specialisation papers*

» BIOL101B – Cellular and Molecular Biology
» CHEM112B – Chemical Reactivity
» ERTH103B – Discovering Planet Earth

*Recommended science/elective papers*

» CHEM111A – Structure and Spectroscopy
» ENVS101B – Environmental Science
ENVIRONMENTAL SCIENCES

200 Level – Papers are worth 20 points unless specified.

**Major papers**
- BIOL212A – Ecology
- ERTH233A – Soils in the Landscape (10 points)
- ERTH234A – Soil Properties and their Management (10 points)
- CHEM261B – Environmental Chemistry and Geochemistry

*Environmental microbiology specialisation papers*
- BIOL210B – Introduction to Genetics
- BIOL241A – Microbiology – Form, Function and Metabolism

**Recommended elective papers**
- BIOL251A – Biochemistry
- ERTH242B – Oceanography
- ERTH245A – Weather and Climate
- ERTH246B – Introduction to Hydrology

300 Level – Papers are worth 20 points unless specified.

**Major papers**
- BIOL312A – Applied Terrestrial Ecology
- ERTH333A – Pedology and Land Evaluation (10 points)
- ERTH334B – Soil and Land Management (10 points)

*Choose 20 points from the following papers:
- BIOL313B – Applied Freshwater Ecology
- BIOL314A – Marine Biology and Monitoring
- CHEM304A/B/C/S/Y – Special Topics in Chemistry
  (in an approved environmental chemistry topic)
- ERTH343B – Coastal Geomorphology and Management
- ERTH344A – Coastal Oceanography and Engineering
- ERTH345A – Catchment Hydrology (10 points)
- ERTH346B – Freshwater Resources and Hazards (10 points)

*Environmental microbiology specialisation papers*
- BIOL341B – Microbial Physiology and Ecology

**Recommended science/elective papers**
- BIOL310A – Advanced Genetics
- BIOL351B – Advanced Biochemistry
- BIOL362C – Molecular Biology and Biotechniques

**Note(s):** For descriptions of individual papers refer to the following paper codes in the Papers Section (page 84): BIOL Biological Sciences; CHEM Chemistry; ENVS Environmental Sciences; ERTH Earth Sciences. For papers with other subject codes refer to the 2015 University of Waikato Calendar.
Environmental Modelling

Environmental modelling focuses on the quantitative skills necessary to write and operate computer models necessary to predict future environmental change, to investigate human impacts on natural ecosystems, and how to manage and mitigate those impacts. This specialisation is for students who want to be able to model dynamics of estuaries, lakes, rivers, and coastlines, waves and ocean currents, and predict sediment movement on the continental shelf and estuaries; as well as to understand principles of environmental modelling.

Environmental Modelling may be taken as a specialisation of the Environmental Sciences major for the BSc or BSc(Tech) degrees.

### Structure of the Environmental Modelling Specialisation

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* May be chosen from 200 or 300 Level papers.

100 Level – Papers are worth 15 points.

**Major prerequisites**
- BIOL102A – The Biology of Organisms
- ERTH104A – Earth and Ocean Environments

**Environmental modelling specialisation papers**
- COMP103A – Introduction to Computer Science 1
- MATH101A/B/S – Introduction to Calculus
- MATH102A/B – Introduction to Algebra
- STAT111B – Statistics for Science OR STAT121A/S – Introduction to Statistical Methods
ENVIRONMENTAL SCIENCES

200 Level – Papers are worth 20 points unless specified.

Major papers
» BIOL212A – Ecology
*Choose 40 points from the following papers:
» CHEM261B – Environmental Chemistry and Geochemistry
» ERTH242B – Oceanography
» ERTH245A – Weather and Climate (10 points)
» ERTH246B – Introduction to Hydrology (10 points)

Environmental modelling specialisation papers
» MATH259B – Mathematical Modelling (10 points)
» STAT221A – Statistical Data Analysis
**Choose 10 points from:
» MATH255B – Differential Equations (10 points)
» ENGG284B – Differential Equations for Engineers (10 points)

Recommended elective papers
» ENGG283A – Linear Algebra for Engineers (10 points)
» ENGG285A – Multivariable Calculus for Engineers (10 points)
» GEOG228A – Information Technology and Cartography
» MATH251A – Multivariable Calculus (10 points)
» MATH253A – Linear Algebra (10 points)
» MATH257A – Computational Mathematics (10 points)

300 Level – Papers are worth 20 points unless specified.

Major papers
***Choose 20 points from the following 300 Level Biological Sciences papers:
» BIOL312A – Applied Terrestrial Ecology
» BIOL313B – Applied Freshwater Ecology
» BIOL314A – Marine Biology and Monitoring
****Choose 20 points from the following 300 Level Earth Sciences papers:
» ERTH333A – Pedology and Land Evaluation (10 points)
» ERTH334B – Soil and Land Management (10 points)
» ERTH343B – Coastal Geomorphology and Management
» ERTH344A – Coastal Oceanography and Engineering
» ERTH345A – Catchment Hydrology (10 points)
» ERTH346B – Freshwater Resources and Hazards (10 points)
*****Choose a further 20 points from the 300 Level Biological Sciences or Earth Sciences papers listed above or
» CHEM361A – Applied Environmental Geochemistry
(in an approved environmental chemistry topic)

Recommended elective papers
» GEOG328B – Geographic Information Systems
» MATH331B – Methods of Applied Mathematics

The remaining papers needed to complete the requirements for the BSc and BSc(Tech) degrees may come from other science subjects or papers from other faculties or schools.

Note(s): For descriptions of individual papers refer to the following paper codes in the Papers Section (page 84): BIOL Biological Sciences; CHEM Chemistry; ENGG Engineering; ENMP Materials and Processing; ENVNS Environmental Sciences; ERTH Earth Sciences. For descriptions of papers with subject codes COMP, MATH or STATS, refer to the Computing & Mathematical Sciences Handbook. For papers with other subject codes refer to the 2015 University of Waikato Calendar.
**Land and Freshwater Environments**

This specialisation is for students with interests in the management of land and water resources and approaches to mitigate adverse impacts. Specific areas include soil management, water quality and nutrient dynamics. Students will gain a combination of biological and earth science skills and theory to allow a broad understanding of terrestrial and aquatic environments, and the links between biophysical processes to ecosystem dynamics.

Land and Freshwater Environments may be taken as a specialisation of the Environmental Sciences major for the BSc or BSc(Tech) degrees.

### Structure of the Land and Freshwater Environments Specialisation

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</table>

*May be chosen from 200 or 300 Level papers.*

**100 Level – Papers are worth 15 points.**

**Major prerequisites**

- BIOL102A – The Biology of Organisms
- ERTH104A – Earth and Ocean Environments

**Land and freshwater environments specialisation papers**

- BIOL101B – Cellular and Molecular Biology
- CHEM111A – Structure and Spectroscopy
- ERTH103B – Discovering Planet Earth
- STAT111A/B – Statistics for Science OR STAT121A/S – Introduction to Statistical Methods

**Recommended science/elective papers**

- CHEM112B – Chemical Reactivity
- ENVS101B – Environmental Science
ENVIRONMENTAL SCIENCES

200 Level – Papers are worth 20 points unless specified.

Major papers
» BIOL212A – Ecology
» ERTH233A – Soils in the Landscape (10 points)
» ERTH234A – Soil Properties and their Management (10 points)
» ERTH245A – Weather and Climate (10 points)
» ERTH246B – Introduction to Hydrology (10 points)

Land and freshwater environments specialisation papers
» CHEM261B – Environmental Chemistry and Geochemistry

Recommended elective papers
» BIOL241A – Microbiology – Form, Function and Metabolism
» BIOL251A – Biochemistry
» CHEM211A – Analytical and Inorganic Chemistry 1
» ERTH222A – Stratigraphy, Structure and Field Methods
» GEOG228A – Information Technology and Cartography

300 Level – Papers are worth 20 points unless specified.

Major papers
» BIOL313B – Applied Freshwater Ecology
» ERTH333A – Pedology and Land Evaluation (10 points)
» ERTH334B – Soil and Land Management (10 points)
» ERTH345A – Catchment Hydrology (10 points)
» ERTH346B – Freshwater Resources and Hazards (10 points)

Land and freshwater environments specialisation papers
» BIOL312A – Applied Terrestrial Ecology

Recommended science/elective papers
» BIOL351B – Advanced Biochemistry
» ERTH384B – Advanced Environmental Monitoring (10 points)
» GEOG328B – Geographic Information Systems

The remaining papers needed to complete the requirements for the BSc and BSc(Tech) degrees may come from other science subjects or papers from other faculties or schools.

Note(s): For descriptions of individual papers refer to the following paper codes in the Papers Section (page 84): BIOL Biological Sciences; CHEM Chemistry; ENVS Environmental Sciences; ERTH Earth Sciences. For papers with other subject codes refer to the 2015 University of Waikato Calendar.
Marine Sciences

This specialisation provides an integrated approach to biological and physical processes in the marine environment, with particular reference to coastal waters and estuaries. The knowledge gained from biological studies that examine how marine organisms function, and the processes affecting their distribution and abundance, is critical for the sustainable exploitation of marine environments.

Marine Sciences may be taken as a specialisation of the Environmental Sciences major for the BSc or BSc(Tech) degrees.

Structure of the Marine Sciences Specialisation

<table>
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<th>Level</th>
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</table>

**May be chosen from 200 or 300 Level papers.

100 Level – Papers are worth 15 points.

Major prerequisites

» BIOL102A – The Biology of Organisms
» ERTH104A – Earth and Ocean Environments

Marine sciences specialisation papers

» BIOL101B – Cellular and Molecular Biology
» ERTH103B – Discovering Planet Earth
» STAT121A/S – Introduction to Statistical Methods

Recommended science/elective papers

» CHEM111A – Structure and Spectroscopy
ENVIRONMENTAL SCIENCES

200 Level – Papers are worth 20 points unless specified.

Major papers
» BIOL212A – Ecology
» ERTH242B – Oceanography
» CHEM261B – Environmental Chemistry and Geochemistry

Marine sciences specialisation papers
*Choose 20 points from:
» BIOL201A – Evolution and Diversity of Life
» ERTH245A – Weather and Climate (10 points)
» ERTH246B – Introduction to Hydrology (10 points)

Recommended elective papers
» CHEM200A – Analytical Tools for the Life and Environmental Sciences
» ERTH222A – Stratigraphy, Structure and Field Methods
» ERTH284B – Introduction to Environmental Monitoring
» GEOG228A – Information Technology and Cartography

300 Level – Papers are worth 20 points unless specified.

Major papers
» BIOL314A – Marine Biology and Monitoring
» ERTH343B – Coastal Geomorphology and Management
» ERTH344A – Coastal Oceanography and Engineering

Recommended science/elective papers
» BIOL312A – Applied Terrestrial Ecology
» BIOL313B – Applied Freshwater Ecology
» BIOL338B – Advanced Zoology
» CHEM306B – Advanced Analytical Chemistry
» ERTH322B – Sedimentary and Petroleum Geology
» ERTH384B – Advanced Environmental Monitoring
» GEOG328B – Geographic Information Systems

The remaining papers needed to complete the requirements for the BSc and BSc(Tech) degrees may come from other science subjects or papers from other faculties or schools.
MATERIALS AND PROCESSING

Materials and Processing is concerned with all the processes and activities of converting raw materials and commodity materials into valuable products required by manufacturers or the end-consumer.

Processing our raw materials and commodity goods more effectively is important to New Zealand's continuing economic welfare. We need to develop products that have significant value in world markets. To do this, we need to understand fully the properties of materials as diverse as food, wood, metals, plastics and fuel. We then need to know how to use this knowledge to design, manufacture and process these materials into high-value products such as dietary formula, ceramics that can withstand high temperatures, titanium alloys, pharmaceuticals, laminated boards and functional proteins. We also need to understand the properties of these high-value products and how they will interact with their environment, whether it be within the body or in the atmosphere.

The discipline serves industrial and other activities where material is undergoing a change, be it chemical, biochemical or physical. Process engineering involves knowing how to prepare feed materials, how to make reactions occur, separating and purifying products, controlling wastes, minimizing energy usage, and ultimately adding value to the raw materials used to produce something useful to people. These skills form the basis for most of New Zealand's export earnings.

The Materials and Process Engineering programme is available through a Bachelor of Engineering (Honours) degree. See page 18 for more details. Papers in Materials and Processing are available at all levels of study from undergraduate degrees through to postgraduate and doctoral studies. See page 116 for details of Materials and Processing papers.

CONTACTS FOR THE SCHOOL OF ENGINEERING
Materials and Processing is administered by the School of Engineering.

| Enrolement Contact Person and First Year Mentor | Room: E.G.04 |
| To be advised                                   | Phone: 07 838 4266 |
|                                                | Email: engineering@waikato.ac.nz |

Convenor

| Associate Professor Michael Walmsley           | Room: EF.2.02 |
|                                                | Phone: 07 838 4701 |
|                                                | Email: walmsley@waikato.ac.nz |
MATERIALS AND PROCESSING

Materials and Processing Major – BSc/BSc(Tech)

General Structure of a Materials and Processing Major for the BSc and BSc(Tech) degrees

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100 Level – ENGG180 Foundations of Engineering and ENMP102 Introduction to Materials Science and Engineering.

200 Level – 60 Points at Level 200 Materials and Processing. ENMP211 Materials 1 and ENMP221 Engineering Thermodynamics are highly recommended.

300 Level – 60 points at Level 300 Materials and Processing.

Specialisations

Students may undertake the following specialisations for the BSc and BSc(Tech) major in Materials and Processing.

» Science International  
» Te Pūtaiao me ngā take Māori

Choosing Papers

Entry into Materials and Processing Papers

There are no formal prerequisites for entry into 100 Level papers in Materials and Processing. The best prepared candidates will have, at a minimum, completed secondary study at Level 3 NCEA in chemistry, physics, mathematics and/or technology. Nonetheless, students without this formal background who can demonstrate sufficient motivation are able to attempt these papers. Higher entrance requirements are expected for students who wish to enrol in a Bachelor of Engineering (Honours) degree.

In some cases, we are able to relax the rules on prerequisites. If you would particularly like to take a paper for which you have not satisfied a specified requirement, please talk to Faculty staff.

Papers for the Materials and Process Engineering programme for the BE(Hons) degree are specified (see page 18).
Materials and Processing Major

100 Level – Papers are worth 15 points.
If you are doing a BSc or BSc(Tech) degree and are interested in a Materials and Processing major, you should take the following core papers.

Prerequisites
  » ENGG180A – Foundations of Engineering
  » ENMP102B – Introduction to Materials Science and Engineering

It is a good idea to do at least two mathematics papers, at least one chemistry paper and one physics paper.

200 Level – Papers are worth 20 points unless specified.
Highly recommended papers
  » ENMP211A – Materials 1
  » ENMP221A – Engineering Thermodynamics
  » 20 points from 200 Level Materials and Processing papers

Additional papers may be taken from other materials and processing papers offered at 200 Level or can be supported by papers from other subjects. For example, students interested in materials science are advised to take some chemistry papers; students interested in biotechnology are advised to take 200 Level biological sciences papers.

300 Level – Papers are worth 20 points unless specified.
Students need to take at least 60 points at Level 300 in materials and processing.
Recommended papers
  » ENMP311B – Materials 2
  » ENMP321B – Process Engineering and Design
  » 20 points from 300 Level Materials and Process Engineering papers

The remaining papers needed to complete the requirements for the BSc and BSc(Tech) degrees may come from other science subjects or papers from other faculties or schools.

Students not intending to major in Materials and Processing

If you are not a Materials and Processing major, please feel free to sample from our wide variety of paper offerings. Generally, it will be easiest for you to pick up materials and processing papers at 100 and 200 Level, as these papers will be less affected by prerequisites. Two very popular papers amongst students in this category are ENMP282 and ENMP283 Science and Engineering Management A and B.

If you intend to major in Chemistry, Biological Sciences, Earth Sciences, Electronics, or Physics, ENGG180 and ENMP102 will help you see how your subject major fits in to New Zealand’s industry and manufacturing.

200 Level materials and processing papers can be useful adjuncts to students majoring in Chemistry, Biological Sciences, Earth Sciences, Electronics and Physics. For instance, Chemistry and Earth Sciences students will find materials science papers (ENMP211 Materials 1, ENMP214 Manufacturing Processes, ENMP215 Manufacturing Technology) useful; Environmental Sciences students will find ENMP241 Environmental Technology 1 useful; and Biological Sciences and Chemistry students interested in biotechnology and food processing will find ENMP222 Biotechnology: Food and Bioresources and ENMP223 Thermofluids, provide an understanding of the key principles in fluid, heat and mass flows, and are useful for Chemistry and Biotechnology majors.
PHYSICS

Physics involves understanding the basic principles by which all things in the universe exist and operate, and is the foundation of other scientific disciplines. It is also the natural basis of all the technology disciplines such as electronics, engineering and computer science, which were pioneered by physicists.

CONTACTS FOR PHYSICS
Physics is administered by the School of Engineering.

Enrolment Contact Person
Associate Professor Alistair Steyn-Ross
Room: DE.2.01
Phone: 07 838 4340
Email: asr@waikato.ac.nz

Physics Major

General Structure of a Physics Major for the BSc and BSc(Tech) degrees

<table>
<thead>
<tr>
<th>Level</th>
<th>Paper Code</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>ENEL111</td>
<td>15</td>
</tr>
<tr>
<td>100</td>
<td>PHYS103</td>
<td>15</td>
</tr>
<tr>
<td>100</td>
<td>MATH101</td>
<td>15</td>
</tr>
</tbody>
</table>

100 Level – Prerequisites: ENEL111 Introduction to Electronics, PHYS103 Physics for Scientists and Engineers, MATH101 Introduction to Calculus, MATH102 Introduction to Algebra.

<table>
<thead>
<tr>
<th>Level</th>
<th>Paper Code</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>PHYS204</td>
<td>10</td>
</tr>
<tr>
<td>200</td>
<td>PHYS206</td>
<td>10</td>
</tr>
<tr>
<td>200</td>
<td>ENEL284</td>
<td>10</td>
</tr>
<tr>
<td>200</td>
<td>ENEL285</td>
<td>10</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Level</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>60</td>
</tr>
</tbody>
</table>

300 Level – Choose 60 points from 300 Level Physics papers. Recommended: PHYS302 Quantum Physics, PHYS315 Computational Biophysics, or any ENEL paper at 300 Level.

Specialisations

Students may undertake the following specialisations for the BSc and BSc(Tech) major in Physics.

» Science International
» Te Pūtaiao me ngā take Māori

Choosing Papers

Entry into Physics Papers

The normal entry level into physics papers is 14 credits in NCEA Level 3 physics. The minimum entry level into PHYS100 is 14 credits in NCEA Level 2 physics or mathematics. Alternatively, you can also enrol in one of the bridging physics papers. Information on bridging options may be found in the Other Programmes section (page 80).

In some cases, we are able to relax the rules relating to prerequisites. If you would particularly like to take a paper for which you have not satisfied a specified requirement, please talk to Faculty staff.
Physics Major

100 Level – Papers are worth 15 points.

Prerequisites

» ENEL111A – Introduction to Electronics
» PHYS103B – Physics for Scientists and Engineers 1
» MATH101A/B/S – Introduction to Calculus
» MATH102A/B – Introduction to Algebra

PHYS100 Exploring Physics is recommended for students lacking a strong secondary school background in physics.

The Physics major depends strongly on mathematics. You should plan to include the papers MATH101 Introduction to Calculus, and MATH102 Introduction to Algebra in your programme of study. If you lack the required NCEA pass in mathematics to attempt these papers, you may be eligible to enrol in MATH168 Preparatory Mathematics, or MATH165 General Mathematics. For further advice please contact the Faculty Registrar.

200 Level – Papers are worth 20 points unless specified.

Students majoring in Physics need to complete at least 60 points at 200 Level Physics, as well as several 200 Level mathematics papers.

Compulsory papers

» PHYS204A – Experimental Physics
» PHYS205A – Relativity, Nuclear and Astrophysics (10 points)*
» PHYS206B – Statistical and Thermal Physics (10 points)*
» ENEL284B – Electricity and Magnetism (10 points)
» ENEL285A – Quantum and Solid State Physics (10 points)

*Note(s): Second year students should include the mathematics corequisites MATH251, MATH253 and MATH255 in their programme.

300 Level – Papers are worth 20 points unless specified.

*Choose 60 points from 300 Level Physics or Electronics (ENEL) papers. Recommended:

» PHYS302B – Quantum Physics
» PHYS315A – Computational Biophysics
» ENEL312A – Electromagnetic Waves
» ENEL317B – Microprocessor Applications and Control
» ENEL321B – Application Specific Integrated Circuits
» ENEL324A – Optoelectronics
» ENEL382B – High Speed Communications*
» ENEL385B – Power Electronics

*Note(s): Students who select this paper should include the corequisite paper ENEL324 in their programme.

The remaining papers needed to complete the requirements for the BSc and BSc(Tech) degrees may come from other science subjects or papers from other faculties or schools.

Refer to page 124 for Physics paper descriptions.
PSYCHOLOGY

Psychology is about understanding the behaviour and cognitive processes of people and animals in their physical, social and organisational environment. As a behavioural science, psychology examines the way behaviour is learned and can be changed. As a social science, it focuses on individuals within the context of families, organisations and other groups, communities, cultures and societies. As a biological science, it studies the senses (hearing, vision, touch) and how the brain and physiological systems relate to behaviour. As a cognitive science, psychology studies perception, attention, memory, thinking and language understanding. The study of development, personality, learning and motivation are also part of psychology. At Waikato, psychology can be studied in a science, a social sciences or an arts degree.

CONTACTS FOR THE SCHOOL OF PSYCHOLOGY

School Manager
Sue Carnaby
Room: K.1.14
Phone: 07 838 4032
Email: carnabys@waikato.ac.nz

Degrees

Psychology is available as a major subject for the Bachelor of Science (BSc), Bachelor of Arts (BA), and Bachelor of Social Sciences (BSocSc) degrees. Students who wish to complete a BSocSc or BA degree should consult the Faculty of Arts & Social Sciences Handbook for details.

Major

<table>
<thead>
<tr>
<th>General Structure of a Psychology Major for the BSc degree</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>100 LEVEL</strong></td>
</tr>
<tr>
<td>PSYC102 Social and Developmental Psychology, 15 points</td>
</tr>
<tr>
<td>PSYC103 General and Experimental Psychology, 15 points</td>
</tr>
<tr>
<td><strong>200 LEVEL</strong></td>
</tr>
<tr>
<td>PSYC208 Psychological Research: Analysis, Design and</td>
</tr>
<tr>
<td>Measurement, PSYC225 Behavioural Psychology and Learning,</td>
</tr>
<tr>
<td>PSYC225 The Psychology of Perception, PSYC227 Foundations</td>
</tr>
<tr>
<td>of Behavioural Neuroscience, and PSYC230 Cognitive</td>
</tr>
<tr>
<td>Psychology, 10 points</td>
</tr>
<tr>
<td><strong>300 LEVEL</strong></td>
</tr>
<tr>
<td>PSYC3XX Applied Cognitive Psychology (10pts),</td>
</tr>
<tr>
<td>PSYC338 Abnormal Psychology (10pts), PSYC341 Visual</td>
</tr>
<tr>
<td>Neuroscience and its Applications (10pts), PSYC344</td>
</tr>
<tr>
<td>Physiology of Human Potential and Development (10pts),</td>
</tr>
<tr>
<td>Research Methods, PSYC314 Behaviour Analysis,</td>
</tr>
<tr>
<td>PSYC338 Abnormal Psychology (10pts).</td>
</tr>
</tbody>
</table>

Note(s): Other 300 Level Psychology papers can also satisfy the 60 points requirement on programme approval.
**Specialisations**

Students may undertake the following specialisations for the BSc major in Psychology.

- Science International  
  - page 73
- Te Pūtaiao me ngā take Māori  
  - page 75

**Choosing Papers**

**Entry into Psychology Papers**

There are no formal prerequisites for admission to 100 Level psychology papers. Individual papers may be taken, assuming any prerequisites listed are met.

**Psychology Major**

To complete a major in psychology in a BSc or BSc(Tech), students must complete 120 points above 100 Level in psychology papers including at least 60 points above 200 Level.

**Recommended Preparatory Papers**

It is recommended that you consider including an introductory writing paper such as ALED100 Writing for University Purposes as part of your degree. In addition, it is recommended that if you do not have mathematics in your background you should consider taking MATH168 Preparatory Mathematics.

**100 Level – Papers are worth 15 points.**

It is highly recommended that you complete both PSYC102 Social and Developmental Psychology, and PSYC103A General and Experimental Psychology.

**Prerequisites**

- PSYC102B – Social and Developmental Psychology
- PSYC103A – General and Experimental Psychology

**200 Level – Papers are worth 20 points unless specified.**

**Compulsory papers**

- PSYC208B – Psychological Research: Analysis, Design and Measurement
- PSYC225A – Behavioural Psychology and Learning (10 points)
- PSYC226A – The Psychology of Perception (10 points)
- PSYC227A – Foundations of Behavioural Neuroscience (10 points)
- PSYC230B – Cognitive Psychology (10 points)

It is highly recommended that you complete all six 200 Level 10 point psychology papers. Make sure that you include prerequisite papers, including 100 Level papers needed for the following year of study.
PSYCHOLOGY

300 Level – Papers are worth 20 points unless specified.
Choose 60 points from Level 300 psychology papers.
Listed below are some combinations of third-year papers for various areas in psychology. You are encouraged to consult academic staff for further recommendations.

To continue to graduate study in psychology (ie BSocSc(Hons), MSocSc, BSc(Hons), the Postgraduate Certificate/Diplomas or the Master of Applied Psychology) you must have passed PSYC307 Research Methods, and meet any other criteria for entry to those specific programmes (refer to the Psychology Graduate Handbook). You are also advised to read the Graduate Handbook for 300 Level prerequisites required for specific graduate papers.

Animal Behaviour
BSc students should take PSYC206 Animal Behaviour: Principles and Applications, PSYC314 Behaviour Analysis, PSYC390 Directed Study. Students should also take Biological Science papers, including BIOL333 Advanced Animal Behaviour, and its prerequisites. Students of the BSc or BSc(Tech) degrees may also take Animal Behaviour as a major subject (see page 31).

Applied Cognitive Science

Behaviour Analysis (including Applied Behaviour Analysis)
PSYC307 Research Methods, PSYC314 Behaviour Analysis, PSYC337 Psychological Measurement, and PSYC390 Directed Study. Which other psychology papers are relevant will depend on your area of interest.

Clinical Psychology
PSYC307 Research Methods, PSYC337 Psychological Measurement, and PSYC338 Abnormal Psychology are the papers required for entry to the Postgraduate Diploma in Clinical Psychology. Recommended papers are PSYC301 Community, Culture and Diversity, PSYC314 Behaviour Analysis and PSYC319 Psychological Perspectives on Child Development.

Applied Social and Community Psychology, and Organisational Psychology
If you are interested in these areas of Psychology you should consult the Faculty of Arts & Social Sciences Handbook, or academic staff for recommendations.
Note that Directed Study papers will not be counted towards the 120 points required for a major in psychology.

Refer to page 127 for Psychology paper descriptions.

The remaining papers needed to complete the requirements for the BSc and BSc(Tech) degrees may come from other science subjects or papers from other faculties or schools.
SCIENCE INTERNATIONAL

Specialisation

Science International combines a Science major with study to 300 Level in Chinese, French, German, Japanese or Spanish. Science graduates who are familiar with the language and customs of other countries are of particular value to export-oriented industries with a technological base.

Note(s): You should consult the relevant language department to determine your language entry level. Due to timetable constraints, it may not be possible to take all combinations of each science with each language.

Science International is available as a specialisation alongside any major subject for the Bachelor of Science or Bachelor of Science (Technology) degrees.

CONTACT FOR SCIENCE INTERNATIONAL
Students are advised to confirm programme details with the Faculty of Science & Engineering Registrar.

Faculty Registrar
Fiona Hurst
Room: FG.G.06
Phone: 07 838 4290
Email: fionaw@waikato.ac.nz

Structure of the Science International Specialisation

<table>
<thead>
<tr>
<th>Level</th>
<th>Science Major</th>
<th>Science Major</th>
<th>Language</th>
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<tbody>
<tr>
<td>100 Level</td>
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<td>15 points</td>
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<td>15 points</td>
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<tr>
<td>300 Level</td>
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<td>20 points</td>
<td>20 points</td>
<td>*</td>
<td>20 points</td>
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</tr>
</tbody>
</table>

100 Level Science papers
Choose at least 90 points from 100 Level Science papers, including 30 points from your Science subject major.
200 and 300 Level Science papers
To meet the requirements of a major, students must complete 120 points above 100 Level in that subject, including 60 points above 200 Level.

*Choose 20 points from 200 or 300 Level Science papers.

Language specialisation
To meet the requirements of a language specialisation, students must complete 80 points above 100 Level in that language, including 40 points above 200 Level.

Chinese specialisation papers – Papers are worth 20 points unless specified.
» CHIN131A – Chinese Language 1: Part A (15 points)
» CHIN132B – Chinese Language 1: Part B (15 points)
» CHIN231A – Chinese Language 2: Part A
» CHIN232B – Chinese Language 2: Part B
» CHIN331A – Chinese Language 3: Part A
» CHIN332B – Chinese Language 3: Part B

French specialisation papers – Papers are worth 20 points unless specified.
» FREN131A – French for Beginners 1 (15 points)
» FREN132B – French for Beginners 2 (15 points)
» FREN231A – French Language Intermediate 1
» FREN232A – French Language Intermediate 2
» FREN321B – Translation Methodology and Practice
» FREN331A – French Language Advanced
» FREN390A/B/S – Directed Study

German specialisation papers – Papers are worth 20 points unless specified.
» GERM131A – German for Beginners 1 (15 points)
» GERM132B – German for Beginners 2 (15 points)
» GERM231A – German Language Intermediate 1
» GERM233B – German Language Intermediate 2
» GERM301A – German Language Studies 3
» GERM302A – Discourses of Love and Self in Modern German Literature

Japanese specialisation papers – Papers are worth 20 points unless specified.
» JAPA131A – Japanese 1: Part A
» JAPA132B – Japanese 1: Part B
» JAPA231A – Japanese 2: Part A
» JAPA232B – Japanese 2: Part B
» JAPA331A – Japanese 3: Part A
» JAPA332B – Japanese 3: Part B

Spanish specialisation papers – Papers are worth 20 points unless specified.
» SPAN131A/B – Spanish for Beginners 1 (15 points)
» SPAN132B – Spanish for Beginners 2 (15 points)
» SPAN231A – Intermediate Spanish 1
» SPAN232B – Intermediate Spanish 2
» SPAN305B – Latin American Literature
» SPAN310A – Spanish 3

Note(s): For descriptions of these papers refer to the Faculty of Arts & Social Sciences Undergraduate Handbook or the 2015 University of Waikato Calendar.
TE PŪTAIAO ME NGĀ TAKE MĀORI

Specialisation

There is a fast-growing need for science graduates who are also fluent Māori language speakers. This specialisation enables students to pursue a science degree in a major subject while extending their knowledge of Māori language and culture.

This specialisation is available within any major subject for the Bachelor of Science or Bachelor of Science (Technology) degrees.

Note(s): You should consult the School of Māori & Pacific Development to determine your language entry level. Due to timetable constraints, it may not be possible to take all combinations of each science with each stream.

CONTACT FOR TE PŪTAIAO ME NGĀ TAKE MĀORI

Students are advised to confirm programme details with the Faculty Registrar.

Faculty Registrar
Fiona Hurst
Room: FG.G.06
Phone: 07 838 4290
Email: fionaw@waikato.ac.nz

Stream 1 is for students with little or no prior knowledge of Māori.

Structure of Te Pūtaiao me ngā take Māori Specialisation – Stream 1

<table>
<thead>
<tr>
<th>Level</th>
<th>Science Major</th>
<th>MAOR111</th>
<th>MAOR112</th>
<th>Tika163</th>
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<td>15 points</td>
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<td>20 points</td>
<td>20 points</td>
<td>20 points</td>
<td>20 points</td>
<td>20 points</td>
</tr>
</tbody>
</table>

*These papers are normally taken in year 3.

100 Level – Papers are worth 15 points.
Choose 30 points at 100 Level from your Science major and 45 points from 100 Level Science papers.

Te Pūtaiao me ngā take Māori specialisation papers
- MAOR111A/C – Te Reo Māori: Introductory 1
- MAOR112B/C – Te Reo Māori: Introductory 2
- Tika163A/B – He Hinātore ki te Ao Māori: Introducing the Māori World

200 Level – Papers are worth 20 points unless specified.
Choose 60 points at 200 Level from your Science major.

Te Pūtaiao me ngā take Māori specialisation papers
- MAOR211A/C – Te Reo Māori: Post-Introductory 1
- MAOR212B/C – Te Reo Māori: Post-Introductory 2
- MAOR213A/C – Te Reo Māori: Post-Intermediate 1
- MAOR214B/C – Te Reo Māori: Post-Intermediate 2
- Tika263B – He Ara Tikanga: Māori Identity in a Changing World
TE PŪTAIAO ME NGĀ TAKE MĀORI

300 Level – Papers are worth 20 points unless specified.
Choose 60 points at 300 Level from your Science major and 20 points from 300 Level Science papers.

Stream 2 is for students who have studied Māori to an advanced level or are fluent speakers.

<table>
<thead>
<tr>
<th>Structure of Te Pūtaiao me ngā take Māori Specialisation – Stream 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 LEVEL</td>
</tr>
<tr>
<td>15 points</td>
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<tr>
<td>200 LEVEL</td>
</tr>
<tr>
<td>20 points</td>
</tr>
<tr>
<td>300 LEVEL</td>
</tr>
<tr>
<td>20 points</td>
</tr>
</tbody>
</table>

100 Level – Papers are worth 15 points.
Choose 30 points at 100 Level from your Science major and 45 points from 100 Level Science papers.

Te Pūtaiao me ngā take Māori specialisation papers
» MAOR211A/C – Te Reo Māori: Post-Introductory 1
» MAOR212B/C – Te Reo Māori: Post-Introductory 2
» TIKA164A – Mai i Tuwhakarere ki te Ao Hurihuri

200 Level – Papers are worth 20 points unless specified.
Choose 60 points at 200 Level from your Science major.

Te Pūtaiao me ngā take Māori specialisation papers
» MAOR213A/C – Te Reo Māori: Post-Intermediate
» MAOR214B/C – Te Reo Māori: Post-Intermediate
» TIKA264B – Ngā Tikanga Apatahi

300 Level – Papers are worth 20 points unless specified.
Choose 60 points at 300 Level from your Science major.
Choose 20 points from 200 or 300 Level Science papers.

Te Pūtaiao me ngā take Māori specialisation papers
» MAOR313A/C/T – Te Reo Māori: Pre-Advanced
» MAOR314B/C/S – Te Reo Māori: Advanced

Note(s): For descriptions of papers with the subject codes MAOR or TIKA refer to the School of Māori & Pacific Development Handbook or the 2015 University of Waikato Calendar.
CONJOINT DEGREES

All degrees within the Faculty of Science & Engineering can be combined with any other degree in the University of Waikato as part of a conjoint degree.

For more information on studying towards a Bachelor of Science, Bachelor of Science (Technology) or Bachelor of Engineering (Honours) as part of a conjoint degree, please contact the Faculty Registrar or Associate Dean (Teaching and Learning).

<table>
<thead>
<tr>
<th>Faculty Registrar</th>
<th>Room: FG.G.06</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiona Hurst</td>
<td>Phone: 07 838 4290</td>
</tr>
<tr>
<td></td>
<td>Email: <a href="mailto:fionaw@waikato.ac.nz">fionaw@waikato.ac.nz</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Associate Dean (Teaching and Learning)</th>
<th>Room: FG.1.02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr Alison Campbell</td>
<td>Phone: 07 838 4582</td>
</tr>
<tr>
<td></td>
<td>Email: <a href="mailto:a.campbel@waikato.ac.nz">a.campbel@waikato.ac.nz</a></td>
</tr>
</tbody>
</table>

The following outlines an example of the BSc component of a conjoint degree. The BSc(Tech) and BE(Hons) can also be taken as part of a conjoint degree. For information regarding papers required for other degree components please contact the relevant school or faculty.

### BSc Component of a Conjoint Degree

<table>
<thead>
<tr>
<th>100 Level</th>
<th>SCIENCE MAJOR 100 Level</th>
<th>SCIENCE MAJOR 100 Level</th>
<th>SCIENCE 100 Level</th>
<th>SCIENCE 100 Level</th>
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</tr>
</thead>
<tbody>
<tr>
<td>200 Level</td>
<td>SCIENCE MAJOR 200 Level</td>
<td>SCIENCE MAJOR 200 Level</td>
<td>SCIENCE MAJOR 200 Level</td>
<td>SCIENCE 200 Level</td>
<td>ELECTIVE 200 Level</td>
</tr>
<tr>
<td>300 Level</td>
<td>SCIENCE MAJOR 300 Level</td>
<td>SCIENCE MAJOR 300 Level</td>
<td>SCIENCE MAJOR 300 Level</td>
<td>ELECTIVE 200 or 300 Level</td>
<td></td>
</tr>
</tbody>
</table>
The Bachelor of Engineering (Honours) and Bachelor of Science (Technology) are both four-year degrees involving compulsory work placement components. These paid work placements give you valuable experience alongside practising experts in your field of study. Our Cooperative Education Unit arranges and oversees your work placement, ensuring the quality of your placement. The contacts made and experiences gained mean that graduates are very successful in finding employment within months of completing the BE(Hons) or BSc(Tech). Obtaining a suitable placement is strongly dependent on academic performance. Students are expected to maintain good grades if they are to secure placements.

The aim of the placements is to integrate academic learning with hands-on learning in the workplace, to produce capable, professional young scientists and engineers. The Cooperative Education Unit at the University of Waikato is the leader in New Zealand for cooperative education type programmes and places on average 200 students each year.
CONTACTS FOR THE COOPERATIVE EDUCATION UNIT

Director
Dr Karsten Zegwaard
Room: E.2.19
Phone: 07 838 4892
Email: k.zegwaard@waikato.ac.nz

All Bachelor of Science (Technology) majors
Sue McCurdy
Room: E.2.20A
Phone: 07 838 4626
Email: s.mccurdy@waikato.ac.nz

Chemical and Biological Engineering, Materials and Process Engineering
Dr Mark Lay
Room: D.G.20
Phone: 07 838 4556
Email: mclay@waikato.ac.nz

Computer Science, Electronic Engineering, Mechanical Engineering, Software Engineering
Jewal Morrison
Room: E.2.21
Phone: 07 838 4100
Email: j.morrison@waikato.ac.nz

Administrator
Raewyn Oulton
Room: E.2.20
Phone: 07 838 4035
Email: r.oulton@waikato.ac.nz

Degrees

Work placements are a compulsory component of the Bachelor of Engineering (Honours) and Bachelor of Science (Technology). Work placement papers are available in each subject and include preparation and reflection papers. For the structure of the work placement component within each degree, please consult the following pages:

» Bachelor of Engineering (Honours) page 9
» Bachelor of Science (Technology) page 27

Papers

Work placement paper listings can be found on the following pages:

» Bachelor of Engineering (Honours) Work Placement Papers page 134
» Bachelor of Science (Technology) Work Placement Papers page 133
OTHER PROGRAMMES

Intermediates

Intermediate first year programmes are offered by the Faculty of Science & Engineering for entrance into professional degrees offered at other universities. You must consult the specialist school you intend to transfer to before enrolling in an intermediate programme at the University of Waikato. Even if you are taking the papers specified below, you should ensure your proposed programme is approved by the other university. For more information, please contact the Faculty Registrar on 0800 438 254.

Engineering (Canterbury)

Option 1: Computer, Electrical, Electronic, and Software Engineering

100 Level – Papers are worth 15 points unless specified.
» COMP103A/B – Introduction to Computer Science 1
» COMP104B/C/S – Introduction to Computer Science 2
» ENEL111A – Introduction to Electronics
» ENGG180A – Foundations of Engineering
» MATH101A/B/S – Introduction to Calculus
» MATH102A/B – Introduction to Algebra
» PHYS103B – Physics for Scientists and Engineers 1
Plus a further 15 points from 100 Level papers.

It is recommended that students intending to take Software Engineering also take MATH258 Introduction to Discrete Mathematics, if possible.

Option 2: Mechatronics, Mechanical, Civil, Natural Resources, and Forest Engineering

100 Level – Papers are worth 15 points unless specified.
» CHEM111A – Structure and Spectroscopy
» COMP103A/B – Introduction to Computer Science 1
» ENGG180A – Foundations of Engineering
» ENMP102B – Introduction to Materials Science and Engineering
» MATH101A/B/S – Introduction to Calculus
» MATH102A/B – Introduction to Algebra
» PHYS103B – Physics for Scientists and Engineers 1
Plus a further 15 points from 100 Level papers.

Option 3: Mechanical, Civil, Natural Resources, Forest Engineering, and Chemical and Process Engineering

100 Level – Papers are worth 15 points unless specified.
» CHEM111A – Structure and Spectroscopy
» COMP103A/B – Introduction to Computer Science 1
» ENGG180A – Foundations of Engineering
» ENMP102B – Introduction to Materials Science and Engineering
» MATH101A/B/S – Introduction to Calculus
» MATH102A/B – Introduction to Algebra
» PHYS103B – Physics for Scientists and Engineers 1
Plus a further 15 points from 100 Level papers.

If you do not gain entry to a required paper on the basis of your NCEA results, you will be contacted as part of the enrolment process. The engineering intermediate can be taken over two years.
Forest Engineering (Canterbury)

100 Level – Papers are worth 15 points.

» BIOL101B – Cellular and Molecular Biology
» BIOL102A – The Biology of Organisms
» STAT121A/S – Introduction to Statistical Methods
» FORE102 – Taught extramurally through the University of Canterbury

And one of:

» CHEM111A – Structure and Spectroscopy
» CHEM112B – Chemical Reactivity

And a further 15 points at 100 Level from Economics, Mathematics, Physics or Geography.

Recommended:

» ECON100A/B/S – Business Economics and the New Zealand Economy

Surveying (Otago)

100 Level – Papers are worth 15 points.

» ALED100A/B – Writing for University Purposes
» COMP103A/B/C/D – Introduction to Computer Science 1
» MATH101A/B/S – Introduction to Calculus
» MATH102A/B – Introduction to Algebra
» PHYS100A – Exploring Physics OR PHYS103B Physics for Scientists and Engineers 1
» STAT121A/S – Introduction to Statistical Methods
» SURX101 – Introductory Surveying (via distance learning at Otago)

And a further 15 points at 100 Level.

Students must attend the SURX101 Introductory Surveying one-week field course, which is held at Otago.

Bridging Programmes

If you are interested in or would like to extend your knowledge of science, the University offers the Science Foundation and Certificate of University Preparation (CUP) programmes, which are non-credit papers and bridging programmes that are designed to help you start your first academic year with the knowledge, skills and confidence needed to succeed.

We will contact you as part of the enrolment process if we feel that you would benefit from enrolling in one or more of these programmes. All of Waikato’s bridging programmes cover aspects of the Year 12 and Year 13 curriculum in the relevant areas to prepare you for enrolment in 100 Level papers in Science. The University also offers the Certificate of Attainment in Foundation Studies (CAFS) programme, which is specifically designed to prepare high school graduates from backgrounds where English is an additional language, for degree study.

Note(s): Student loan and allowances support is available only to students enrolling in the Certificate of University Preparation.

Science Foundation

This non-credit programme, offering tutorials in biology, chemistry, physics and mathematics, is held prior to the beginning of the A Semester. This programme is for those who have been accepted for enrolment into science or engineering and would benefit from brushing up on their knowledge.

For more information about the Science Foundation programme, please refer to the Bridging Programmes link on the Waikato Pathways College website at www.waikato.ac.nz/pathways/
OTHER PROGRAMMES

Foundation Studies
The Foundation Studies programme is a two semester, full-time academic programme specifically designed to prepare high school graduates from non-English speaking backgrounds for degree study in New Zealand. For more information about the Foundation Studies programme, please refer to the Waikato Pathways College website at www.waikato.ac.nz/pathways/

Compulsory Papers:
» CAFS001 – English for Foundation Studies 1
» CAFS002 – English for Foundation Studies 2
» CAFS003 – Language and Learning Skills for Foundation Studies

Optional Papers:
» CAFS004 – Bridging Calculus
» CAFS005 – Bridging Statistics†
» CAFS006 – Bridging Accounting
» CAFS007 – Bridging Economics†
» CAFS009 – Bridging Biology
» CAFS010 – Bridging Chemistry
» CAFS011 – Bridging Physics
» CAFS012 – Introduction to the Social Sciences†
» CAFS013 – Comparative Cultures: An Introduction
» CAFS014 – Bridging Psychology†
» CAFS0099 – English for Specific Purposes
» CUPR008 – Bridging Mathematics with Statistics

† Not offered in 2015.

Note(s): Students wanting entry into the BE(Hons) degree must achieve a B grade average, including no less than a B grade for CAFS001 and CAFS002, and no less than a B in CAFS011 Bridging Physics and CAFS004 Bridging Calculus, and for some programmes CAFS010 Bridging Chemistry. Students wanting entry into the BSc or BSc(Tech) degrees require no less than a B grade for CAFS001 and CAFS002 and no less than a C grade in all other papers. It is advantageous to select the Foundation science papers.
Certificate of University Preparation – CUP

The Certificate of University Preparation bridges the gap between high school and first year university study. This qualification is for people who do not gain University Entrance, but who are still committed to degree level study. The CUP covers key components of the Year 12 and 13 curriculum in a number of areas. If you do not gain University Entrance, subject to successful completion of the CUP programme, you can transfer to a degree.

The CUP programme requires one semester of full-time study and is made up of four non-credit papers. For more information, visit www.waikato.ac.nz/pathways/

Compulsory:
» CUPR001 – Introduction to Study Skills
» CUPR002 – Introduction to Critical Thought and Expression

Plus 30 points from two of:
» CAFS004 – Bridging Calculus
» CAFS005 – Bridging Statistics†
» CAFS009 – Bridging Biology
» CAFS010 – Bridging Chemistry
» CAFS011 – Bridging Physics
» CUPR008 – Bridging Mathematics and Statistics
» CUPR025 – Bridging General Science

† Not offered in 2015.

Note(s): Students wanting entry into the BSc or BSc(Tech) degrees from a CUP programme must have no less than a C grade in any paper. Students wanting entry into the BE(Hons) degree (depending on which specified programme you wish to study) must achieve no less than a B grade in two of physics, calculus and chemistry, plus no less than C grades in all other papers.

If you have applied to enrol in the Faculty of Science & Engineering and do not get University Entrance, your application will be referred to the staff administering the Certificate of University Preparation. If you have any questions about your eligibility for the CUP, please contact the Faculty Registrar.
### PAPERS

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**Note(s):** This section gives a brief description of the papers needed to complete a Bachelor of Engineering (Honours) (page 9), Bachelor of Science (page 25) or Bachelor of Science (Technology) (page 27). For more information on a paper, please contact the paper convenor/co-ordinator/lecturer listed for that paper.
UNDERSTANDING PAPER CODES

The code of each paper contains information regarding the subject, the level, the year, and the period and location of teaching.

Example: BIOL102-15A (HAM) – The Biology of Organisms

<table>
<thead>
<tr>
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Subject Codes

Descriptions of papers with the following subject codes are listed in this handbook:

- BIOL Biological Sciences
- CHEM Chemistry
- ENEL Electronics
- ENGG Engineering
- ENME Mechanical Engineering
- ENMP Materials and Processing (see Materials and Processing)
- ENVS Environmental Sciences
- ERTH Earth Sciences
- PHYS Physics
- PSYC Psychology
- SCIE Science & Engineering
  (Work Placements)

This handbook refers to, but does not provide descriptions of papers with the following subject codes:

- ANTH Anthropology
- COMP Computer Science
- ECON Economics
- ENVP Environmental Planning
- FREN French
- GEOG Geography
- GERM German
- JAPA Japanese
- MAOR Te Reo Māori
- MATH Mathematics
- MSYS Management Systems
- PHIL Philosophy
- POLS Political Science
- SPAN Spanish
- STAT Statistics
- TIKA Tikanga Māori
- TOMG Tourism Management

Period Indicators

- A A Semester: March – June
- B B Semester: July – November
- C An atypical teaching period
- S Summer School: January – February
- T Summer School 2: November – December
- Y Full year: March – November

Location Indicators

- HAM Papers taught in Hamilton
- TGA Papers taught in Tauranga
- NET Online course
- SEC Papers taught at a secondary school
100 LEVEL SCIENCE PAPERS

The following is a list of all of the 100 Level papers available in Science subjects at the University of Waikato.

**Biological Sciences**
- BIOL101B – Cellular and Molecular Biology
- BIOL102A – The Biology of Organisms

**Chemistry**
- CHEM100A – Chemistry in Context
- CHEM106 – Chemical Hazards, Safety and Legislation†
- CHEM111A – Structure and Spectroscopy
- CHEM112B – Chemical Reactivity

**Computer Science**
- COMP103A/B/C – Introduction to Computer Science 1
- COMP104B/S/C – Introduction to Computer Science 2
- COMP123A/B/S – The Computing Experience
- COMP124 – He Tomokanga ki te Ao Rorohiko†
- COMP125A – Visual Computing
- COMP126B – Computing Media

**Earth Sciences**
- ERTH103B – Discovering Planet Earth
- ERTH104A – Earth and Ocean Environments

**Electronics**
- ENEL111A – Introduction to Electronics

**Engineering**
- ENGG180A – Foundations of Engineering

**Environmental Science**
- ENVS101B – Environmental Science*

**Materials and Process Engineering**
- ENMP102B – Introduction to Materials Science and Engineering

**Mathematics**
- MATH101A/B/S – Introduction to Calculus
- MATH102A/B – Introduction to Algebra
- MATH165A/B – General Mathematics
- MATH168A/B – Preparatory Mathematics**

**Philosophy**
- PHIL102B – Introduction to Logic

**Physics**
- PHYS100A – Exploring Physics
- PHYS103B – Physics for Scientists and Engineers 1

**Psychology**
- PSYC102B – Social and Developmental Psychology
- PSYC103A – General and Experimental Psychology

**Statistics**
- STAT111B – Statistics for Science
- STAT121A/S – Introduction to Statistical Methods

† Not offered in 2015.
* Interdisciplinary paper with contributions from Biological Sciences, Chemistry and Earth Sciences.
** Cannot be included in the requirement of 105 points at 100 Level across four science subjects for the BSc and BSc(Tech) degrees.
BIOLOGICAL SCIENCES PAPERS

100 Level Papers

BIOL101-15B (HAM) & 14B (SEC) – Cellular and Molecular Biology
15 Points
This first year paper deals with the ultrastructure and function of both prokaryotic and eukaryotic cells, including a discussion of the energy flow in photosynthesis, respiration and metabolism. An introduction to microbiology emphasises the structure, metabolic and taxonomic diversity of microorganisms and viruses, and the immune response. Molecular genetics focuses on the use of DNA information to control cellular activities and includes an introduction to recombinant DNA technologies, while Mendelian and population genetics focuses on the generation of genetic diversity and the principles of evolution.

This paper is one of the two core papers for all students majoring in Biological Sciences or intending to do at least some biology papers at the second and third year level.

Lecturer(s): Dr Alison Campbell, Dr Ryan Martinus and Associate Professor Ian McDonald
Senior Tutor: Brydget Tulloch
Required book(s): Reece et al. Campbell Biology 9th ed (Benjamin Cummings)
Assessment: Internal assessment/examination ratio: 1 : 1

BIOL102-15A (HAM) & 14A (SEC) – The Biology of Organisms
15 Points
This paper is concerned with the distinctive features of the various groups of plants and animals, and how they have overcome various basic problems such as the acquisition of nutrients, gaseous exchange, regulation and transport of body fluids, reproduction, and development. Aspects of animal behaviour, and the principles of ecology are also covered.

Like its counterpart BIOL101, this paper is a foundation paper for all students majoring in Biological Sciences or intending to do at least some biology papers at second and third year levels.

Lecturer(s): Dr Alison Campbell and To be advised
Senior Tutor: Brydget Tulloch
Required book(s): Reece et al. Campbell Biology 9th ed (Benjamin Cummings)
Assessment: Internal assessment/examination ratio: 1 : 1

ENVS101-15B (HAM) – Environmental Science
15 Points
For details see Environmental Sciences ENVS101.

200 Level Papers

BIOL201-15A (HAM) – Evolution and Diversity of Life
20 Points
An examination of the evolutionary history of life, beginning with an introduction to the history and philosophy of evolutionary thinking. Other topics include present-day evidence of evolution in plant, animal, and bacterial taxa, modern methods for obtaining and analysing this evidence, and discussion of the mechanisms of evolution. This paper should be regarded as essential by all students of biology.

Lecturer(s): Dr Michael Clearwater, Dr Chrissen Gemmill, Associate Professor Carolyn King and Dr Ian Duggan
Prerequisite(s): BIOL101 or BIOL102
Assessment: Internal assessment/examination ratio: 1 : 1
BIOLOGICAL SCIENCES PAPERS

BIOL210-15B (HAM) – Introduction to Genetics
20 Points
This paper deals with genetics in the widest sense, from the molecular and cellular to the applied and evolutionary. Both prokaryote and eukaryote genetics are discussed with respect to DNA replication, gene expression and control, and the role of mutations at both the DNA and chromosomal levels. Applications of molecular genetics such as cloning, DNA sequencing, genetic engineering, DNA fingerprinting and antibody technologies are introduced. An in-depth treatment of Mendelian genetics and an introduction to quantitative genetics complete the paper.

The paper is seen as being of major importance to students of biology, irrespective of whether their interests are in metabolic and cellular processes, plant/animal genetic improvement, or ecological and evolutionary.

Lecturer(s): Dr Ray Cursons, Dr Linda Peters and Dr Steve Bird
Prerequisite(s): BIOL101
Assessment: Internal assessment/examination ratio: 1 : 1

BIOL212-15A (HAM) – Ecology
20 Points
This paper covers the principles of ecology, including adaptation to environment, species interactions, population dynamics, biogeography, and conservation ecology. Weekend field trips and computer laboratory work are essential elements of this paper.

Lecturer(s): Dr Ian Duggan, Professor Brendan Hicks, Associate Professor Conrad Pilditch and Professor David Hamilton
Prerequisite(s): BIOL102, (ENVS101 is strongly recommended)
Assessment: Internal assessment/examination ratio: 1 : 1

BIOL223-15B (HAM) – Plant Biology and Ecology
20 Points
An introduction to the structure and adaptation of plants, ecology, reproduction, evolution and systematics. Laboratory work emphasises practical handling of plants. The paper provides a foundation for advanced plant papers, and complements BIOL226 Flora of Aotearoa.

Lecturer(s): Dr Chrissen Gemmill, Dr Michael Clearwater and Dr Daniel Laughlin
Prerequisite(s): BIOL102
Assessment: Internal assessment/examination ratio: 1 : 1

BIOL226-15T (HAM) – Flora of Aotearoa/New Zealand
20 Points
A paper for students interested in New Zealand’s native and naturalised flora, with emphasis on identification of plants and plant systematics. A three-day field trip will be held as part of this paper.

At the end of this paper students will be familiar with all the major elements of the New Zealand flora, and will be able to work with any modern flora to key out and identify plants from the scientific literature. The paper will normally be taught entirely over two weeks.

For entry contact Dr Chrissen Gemmill, c.gemmill@waikato.ac.nz
Lecturer(s): Dr Chrissen Gemmill, Professor Bruce Clarkson, Dr Michael Clearwater and Dr Daniel Laughlin
Assessment: Internal assessment/examination ratio: 1 : 0
BIOL227 – Flora of the Pacific  
20 Points  
This paper will not be offered in 2015.

BIOL234-15A (HAM) (TGA) – Functional Animal Biology  
20 Points  
This paper is an integrated theoretical and experimental study of the principles of animal physiology. Comparative aspects will be emphasised in how animals adapt to their environment, including selected topics in ecophysiology. Topics covered include the physiology of nerve and muscle, chemical communication and senses, animal locomotion, respiration, circulation, osmoregulation and thermoregulation. An introduction to animal behaviour will include lectures on orientation and navigation, visual and auditory communication, mating systems and other aspects of social behaviour.

Lecturer(s): Associate Professor Nick Ling and Professor Joe Waas  
Prerequisite(s): BIOL102  
Assessment: Internal assessment/examination ratio: 2 : 3

BIOL235-15B (HAM) – Biomedical and Molecular Physiology  
20 Points  
An introduction to human and mammalian biology. Topics covered include the tissues and organs of the body; the structure and functioning of the nervous system and the endocrine system; digestion, respiration, circulation; the immune system; reproduction and development. Health and social issues will be considered.

This paper provides a base for the third-year paper BIOL335.

Lecturer(s): Dr Pawel Olszewski and Dr Steve Bird  
Prerequisite(s): BIOL102; (BIOL101 is recommended)  
Assessment: Internal assessment/examination ratio: 2 : 3

BIOL241-15A (HAM) – Microbiology: Form, Function and Metabolism  
20 Points  
This paper deals almost wholly with bacteria. Its aim is to provide insight into their structure, how they are classified, how they grow and some account of their very diverse physiologies. Structure and physiology are discussed in relation to the role of bacteria in nature and how various methods (such as the use of antibiotics) may be used to control their growth.

The paper is a prerequisite for BIOL341, and can be seen as complementary to the genetics, biochemistry and biotechniques papers.

Lecturer(s): Associate Professor Ian McDonald  
Prerequisite(s): BIOL101; (BIOL102 is recommended)  
Restriction(s): ENMP325  
Required book(s): Madigan et al Brock’s Biology of Microorganisms 13th ed (Prentice-Hall)  
Assessment: Internal assessment/examination ratio: 1 : 2
BIOLOGICAL SCIENCES PAPERS

BIOL251-15A (HAM) – Biochemistry
20 Points
The aim of this introductory paper is to familiarise students with most aspects of biochemistry, including the structure and function of proteins and enzymes, energy-yielding metabolism and the biochemical basis of nutrition and the functioning of hormones. An emphasis is placed on the relevance of biochemistry to understanding what is going on within and around you and the paper is seen as serving the needs of all biologists and of those chemists intending to work in primary production industries. This paper is strongly recommended for all students with an interest in biotechnology, molecular genetics, or plant, animal or microbial physiology.

Lecturer(s): Dr Ryan Martinus and Professor Vic Arcus
Prerequisite(s): BIOL101 and 15 points at Level 100 Chemistry
Assessment: Internal assessment/examination ratio: 1 : 1

ENMP222 – Biotechnology: Food and Bioresources
20 Points
This paper will not be offered in 2015.

300 Level Papers

BIOL307-15A/B/C/Y (HAM) & 14B (TGA) – Special Topic
20 Points
An experimental and/or theoretical paper offered in biological subjects. A chosen topic is conducted with an individual supervisor and is assessed by a final written report and oral presentation. The major topic areas are: animal behaviour; aquatic ecology; biochemistry; genetics; microbiology; plant and animal physiology and ecology.

Admission is at the discretion of the co-ordinator(s) for this paper. This paper will not normally be accepted as one of the three papers required for a major in Biological Sciences.

Co-ordinator(s): Professor Joe Waas
Assessment: Internal assessment/examination ratio: 1 : 0

BIOL310-15A (HAM) – Advanced Genetics
20 Points
This paper follows on from BIOL210 and deals in greater detail with both the molecular and whole organism aspects of genetics. Throughout the paper there will be an emphasis on the application of genetic knowledge; on the one hand in the direction of genetic engineering and genetic analysis and on the other hand in the study of population genetics.

The paper is recommended to all biologists; it complements papers both in the evolutionary areas of biology as well as those in the metabolic and biotechnological.

Lecturer(s): Dr Ray Cursons, Dr Linda Peters, Dr Steve Bird and Professor Vic Arcus
Prerequisite(s): BIOL210
Assessment: Internal assessment/examination ratio: 1 : 1

BIOL312-15A (HAM) (TGA) – Applied Terrestrial Ecology
20 Points
A course that explores ecological principles, ecosystem dynamics and functioning, restoration, conservation genetics, conservation ecology, forest ecosystems, pest control and protection of native species.

Lecturer(s): Dr Daniel Laughlin and Associate Professor Carolyn King
Prerequisite(s): BIOL212
Assessment: Internal assessment/examination ratio: 3 : 2
BIOL313-15B (HAM) (TGA) – Applied Freshwater Ecology
20 Points
This paper is an introduction to the applied ecology of freshwater communities (limnology). It deals with both the physical and chemical environments of lakes and rivers, as well as with the various plant and animal communities found in these habitats. The variety and ways of life of freshwater organisms and the factors governing their populations are examined. Freshwater ecosystems are often affected by human activities and so the paper also deals with the effects of land use, lake management, and management of stream habitats.

Lecturer(s): Associate Professor Ian Hogg, Professor Brendan Hicks, Dr Ian Duggan and Professor David Hamilton
Prerequisite(s): BIOL212
Assessment: Internal assessment/examination ratio: 1 : 1

BIOL314-15A (HAM) (TGA) – Marine Biology and Monitoring
20 Points
This paper deals with the ecology of marine organisms, focusing particularly on events at the individual, assemblage and population level. A wide range of habitats is considered, in order to stress the diverse nature of the marine environment. There is also an emphasis on detecting change due to human activities on marine systems, including fisheries. As a consequence, statistics of ecological surveys and experiments are an integral part of the paper. Please note that there is a class limit of 45 for this paper.

Lecturer(s): Associate Professor Conrad Pilditch, Professor Brendan Hicks and Professor Chris Battershill
Prerequisite(s): BIOL212; (BIOL201 is recommended)
Assessment: Internal assessment/examination ratio: 1 : 1

BIOL324-15B (TGA) Aquaculture Reproduction and Early Life Stages
20 Points
Students will study the underlying reproductive physiology and developmental biology of early life cycle strategies used by aquatic animal species. This knowledge will be examined for its use in the husbandry, breeding and production of species in aquaculture. This paper is only available to Tauranga students.

Lecturer(s): Professor Chris Battershill (University of Waikato) and Dr Simon Moncaster (Bay of Plenty Polytechnic)
Prerequisite(s): Aquaculture 1, Aquaculture 2, Diploma in Marine Studies Bay of Plenty Polytechnic or BIOL234 University of Waikato
Assessment: Internal assessment/examination ratio: 3 : 2

BIOL325-15A (HAM) – Plant Function
20 Points
This paper provides an introduction to the discipline of plant physiological ecology. Participants will gain an understanding of how plants interact with their environment as they grow and reproduce, using examples from both natural vegetation and managed agricultural environments. Practical work will emphasise laboratory and field techniques for measuring plant performance, including measurements of microclimate, photosynthesis and water use.

Lecturer(s): Dr Michael Clearwater
Prerequisite(s): BIOL223
Assessment: Internal assessment/examination ratio: 1 : 1

BIOL326 – Advanced Topics in Plant Biology
20 Points
This paper will not be offered in 2015.
BIOLOGICAL SCIENCES PAPERS

BIOL333-15B (HAM) – Advanced Animal Behaviour
20 Points
This paper provides an up-to-date review of issues in the field of animal behaviour. We examine the development, causation, function and evolutionary history of vertebrate and invertebrate behaviour.

Lecturer(s): Professor Joe Waas, Associate Professor Nick Ling, Dr Pawel Olszewski and contributors from Landcare, the Department of Conservation and AgResearch
Prerequisite(s): BIOL234
Assessment: Internal assessment/examination ratio: 1 : 1

BIOL335-15A (HAM) – Mammalian Physiology
20 Points
This paper is an integrated theoretical and experimental study of selected aspects of the physiology of mammals. The paper follows on from Functional Animal Biology (BIOL234) and Humans and Other Mammals (BIOL235) and deals with topics not covered in these papers as well as some of the same topics in more depth. The paper is concerned with mammalian physiology, in particular covering areas of applied research in mammalian physiology and including neurophysiology and the physiology of behaviour, immunology, muscle growth and development, reproduction and lactation.

Lecturer(s): Associate Professor Nick Ling and Dr Pawel Olszewski
Prerequisite(s): BIOL234 or BIOL235; (BIOL251 is recommended)
Assessment: Internal assessment/examination ratio: 2 : 3

BIOL338-15B (HAM) – Advanced Zoology
20 Points
This paper looks at selected topics in evolutionary zoology, with particular emphasis on the dominant invertebrate and vertebrate groups.

This paper is complementary to BIOL335 and BIOL333.

Lecturer(s): Associate Professor Carolyn King and Associate Professor Ian Hogg
Prerequisite(s): BIOL201 or BIOL234
Assessment: Internal assessment/examination ratio: 1 : 1

BIOL341-15B (HAM) – Microbial Physiology and Ecology
20 Points
This paper looks at the great metabolic diversity of bacteria and their ability to respond to fluctuating and extreme environments. Emphasis will be placed on the unifying principles and the relationship of bacterial physiology to the taxonomy and ecology of archaebacteria and eubacteria. The role of adhesion will be discussed leading to the importance of bacterial biofilms and the metabolic interactions that occur within these consortia. Bacterial phylogeny will be used to introduce new methods of molecular ecology.

Lecturer(s): Associate Professor Ian McDonald
Prerequisite(s): BIOL241
Required book(s): Madigan et al _Brock’s Biology of Microorganisms_ 13th ed (Prentice-Hall)
Assessment: Internal assessment/examination ratio: 1 : 2
BIOL351-15B (HAM) – Advanced Biochemistry
20 Points
This paper is targeted at students interested in biochemistry, plant and animal physiology, biotechnology, genetics, microbiology and chemistry. We will build upon the principles of biochemistry introduced in BIOL251 to:

1. Examine the molecular mechanisms underlying cellular communication and trafficking of proteins between organelles, cellular stress responses and cell death.
2. Consider metabolic regulation in relation to the control of enzyme stability and activity as well as human diseases (eg diabetes).
3. Specific topics illustrating a variety of other aspects of biochemistry such as mammalian vision, toxicology and inflammation will also be presented. Students will also be required to evaluate and present recent findings in biochemistry and molecular cell biology as part of the directed study section of the course.

Lecturer(s): Dr Ryan Martinus and Professor Vic Arcus
Prerequisite(s): BIOL251
Assessment: Internal assessment/examination ratio: 1 : 1

BIOL362-15C (BLK) (HAM) – Molecular Biology and Biotechniques
20 Points
This online course will examine the molecular biological technologies used to analyse and manipulate DNA, RNA and proteins. It includes coverage of the major recombinant DNA techniques.

This paper is strongly recommended to students doing BIOL351 or BIOL310, or intending to work in the fields of molecular genetics, biochemistry or biomedical research.

Lecturer(s): Dr Ray Cursons, Dr Linda Peters, Professor Vic Arcus and Dr Steven Bird
Prerequisite(s): BIOL210
Assessment: Internal assessment/examination ratio: 2 : 3

ENMP322-15B (HAM) – Biotechnology
20 Points
For details see Materials and Processing ENMP322.
CHEMISTRY PAPERS

100 Level Papers

CHEM100-15A (HAM) (TGA) – Chemistry in Context
15 Points
An introductory course assuming minimal chemistry background for students who are non-chemistry majors. Students with 16 or more credits in NCEA Level 3 Chemistry are encouraged to take CHEM111 instead. An emphasis is made to place the chemical concepts taught in the course within the broader context of the world around us.

Lecturer(s): Dr Joseph Lane
Restriction(s): CHEM101, CHEM102, CHEM111, CHEM112
Recommended book(s): CHEM 2: Chemistry in Your World 2nd ed (Cengage)
Assessment: Internal assessment/examination ratio: 60 : 40

CHEM106 – Chemical Hazards: Safety and Legislations
15 Points
This paper will not be offered in 2015.

CHEM111-15A (HAM) – Structure and Spectroscopy
15 Points
A theoretical and practical course covering aspects of analytical and inorganic chemistry. This course is required for the Chemistry major.

Lecturer(s): Professor Bill Henderson, Associate Professor Merilyn Manley-Harris and Associate Professor Graham Saunders
Prerequisite(s): 16 credits at Level 3 NCEA Chemistry or equivalent
Required book(s): Brown et al Chemistry the Central Science (Prentice Hall)
Assessment: Internal assessment/examination ratio: 45 : 55

CHEM111-15T (HAM) – Structure and Spectroscopy
15 Points
A theoretical and practical course covering aspects of analytical and inorganic chemistry. This occurrence of the paper is offered to students who achieved an A in CHEM100 and want to enrol in CHEM211- CHEM214, which are required for the Chemistry major.

Required book(s): Brown et al Chemistry the Central Science (Prentice Hall)
Assessment: Internal assessment/examination ratio: 45 : 55

CHEM112-15B (HAM) – Chemical Reactivity
15 Points
A theoretical and practical course covering aspects of physical and organic chemistry. This course is required for the Chemistry major.

Lecturer(s): Dr Michael Mucalo and Associate Professor Merilyn Manley-Harris
Prerequisite(s): 16 credits at Level 3 NCEA Chemistry or equivalent or A grade or above in CHEM100
Recommended book(s): Brown et al Chemistry the Central Science (Prentice Hall)
Assessment: Internal assessment/examination ratio: 45 : 55

ENVS101-15B (HAM) – Environmental Science
15 Points
For details see Environmental Sciences ENVS101.
200 Level Papers

CHEM200-15B (HAM) – Analytical Tools for the Life and Environmental Sciences
20 Points
A largely practical paper for students in the life and environmental sciences who require an understanding of the abilities and limitations of chemical analysis in their fields of study.

Lecturer(s): To be advised
Prerequisite(s): CHEM100
Restrictions(s): CHEM111 and CHEM204
Assessment: Internal assessment/examination ratio: 1 : 0

CHEM211-15A (HAM) – Analytical and Inorganic Chemistry 1
20 Points
A theoretical paper covering aspects of analytical and inorganic chemistry.

Lecturer(s): Professor Bill Henderson, Associate Professor Graham Saunders, Associate Professor Merilyn Manley-Harris and Dr Michèle Prinsep
Prerequisite(s): CHEM111
Assessment: Internal assessment/examination ratio: 1 : 1

CHEM212-15B (HAM) – Organic and Physical Chemistry 1
20 Points
A theoretical paper covering aspects of organic and physical chemistry.

Lecturer(s): Dr Michael Mucalo, Associate Professor Merilyn Manley-Harris, and Dr Michèle Prinsep
Prerequisite(s): CHEM112
Assessment: Internal assessment/examination ratio: 1 : 1

CHEM213-15A (HAM) – Analytical and Inorganic Chemistry Laboratory 1
10 Points
A laboratory based paper covering aspects of analytical and inorganic chemistry.

Lecturer(s): Professor Bill Henderson, Associate Professor Graham Saunders, Associate Professor Merilyn Manley-Harris, and Dr Michèle Prinsep
Corequisite(s): CHEM211
Assessment: Internal assessment/examination ratio: 1 : 0

CHEM214-15B (HAM) – Organic and Physical Chemistry Laboratory 1
10 Points
A laboratory based paper covering aspects of organic and physical chemistry.

Lecturer(s): Dr Michael Mucalo, Associate Professor Merilyn Manley-Harris, and Dr Michèle Prinsep
Corequisite(s): CHEM212
Assessment: Internal assessment/examination ratio: 1 : 0
CHEMISTRY PAPERS

CHEM261-15B (HAM) – Environmental Chemistry and Geochemistry
20 Points
This paper is designed to give students in chemistry, Earth sciences and biological sciences an understanding of the chemistry of our environment. The composition of the earth, particularly its atmosphere and hydrosphere, and its derivation from the solar system, will be examined. Concepts of residence times, fluxes and geochemical cycles will be introduced. The features that make the Earth unique among the known planets, and habitable, especially the importance of oxygen, carbon dioxide, photosynthesis and respiration form an important part of this paper. Atmospheric processes to be examined include carbon dioxide and the greenhouse effect, acid rain and the sulphur cycle, and photochemistry.

Students will greatly benefit by taking this second semester paper in combination with CHEM200 Analytical Tools for the Life and Environmental Sciences. Students undertake one day of field-work and five three-hour laboratory sessions.

Lecturer(s): Dr Adam Hartland, Associate Professor Merilyn Manley-Harris and Professor Bill Henderson
Prerequisite(s): 15 points at Level 1 Chemistry and 15 points at Level 1 Earth Sciences
Assessment: Internal assessment/examination ratio: 1 : 0

300 Level Papers

CHEM301-15A (HAM) – Advanced Organic Chemistry
20 Points
This paper looks at mass spectrometry and advanced NMR spectroscopy. It explores biosynthesis of natural products and advanced carbohydrate chemistry, as well as stereoelectronic effects, and enolates and enamines in synthesis and biosynthesis.

Lecturer(s): Dr Michèle Prinsep and Associate Professor Merilyn Manley-Harris
Prerequisite(s): CHEM201
Assessment: Internal assessment/examination ratio: 1 : 1

CHEM302-15A (HAM) – Advanced Physical Chemistry
20 Points
This paper covers topics selected from thermodynamics of real systems, surface chemistry, nanotechnology, reaction kinetics and mechanisms, metal corrosion, dynamic electrochemistry, and atomic and molecular structure as revealed by quantum chemistry.

Lecturer(s): Dr Michael Mucalo
Prerequisite(s): CHEM202
Required book(s): Engel and Reid Physical Chemistry (Pearson)
Assessment: Internal assessment/examination ratio: 1 : 1
CHEM303-15B (HAM) – Advanced Inorganic Chemistry
20 Points
Topics dealt with in this paper include the chemistry of the heavier transition elements, and of the lanthanides and actinides. The important topics of bioinorganic chemistry and organometallic chemistry are also presented in some detail. Other aspects of inorganic chemistry that are explored include metal-hydride chemistry, electron-deficient compounds, and complex oxides and oxyanions. For the practical component of the paper, students spend 36 hours in the laboratory working on individual projects from inorganic chemistry. These usually combine quite demanding preparative chemistry with a research component.

Lecturer(s): Professor Bill Henderson and Associate Professor Graham Saunders
Prerequisite(s): CHEM203
Assessment: Internal assessment/examination ratio: 1 : 1

CHEM304-15A/B/C/S/Y (HAM) – Special Topics in Chemistry
20 Points
Each student is assigned an independent or small team research project, which can be laboratory and/or literature-survey based. Students are expected to complete at least 100 hours of laboratory work on their project. Some informal seminars covering project/design and report writing are held, and students present their work to other class members at seminars.

Assessment is based mainly on the detailed reports that are submitted at the end of the paper. This paper provides a useful introduction to research for students who intend to progress to more serious research as part of a MSc programme, and is also a useful way for a student to gain familiarity with an instrumental technique (or techniques) in appropriate cases.

Co-ordinator(s): Dr Michèle Prinsep
Assessment: Internal assessment/examination ratio: 1 : 0

CHEM305-15B (HAM) – Environmental, Forensic, Toxicological and Medicinal Chemistry
20 Points
A paper with a selection of topics from heavy metals and organic compounds in the environment; arson, explosives and fingerprint investigations in forensic casework; toxicological effects in humans, drugs (particularly anti-cancer drugs) and other topics. An organic chemistry/biochemistry background is an advantage for this section of the paper.

The combination of CHEM305 and CHEM306 (built on the foundation of CHEM204) is highly recommended for students wishing to specialise in analytical chemistry.

Lecturer(s): Professor Bill Henderson, Associate Professor Graham Saunders and Dr Michèle Prinsep
Prerequisite(s): CHEM201, CHEM209, or both CHEM112 and BIOL251
Assessment: Internal assessment/examination ratio: 2 : 3
CHEMISTRY PAPERS

CHEM306-15B (HAM) – Advanced Analytical Chemistry
20 Points
Chemical analysis is an essential part of scientific research across the range of disciplines, and these days is usually carried out using specialised part-mechanical and part-electronic devices referred to as instruments. A sound understanding of analytical chemistry and the various instrumental methods of analysis is not only extremely useful to graduate research in biology, earth sciences and/or chemistry, but is also the skill most sought-after by New Zealand employers of chemistry graduates. In this paper, the aim is to further develop such an understanding.

Topics covered are as follows:
» Sampling, sample preparation, trace analysis, data interpretation
» Use of High Pressure Liquid Chromatography (HPLC)
» Interfacing computers and instruments
» Inductively-Coupled Plasma Optical Emission Spectroscopy (ICP-OES)
» Chromatography with emphasis on Gas Chromatography-Mass Spectrometry (GC-MS)
» Emphasis in the laboratory course is on gaining practical working experience of the concepts and instruments discussed in lectures.

Lecturer(s): Associate Professor Merilyn Manley-Harris, Dr Adam Hartland and Associate Professor Graham Saunders
Prerequisite(s): CHEM204
Required book(s): Kellner et al Analytical Chemistry (Wiley-VCH) (Same book as CHEM211)
Assessment: Internal assessment/examination ratio: 3 : 2

CHEM361-15A (HAM) – Applied Environmental Geochemistry
20 points
This course is designed to give students the necessary skills and understanding to tackle the analysis of chemical datasets from natural and polluted waters. The course advances understanding of environmental chemical principals developed in CHEM261 to focus on aqueous geochemistry, combining team-based fieldwork, chemical and computer labs, taught lectures and individual study. Students investigate the processes which determine the chemical composition of natural and polluted waters using the geochemical modelling codes PHREEQC and visual MINTEQ, providing the student with industry-relevant geochemical modelling skills. Students carry out a practical research project involving field and laboratory work and geochemical modelling, finally writing a coherent report including reference to relevant literature. In addition, students will deliver an oral presentation and a poster presentation about the project. Thus, the outcome of this course is to develop students professionally, preparing them for a career in environmental science and management.

Co-ordinator(s): Dr Adam Hartland
Prerequisite(s): CHEM261
Assessment: Internal assessment/examination ratio: 1 : 0
EARTH SCIENCES PAPERS

100 Level Papers

ENVS101-15B (HAM) – Environmental Science
15 Points
For details see ENVS101 Environmental Sciences.

ERTH103-15B (HAM) – Discovering Planet Earth
15 Points
A lecture and laboratory paper that explores the Earth’s interior and its dynamic interaction with the crust. Topics covered include the major rocks and minerals and their economic importance; interpreting the rock record and geologic maps; the geological time scale and fossils; rock deformation; plate tectonics; volcanism; earthquakes; the New Zealand geological environment. A one-day field trip will be run introducing students to aspects of Earth sciences.

Lecturer(s): Dr Adrian Pittari, Dr Shaun Barker and Dr Beth Fox
Tutor(s): Dr Hazel Needham
Required reading: ERTH103 Study Guide
Assessment: Internal assessment/examination ratio: 1 : 1

ERTH104-15A (HAM) – Earth and Ocean Environments
15 Points
A lecture and laboratory paper that explores the processes operating in the terrestrial and ocean environments, and the resulting deposits and landforms. Topics covered include oceanography; coastal hazards and climate change; the hydrological cycle; rivers and groundwater; glaciers; weathering; erosion and mass movement; and soil formation. A one-day field trip will be run introducing students to the physical environment of the Waikato-Raglan district.

Lecturer(s): Dr Megan Balks, Dr David Campbell and Dr Willem de Lange
Tutor(s): Dr Hazel Needham
Required book(s): ERTH104 Study Guide
Assessment: Internal assessment/examination ratio: 1 : 1
200 Level Papers

ERTH221-15B (HAM) – Earth Materials and Processes  
20 Points  
In this paper the nature and significance of Earth materials are studied, and particularly the processes 
and products of volcanism and sedimentation. Students learn the methods of describing and identifying 
the common minerals and rocks of the Earth’s crust. There is an emphasis on laboratory work which 
covers introductory crystallography, optical mineralogy using petrographic microscopes, igneous, 
metamorphic, and sedimentary petrography, grain-size analysis, and detrital mineralogy. 
It is strongly advised that this paper is taken in conjunction with ERTH222. A background in first-year 
chemistry is advisable, but is not essential.  
Note(s): This paper has an enrolment limit of 65 students due to a limited number of 
petrographic microscopes.  
Lecturer(s): Dr Adrian Pittari, Dr Shaun Barker, Dr Beth Fox and Professor Peter Kamp  
Prerequisite(s): ERTH103 and one of ERTH104, ENVS101, GEOG103  
Recommended book(s): Francis and Oppelnheimer Volcanoes (Oxford);  
Winter Principles of Igneous and Metamorphic Petrology (Prentice Hall);  
Boggs Jr Principles of Sedimentology and Stratigraphy (Merrill);  
Prothero and Schwat Sedimentary Geology: an Introduction to Sedimentary  
Rocks and Stratigraphy (W.H.Freeman)  
Assessment: Internal assessment/examination ratio: 1 : 1  

ERTH222-15A (HAM) – Stratigraphy, Structure and Field Methods  
20 Points  
This paper teaches students field methods in Earth Sciences related to the description, mapping 
and structural interpretation of rock sequences underlying land surfaces. It is the principal paper 
at second-year level that gives students experience in fieldwork. Topics covered are stratigraphic 
procedures; field mapping and map interpretation; introduction to analysis of geological structures; 
report writing; and computer graphics for Earth science applications. The paper includes a compulsory 
field camp at Port Waikato, where students undertake section descriptions and mapping exercises. 
This is followed by training in, and the completion of, a compulsory report on the fieldwork.  
Note(s): This paper has an enrolment limit of 50 students, due to field trip accommodation availability.  
Lecturer(s): Dr Shaun Barker, Dr Beth Fox and Professor Peter Kamp  
Prerequisite(s): ERTH103 and one of ERTH104, ENVS101 or GEOG103  
Recommended book(s): Boggs Jr Principles of Sedimentology and Stratigraphy (Merrill);  
Prothero et al Sedimentary Geology – An Introduction to Sedimentary Rocks  
and Stratigraphy (Freeman)  
Assessment: Internal assessment/examination ratio: 3 : 2
ERTH233-15A (HAM) – Soils in the Landscape
10 Points
Soils are New Zealand’s most important natural resource: they sustain life, sequester carbon, and provide many essential ‘services’ and functions. ERTH233 is an introductory paper on the nature and formation of soils and their place in the landscape, their classification, distribution pattern and use as a finite resource in New Zealand. Two fieldtrips (half day, one day) examining the properties and origins of soils in the Waikato region are undertaken. The paper is a partner to ERTH234.

Lecturer(s): Professor David Lowe
Prerequisite(s): Any two of ERTH103, ERTH104, ENVS101 or GEOG103
Restriction(s): ERTH231
Required book(s): Clayden and Hewitt Horizon Notation for New Zealand Soils (Manaaki Whenua Press)
Recommended book(s): Molloy Soils in the New Zealand Landscape 2nd ed (NZ Society of Soil Science)
Assessment: Internal assessment/examination ratio: 1 : 1

ERTH234-15A (HAM) – Soil Properties and their Management
10 Points
This paper is an introduction to the physical, chemical, mineralogical, and biological properties of soils including analysis and interpretation using laboratory methods, and issues of soil quality, land degradation and sustainable management. The paper is a partner to ERTH233.

Lecturer(s): Professor Louis Schipper
Prerequisite(s): Any two of ERTH103, ERTH104, ENVS101 or GEOG103
Restriction(s): ERTH231
Assessment: Internal assessment/examination ratio: 1 : 1

ERTH242-15B (HAM) – Oceanography
20 Points
New Zealand has the fourth largest Exclusive Economic Zone in the world, which creates a demand for graduates with good understanding of oceanography. The paper is largely an introduction to physical oceanography and examines the nature and origin of the oceans; the currents, waves, and circulation patterns found in the oceans; and ocean/climate interactions such as ENSO events. Additional topics include paleoceanography; oceanographic instrumentation and technology; marine resources and management; productivity, energetics and fisheries; and oceanography of the New Zealand Exclusive Economic Zone.

This paper is suitable for all students with an interest in some aspect of marine sciences, and should provide a basic grounding in oceanography which is not normally available elsewhere in a single course until masters-level papers.

Lecturer(s): Dr Julia Mullarney, Dr Willem de Lange and Associate Professor Karin Bryan
Prerequisite(s): Any two of ERTH103, ERTH104, ENVS101 or GEOG103
Recommended book(s): Garrison Oceanography 6th ed. (Tomson, Brooks & Pole);
Goff et al The New Zealand Coast: Te Tai O Aotearoa (Dunmore Press)
Assessment: Internal assessment/examination ratio: 1 : 1
EARTH SCIENCES PAPERS

ERTH245-15A (HAM) – Weather and Climate
10 Points
An introduction to atmospheric processes, including meteorology of the New Zealand region, precipitation processes, energy exchanges within the hydrosphere, and microclimatology, with emphasis on the role of water in climate processes.
Lecturer(s): Dr David Campbell
Prerequisite(s): Any two of ERTH103, ERTH104, ENVS101 or GEOG103
Required book(s): ERTH245 Study Guide
Restriction(s): ERTH241
Assessment: Internal assessment/examination ratio: 1 : 1

ERTH246-15B (HAM) – Introduction to Hydrology
10 Points
An introduction to the land component of the hydrological cycle and associated human modifications. Topics include introduction to groundwater, fluvial processes and landforms, catchment hydrology and hydro power evaluation.
Lecturer(s): Associate Professor Earl Bardsley
Prerequisite(s): Any two of ERTH103, ERTH104, ENVS101 or GEOG103
Restriction(s): ERTH241
Assessment: Internal assessment/examination ratio: 1 : 1

ERTH251-15B (HAM) – Engineering Geomorphology
10 Points
An introduction to the study of mass wasting processes on hillslopes: classification of mass wasting; processes of rock and soil slope failure and their recognition based on geomorphic evidence; nature and geomorphology of debris flows and debris avalanches; hazard assessment for slope failure. Field and laboratory work concentrates on basic mapping and surveying techniques, air photo interpretation and geomorphic map presentation, collection and description of soil profile logs.
Lecturer(s): Dr Vicki Moon
Prerequisite(s): Any two of ERTH103, ERTH104, ENVS101 or GEOG103
Assessment: Internal assessment/examination ratio: 1 : 1

ERTH284-15B (HAM) – Introduction to Environmental Monitoring
10 Points
This paper introduces students to aspects of environmental monitoring within the New Zealand resources management framework and includes principles of environmental monitoring as applied to a range of environments in the Waikato Region; sampling strategies; and data interpretation. Practical exercises concentrate on specific skills in the acquisition and interpretation of environmental data, including undertaking field surveys; sampling of earth materials; sample management and analysis; report presentation and communication of results.
Lecturer(s): Dr Vicki Moon, Dr Megan Balks and guest lecturers from Waikato Regional Council
Prerequisite(s): Any two of ENVS101, ERTH103, ERTH104 or GEOG103
Restriction(s): ENVP308
Assessment: Internal assessment/examination ratio: 1 : 1
300 Level Papers

ERTH311-15A/B/C (HAM) – Special Topics in Earth Sciences
20 Points
Students are assigned a research project on which they are expected to spend at least 100 hours and to write a report. This paper is not normally part of an Earth Sciences major and is intended for top academic achievers. Admission is at the discretion of the relevant Paper Convenor/Coordinator, and will depend on the availability of a supervisor.
Assessment: Internal assessment/examination ratio: 1 : 0

ERTH312-15A/B/C (HAM) – Special Topics in Earth Sciences
10 Points
Students are assigned a research project on which they are expected to spend at least 50 hours and to write a report. This paper is not normally part of an Earth Sciences major. Admission is at the discretion of the relevant Paper Convenor/Coordinator and will depend on the availability of a supervisor.
Assessment: Internal assessment/examination ratio: 1 : 0

ERTH321-15A (HAM) – Volcanology
20 Points
Volcanism is the fundamental geological process shaping our planet, one that provides abundant resources for society while also posing significant hazards. This paper explores the nature, dynamics and significance of all types of volcanoes and volcanic processes, and examines the magmatic systems that feed volcanoes. Topics covered include properties of magma, lava flows, explosive eruption mechanisms and emplacement processes, volcano monitoring, origin of magmas, crystallisation of rock-forming minerals and phase equilibria, petrology and trace element geochemistry of volcanic rocks, and geothermal and mineral resources.
The paper includes a two-day field trip to Taupo and Tongariro to examine some world-class volcanoes and volcanic deposits.
Lecturer(s): Dr Adrian Pittari and Dr Shaun Barker
Prerequisite(s): ERTH221 (ERTH222 is strongly recommended)
Assessment: Internal assessment/examination ratio: 3 : 2

ERTH322-15B (HAM) – Sedimentary and Petroleum Geology
20 Points
This paper describes various types of sedimentary basins in terms of their plate tectonic setting, and looks at the different controls on sedimentation. It offers an integrated lecture-lab segment on principles and application of sequence stratigraphy which involves the interpretation of oil exploration acquired seismic reflection profiles. The concept of sedimentary facies is emphasised, particularly those criteria used for interpreting the depositional environments of ancient sedimentary rock sequences. New Zealand examples are used throughout the paper. Laboratory work includes facies analysis and mapping, microfossil analysis, thin-section petrography, X-ray diffraction techniques, and there is a compulsory three-day geology field trip to northern Taranaki, based at Awakino, and an associated report.
This paper leads on from ERTH221 and/or ERTH222 and it may be considered a partner to ERTH321.
Lecturer(s): Professor Peter Kamp, Dr Rochelle Hansen and Dr Beth Fox
Prerequisite(s): ERTH221 or ERTH222
Recommended book(s): Boggs Jr Principles of Sedimentology and Stratigraphy (Merrill); James et al Facies Models – Response to Sea Level Change (Geological Association of Canada); Prothero et al Sedimentary Geology – An Introduction to Sedimentary Rocks and Stratigraphy (Freeman)
Assessment: Internal assessment/examination ratio: 3 : 2
EARTH SCIENCES PAPERS

ERTH333-15A (HAM) – Pedology and Land Evaluation
10 Points
This paper examines soil genesis and spatial variability, quantitative soil survey and soil-landscape modelling, soil taxonomy, and the interpretation of soil and land data in a form applicable to land-use planning and management. This paper, which follows on from ERTH233, is a partner to ERTH334.

Lecturer(s): Professor David Lowe
Prerequisite(s): ERTH233
Restriction(s): ERTH331
Recommended book(s): Schaetzl and Anderson Soils: Genesis and Geomorphology (Cambridge University Press); Milne et al Soil Description Handbook 2nd ed (Manaaki Whenua Press)
Assessment: Internal assessment/examination ratio: 3 : 2

ERTH334-15B (HAM) – Soil and Land Management
10 Points
Analysis and interpretation of soil properties relating to land and environmental management, soil fertility, soil water management, land treatment of wastes, soil degradation and remediation, soil nitrogen and phosphorus cycling. This paper, which follows on from ERTH234, is a partner to ERTH333.

Lecturer(s): Professor Louis Schipper and Dr Megan Balks
Prerequisite(s): ERTH234
Restriction(s): ERTH331
Assessment: Internal assessment/examination ratio: 3 : 2

ERTH343-15B (HAM) (TGA) – Coastal Geomorphology and Management
20 Points
The paper focuses on understanding of coastal processes, sediments and evolution of coastal landforms as a basis for coastal management. Topics covered include beach sediments and processes, coastal erosion, and littoral, tidal flats, tidal inlets, estuaries, dunes, rocky shorelines; semiquantitative methods for coastal hazard analysis and tidal inlet stability; coastal planning issues relating to the RMA (1991); sea-level rise impacts, dredging and spoil dispersion, port and marina developments, and methods of coastal protection.

There will be a one-day field trip to examine aspects of coastal geomorphology processes and management.

Lecturer(s): Dr Willem de Lange and Associate Professor Karin Bryan
Prerequisite(s): 40 points from 200 Level Earth Sciences or approved Geography papers
Recommended books: Komar Beach Processes and Sedimentation 2nd ed (Prentice-Hall) 1998;
Middleton Data Analysis in the Earth Sciences Using Matlab (Prentice-Hall)
Assessment: Internal assessment/examination ratio: 3 : 2

ERTH344-15A (HAM) – Coastal Oceanography and Engineering
20 Points
This paper focuses on physical oceanography of the coastal zone. Topics include methodologies for quantifying processes and coastal responses; evaluation of design conditions for coastal engineering; and application of numerical models for simulating coastal processes. This paper, which follows on from ERTH242, includes a one-day field trip.

Lecturer(s): Associate Professor Karin Bryan and Dr Julia Mullarney
Prerequisite(s): ERTH242 or ERTH245
Recommended book(s): Komar Beach Processes and Sedimentation 2nd ed (Prentice-Hall) 1998;
Middleton Data Analysis in the Earth Sciences Using Matlab (Prentice-Hall)
Assessment: Internal assessment/examination ratio: 3 : 2
ERTH345-15A (HAM) – Catchment Hydrology  
10 Points  
Measurement, analysis and modelling of surface hydrological processes at the catchment scale, emphasizing precipitation, river flow, evaporation, interception loss and hillslope runoff processes. This paper is a partner to ERTH346.

Lecturer(s): Dr David Campbell  
Prerequisite(s): ERTH245 or ERTH246  
Restriction(s): ERTH341  
Assessment: Internal assessment/examination ratio: 3 : 2

ERTH346-15B (HAM) – Freshwater Resources and Hazards  
10 Points  
Overview of freshwater resources and their analysis, with some emphasis on groundwater resources; introduction to hydrological hazards including flood hazard analysis and river contamination modelling. This paper is a partner to ERTH345.

Lecturer(s): Associate Professor Earl Bardsley  
Prerequisite(s): ERTH246 or ERTH245  
Restriction(s): ERTH341  
Recommended book(s): Wainwright and Mulligan Environmental Modelling (Wiley) 2004  
Assessment: Internal assessment/examination ratio: 3 : 2

ERTH352-15A (HAM) – Engineering Geology  
10 Points  
An understanding of the nature and mechanics of soil instability is developed from an examination of slope erosion processes and the physical properties of earth materials. Strategies are discussed for mitigation and avoidance of hazards resulting from slope instability and associated erosion processes.

Lecturer(s): Dr Vicki Moon  
Prerequisite(s): ERTH251  
Assessment: Internal assessment/examination ratio: 3 : 2

ERTH384-15B (HAM) – Advanced Environmental Monitoring  
10 Points  
This paper has focus on detecting and quantifying change in the natural environment. A source-to-sea theme is included, with topics incorporating catchment hydrology, soil and land use patterns, sedimentation and nutrient inputs to estuaries. Techniques covered include simple modelling, statistical methods and field survey analysis.

Lecturer(s): Associate Professor Karin Bryan, Associate Professor Earl Bardsley and Dr Megan Balks  
Prerequisite(s): 40 points from 200 Level Earth Sciences or approved Geography papers  
Assessment: Internal assessment/examination ratio: 3 : 2
Electronics Papers

100 Level Papers

ENEL111-15A (HAM) – Introduction to Electronics
15 Points
This paper covers basic electronic concepts. Topics include circuit theory, Thevenin’s theorem, resistors, capacitors, inductors and power sources, diodes, amplifiers, feedback, logic circuits, analog-to-digital and digital-to-analog conversion.

Note(s): This paper is recommended for all Physics majors.

Co-ordinator(s): Professor Jonathan Scott
Prerequisite(s): 14 credits at Level 3 in NCEA Physics
Corequisite(s): Students who intend to continue in Physics or Electronics are also recommended to enrol in MATH101
Required book(s): To be advised
Assessment: Internal assessment/examination ratio: 1 : 1

200 Level Papers

COMP200-15A (HAM) – Computer Systems
10 Points
For details refer to the Faculty of Computing & Mathematical Sciences Handbook.

ENEL205-15B (HAM) – Analog Electronics and Circuit Analysis
20 Points
This paper covers design and analysis of analog electronic circuits. Topics include ac circuit analysis, nodal analysis, Laplace Transforms, BJT amplifier circuits and their equivalent circuits, frequency response. Feedback, output stages, oscillators, operational amplifiers and their limitations, active filters, using PSPICE. This paper includes a laboratory component.

Co-ordinator(s): Dr Sadhana Talele
Prerequisite(s): ENEL111
Assessment: Internal assessment/examination ratio: 1 : 1

ENEL212-15A (HAM) – Electronics for Digital Systems
10 points
This paper covers the theory, design and applications of logic circuits and technology related to digital systems.

Co-ordinator(s): Dr Michael Cree
Prerequisite(s): COMP104 or ENEL111
Restriction(s): ENEL211
Assessment: Internal assessment/examination ratio: 1 : 1

ENEL213-15A (HAM) – Instrumentation
10 points
This paper covers the design of analogue and digital instrumentation to measure electrical parameters and the design and use of sensors.

Co-ordinator(s): Nihal Kularatna
Prerequisite(s): ENEL111
Restriction(s): ENEL211
Assessment: Internal assessment / examination ratio: 1:0
ENEL284-15B (HAM) – Electricity and Magnetism
10 Points
This paper teaches principles of electromagnetism relevant to engineering. It covers fundamental theory of electric and magnetic fields.

Co-ordinator(s): Professor Moira Steyn-Ross
Prerequisite(s): PHYS103 and ENEL111
Corequisite(s): either ENGG285 or MATH251, and either ENGG283 or MATH253, and either ENGG284 or MATH255
Restriction(s): ENEL281, PHYS201 and PHYS304
Assessment: Internal assessment/examination ratio: 1 : 2

ENEL285-15A (HAM) – Quantum and Solid State Physics
10 Points
This paper teaches principles of modern physics relevant to engineering. It covers introductory quantum mechanics, atomic and semiconductor physics.

Co-ordinator(s): Dr Michael Cree
Prerequisite(s): PHYS103 and MATH101
Restriction(s): ENEL281, PHYS202 and PHYS304
Recommended book(s): Krane Modern Physics 3rd ed 2012
Assessment: Internal assessment/examination ratio: 1 : 2

300 Level Papers

COMP311 – Computer Systems Architecture
20 Points
This paper will not be offered in 2015.

ENEL301-15A/B/C/Y (HAM) – Special Topics in Electronics
20 Points
An independent theoretical, literature, or experimental investigation of an electronics topic, supervised by a member of staff. Progress and assessment are negotiated between the student and supervisor, and typically take the form of a poster, paper manuscript and/or report.

Note(s): Admission is at the discretion of the Head of School.
Co-ordinator(s): Associate Professor Rainer Künnemeyer
Assessment: Internal assessment/examination ratio: 1 : 0

ENEL312-15A (HAM) – Electromagnetic Waves
20 Points
This paper discusses electromagnetic wave phenomena using classical electromagnetic theory, which is applied to a range of engineering applications such as transmission lines, waveguides, antennas, electromagnetic interference, and microwave circuits.

Note(s): A minimum mark of 40% is required in the examination to receive a passing grade. Laboratory attendance is compulsory.
Co-ordinator(s): Associate Professor Rainer Künnemeyer
Prerequisite(s): ENEL284 or PHYS201, and ENGG285 or MATH251
Restriction(s): ENEL301-09A
Equivalent: PHYS312
Required book(s): To be advised
Assessment: Internal assessment/examination ratio: 1 : 2
**ELECTRONICS PAPERS**

**ENEL317-15B (HAM) – Microprocessor Applications and Control**  
20 Points  
This paper provides an introduction to the field of mechatronics. Topics covered include a study of sensors and transducers, signal conditioning electronics, circuit analysis using both the Laplace and Z transforms, and PID control theory. Laboratory exercises in which microprocessors are interfaced to physical systems in order to monitor and/or control real-world processes. This paper includes a compulsory laboratory component.  
**Note(s):** A minimum mark of 40% in the internal tests is normally required in order to receive a passing grade.  
Co-ordinator(s): Associate Professor Howell Round  
Prerequisite(s): COMP103 and ENEL205 and one of ENEL211 or ENEL212  
Assessment: Internal assessment/examination ratio: 1 : 0

**ENEL321-15B (HAM) – Application Specific Integrated Circuits**  
20 Points  
The design and construction of integrated circuits including silicon and compound semiconductor IC fabrication, design hierarchy, circuit layout, operating reliability and failure, verification and test. Circuits that can only be fabricated in a monolithic environment are studied and built.  
Co-ordinator(s): Professor Jonathan Scott  
Prerequisite(s): COMP103 and ENEL205 and one of ENEL211 or ENEL212  
Recommended book(s): Weste and Harris *CMOS VLSI Design* (Addison-Wesley) 2005; Grey and Meyer, *Analysis and Design of Analog Integrated Circuits*  
Assessment: Internal assessment/examination ratio: 1 : 1

**ENEL324-15A (HAM) – Optoelectronics**  
20 Points  
This paper discusses the principles of modern optoelectronic components and systems in particular lasers, semi-conductor devices, optoelectronic devices and optical fibres. Theoretical as well as practical aspects will be covered.  
**Note(s):** Laboratory attendance is compulsory. A minimum mark of 40% is required in the examination to receive a passing grade.  
Co-ordinator(s): Associate Professor Rainer Künnemeyer  
Prerequisite(s): MATH101, MATH102 and either ENEL285 or PHYS202  
Assessment: Internal assessment/examination ratio: 1 : 2

**ENEL382-15B (HAM) – High Speed Communications**  
20 Points  
This lecture and laboratory paper introduces communications theory and its application to wireless and fibre-optic communication systems.  
**Note(s):** A minimum mark of 40% is required in the examination to receive a passing grade.  
Co-ordinator(s): Dr Sadhana Talele  
Prerequisite(s): One of ENGG283 or MATH253, and one of ENGG285 or MATH251  
Corequisite(s): ENEL324  
Assessment: Internal assessment/examination ratio: 1 : 1
ENEL385-15B (HAM) – Power Electronics
20 Points
This paper covers the theory and practice of power semiconductors, power converters, power management, protection, and variable speed drives.

Note(s): A minimum mark of 40% is required in the examination to receive a passing grade.

Co-ordinator(s): Nihal Kularatna
Prerequisite(s): ENEL205
Restriction(s): ENEL485 and ENEL585
Assessment: Internal assessment/examination ratio: 1 : 1

400 Level Papers

ENEL417-15A (HAM) – Mechatronics
20 Points
This paper covers embedded micro-programming, feedback control, interface to electro-mechanical systems involving gears, motors, belt drivers, actuators and sensors: the enabling technologies of robotics. A series of projects require students to integrate software, control, mechanical and electromotive skills to achieve practical goals.

Co-ordinator(s): Professor Jonathan Scott
Prerequisite(s): ENEL317
Restriction(s): ENEL517
Assessment: Internal assessment/examination ratio: 1 : 0
ENEL423-15B (HAM) – Electro-Optical Instrumentation
20 Points
Theoretical and practical aspects of advanced electro-optical instrumentation will be discussed and applied in practical sessions. Topics include telemeters, interferometers for velocity or vibration detection, optical gyroscopes, optical fibre sensors, and others.

Note(s): A minimum mark of 40% in the examination is required to receive a passing grade. Laboratories are compulsory. This paper will only be offered if there are sufficient student numbers.

Co-ordinator(s): Associate Professor Rainer Künnemeyer
Prerequisite(s): ENEL324
Restriction(s): ENEL322 and ENEL522
Required book(s): To be advised
Assessment: Internal assessment/examination ratio: 1 : 1

ENEL485-15B (HAM) – Power Electronics
20 Points
This paper covers the theory and practice of power semiconductors, power converters, power management, protection, and variable speed drives.

Note(s): A minimum mark of 40% in the examination is required to receive a passing grade.

Co-ordinator(s): Nihal Kularatna
Prerequisite(s): ENEL205
Restriction(s): ENEL385 and ENEL585
Assessment: Internal assessment/examination ratio: 1 : 1

ENGG401-15A (HAM) – Control Theory and Image Processing
20 Points
For details see Engineering ENGG401.
ENGINEERING PAPERS

100 Level Papers
ENGG180-15A (HAM) – Foundations of Engineering
15 Points
Introduction to engineering analysis, engineering design, and the engineering profession. It includes: skills of a successful engineer, the nature of design and the design process; fundamental laws for engineering analysis, and accounting principles applied to mass and energy. Students undertake a design-build-test experience to practice design skills.

Co-ordinator(s): Dr Rob Torrens
Restriction(s): ENGG302
Equivalent: ENMP101
Assessment: Internal assessment/examination ratio: 1 : 1

200 Level Papers
ENGG279-15B (HAM) – Preparation for the Professional Workplace
0 Points
For details see Work Placements on page 134.

ENGG282-15B (HAM) – Engineering Design
10 Points
This core paper for BE(Hons) students introduces the design process as a problem-solving activity. This is reinforced by a group design project. Students also learn how to use and apply CAD design software and produce engineering drawings.

Co-ordinator(s): Associate Professor Mike Duke
Assessment: Internal assessment/examination ratio: 1 : 1

ENGG283-15A (HAM) – Linear Algebra for Engineers
10 Points
This paper develops the fundamental ideas and techniques of linear algebra, with an emphasis on the practical engineering aspects of the subject. Topics will be selected from: basis and dimension of a vector space, geometric effect of a matrix transformation, determinant, subspaces of vector spaces, linear independence, change of basis, range and kernel, eigenvectors and eigenvalues, diagonalisation of matrices, the inner product, orthonormal bases, the Gram-Schmidt process, orthogonal diagonalisation of symmetric matrices, complex Euclidean spaces, Hermitian matrices and their diagonalisation.

Co-ordinator(s): Dr Nick Cavenagh
Prerequisite(s): MATH102
Restriction(s): MATH253
Required book(s): Anton Elementary Linear Algebra 8th or 9th ed (Wiley) 2000
Assessment: Internal assessment/examination ratio: 1 : 1
ENGG284-15B (HAM) – Differential Equations for Engineers
10 Points
This paper includes ordinary and partial differential equations with applications to engineering problems; first-order equations, systems of equations and higher-order equations, phase-plane diagrams and geometrical methods; solution to the wave equation, heat diffusion equation and Laplace’s equation using separation of variables and Fourier series techniques.
Co-ordinator(s): Woei Chet Lim
Prerequisite(s): MATH101 and MATH102
Restriction(s): MATH255
Required book(s): Boyce and Di Prima Elementary Differential Equations and Boundary Value Problems 7th or 8th ed (Wiley) 2003
Assessment: Internal assessment/examination ratio: 1 : 1

ENGG285-15A (HAM) – Multivariable Calculus for Engineers
10 Points
Differentiation of functions of n-variables and vector functions; applications including tangent planes, normals and optimisation; integration in n-dimensions; and applications including curve length, surface areas and volumes. Further applications will be selected from: centre of mass co-ordinates and moments of inertia; gradient, divergence and curl operators; curvilinear co-ordinate systems; and integral theorems with applications to engineering problems.
Co-ordinator(s): Yuri Litvinenko
Prerequisite(s): MATH101 and MATH102
Restriction(s): MATH251
Recommended book(s): Finney et al Thomas’ Calculus 10th or 11th ed (Addison-Wesley) 2003
Assessment: Internal assessment/examination ratio: 1 : 1

ENGG287-15A (HAM) – Engineering Applications
10 Points
Computer programming as a tool for engineering, using computer languages and systems to solve engineering problems.
Co-ordinator(s): Associate Professor Alistair Steyn-Ross
Prerequisite(s): PHYS103 and one of COMP103 or COMP106 or COMP153
Assessment: Internal assessment/examination ratio: 1 : 1
300 Level Papers

ENGG301-15A/B/C/Y (HAM) – Special Topic in Engineering
20 Points
An independent theoretical, literature or experimental investigation of an engineering topic, supervised by a member of staff. Progress is discussed in group seminars and assessment is based on activities such as a seminar, poster presentations and a full report.

Co-ordinator(s): Dr James Carson
Assessment: Internal assessment/examination ratio: 1 : 0

ENGG302-15A (HAM) – Engineering for Technology
20 Points
Engineering fundamentals and the design process; the relationships of engineering to technology. Includes a design-build-test experience and links to pedagogical teaching processes. This paper is only available for GradDip[Eng](Technology Teaching).

Convenor(s): Dr Rob Torrens
Prerequisite(s): At the discretion of the Head of School
Restriction(s): ENGG180
Assessment: Internal assessment/examination ratio: 3 : 2

ENGG371-15C (HAM) – Engineering Work Placement 1
0 Points
For details see Work Placements on page 135.

ENGG372-15C (HAM) – Engineering Work Placement 2
0 Points
For details see Work Placements on page 135.
ENGG379-15A (HAM) – Reflection on Professional Workplace Experience
0 Points
For details see Work Placements on page 135.

ENGG381-15A (HAM) – Engineering Statistics
20 Points
This paper is aimed specifically at engineering students. It covers statistical models, experimentation for quality designing and control, process measurement and improvement, statistical process control and capability, and reliability.

Lecturer(s): Dr Steven Miller
Prerequisite(s): MATH101 and MATH102
Assessment: Internal assessment/examination ratio: 1 : 1

400 Level Papers

ENGG401-15A (HAM) – Control Theory and Image Processing
20 points
This paper deals with PID feedback control of linear systems using classical as well as state space methods. It is highly computer and project based.

Convenor(s): Associate Professor Howell Round
Prerequisite(s): One of ENEL317 or ENME352
Restriction(s): ENGG501
Required book(s): Franklin et al. *Feedback Control of Dynamic Systems* 5th ed (Prentice Hall)
Assessment: Internal assessment/examination ratio: 1 : 0

ENGG492-15A/B/C/Y (HAM) – Honours Research and Management Project
60 Points
Practical projects including design philosophy; market requirements; specifications; project planning and research; management components and material selection; basic design and analysis; computer aided design; prototype development; reliability; quality; safety; failure analysis and protection, regulations; standards and codes; documentation and patents. There is a substantial research component. This paper can only be taken for the BE(Hons).

Co-ordinator(s): To be advised
Programme Convenor(s): Dr Johan Verbeek (Chemical and Biological Engineering),
Professor Jonathan Scott (Electronic Engineering),
Associate Professor Michael Walmsley (Materials and Process Engineering),
Associate Professor Mike Duke (Mechanical Engineering) and
Professor Steve Reeves (Software Engineering)
Prerequisite(s): All 100, 200, 300 Level BE(Hons) papers of the student’s chosen programme.
Assessment: Internal assessment/examination ratio: 1 : 0
ENENVIRONMENTAL SCIENCES PAPERS

100 Level Papers
ENVS101-15B (HAM) – Environmental Science
15 Points
An interdisciplinary study of the fundamental concepts in environmental science. The paper includes ecosystems, nutrient cycles, population principles, water, soil and energy resources, wetlands, human food supplies, agrochemicals, heavy metals, the greenhouse effect, photochemical smog, and waste management.

Lecture material is complemented by a practical component that includes six three-hour laboratory sessions and two field trips.

Co-ordinator(s): Dr Megan Balks
Lecturer(s): Dr Ian Duggan, Dr Megan Balks, Professor Bill Henderson and Associate Professor Conrad Pilditch
Tutor(s): Tanya O’Neill
Required reading: ENVS101 Study Guide
Assessment: Internal assessment/examination ratio: 1 : 1
MATERIALS AND PROCESSING PAPERS

100 Level Papers

ENGG180-15A (HAM) – Foundations of Engineering
15 Points
For details see Engineering ENGG180.

ENMP102-15B (HAM) – Introduction to Materials Science and Engineering
15 Points
Engineers in all disciplines encounter and use materials in their various practices. To function effectively, an engineer needs to have some understanding of the properties and behaviour of materials. This is particularly relevant in design and maintenance, when engineers need to make important decisions on the choice of materials to be used in a component. This paper is, therefore, designed to address the introductory materials science requirements for first-year engineering programmes.

Co-ordinator(s): Dr Rob Torrens
Recommended book(s): Callister et al Materials Science and Engineering – An Introduction
8th ed (Wiley) 2010
Assessment: Internal assessment/examination ratio: 1 : 1

200 Level Papers

ENGG282-15B (HAM) – Engineering Design
10 Points
For details see Engineering ENGG282.

ENMP211-15A (HAM) – Materials 1
20 Points
Why are some materials as hard as nails, soft as putty, tough as old boots, or as strong as an ox? And how can they be improved? This paper introduces the basic concepts of materials technology and how to apply these concepts to everyday environments. You will be introduced to the uses and limitations of metals (ferrous and non-ferrous), ceramics/fine ceramics (superconductors, ionic conductors etc), cements and concrete, polymers and composite materials (natural, such as wood, and synthetic, such as carbon fibre-reinforced composites).

Co-ordinator(s): Professor Kim Pickering
Prerequisite(s): 15 points at Level 100 chemistry or equivalent credit, or ENMP102
Assessment: Internal assessment/examination ratio: 1 : 1

ENMP213-15B (HAM) – Mechanics of Materials 1
20 Points
Students learn the basics of stress analysis used in mechanical engineering design. This course introduces the essential aspects of designing structures subjected to axial, bending and torsional loads. An important outcome is an introduction to the fundamental principles of stress analysis. This paper is taught through lectures, tutorials and a weekly workshop for problem solving.

Co-ordinator(s): Professor Ilanko
Prerequisite(s): MATH101 and PHYS103
Assessment: Internal assessment/examination ratio: 1 : 1

ENMP214-15B (HAM) – Manufacturing Processes
10 Points
This paper gives students an understanding of the fundamental principles and basic relationships underlying selected major manufacturing processes widely used in industry, including machining processes, metal casting, forming processes such as extrusion, welding and joining processes. Knowledge on metrology and non-destructive testing techniques will also be introduced. It is highly recommended that students taking this paper also take ENMP215.

Co-ordinator(s): To be advised
Prerequisite(s): ENMP102
Assessment: Internal assessment/examination ratio: 1 : 1
ENMP215-15B (HAM) – Manufacturing Technology
10 Points
This paper covers the practical aspects of manufacturing processes, and students have the opportunity to increase their practical workshop skills. The major processes covered by the paper include machining, casting, mechanical forming, welding, and printed board manufacturing. It is highly recommended that students taking this paper also take ENMP214.

Co-ordinator(s): Dr Chi Kit Au
Prerequisite(s): ENMP102
Required book(s): M. Groover Automation, Production Systems and Computer Integrated Manufacturing (Pearson)
Assessment: Internal assessment/examination ratio: 1 : 1

ENMP221-15A (HAM) – Engineering Thermodynamics
20 Points
This paper teaches fundamental concepts and laws of thermodynamics and thermodynamic properties of engineering materials, with applications to mass and energy analysis of chemical processes, power cycles, and refrigeration cycles. It includes laboratory work.

Co-ordinator(s): Dr Johan Verbeek
Prerequisite(s): ENGG180 or ENMP102
Required book(s): Cengel and Boles Thermodynamics, an Engineering Approach 6th ed (McGraw Hill)
Assessment: Internal assessment/examination ratio: 1 : 1

ENMP222 – Biotechnology: Food and Bioresources
20 Points
This paper will not be offered in 2015.

ENMP223-15B (HAM) – Thermofluids
20 Points
This paper teaches fundamental concepts and laws related to static and dynamic behaviour of fluids, and heat transfer in steady and transient systems. It includes laboratory work.

Co-ordinator(s): Associate Professor Michael Walmsley
Prerequisite(s): MATH101, PHYS103 or ENMP221
Assessment: Internal assessment/examination ratio: 1 : 1

ENMP241-15B (HAM) – Environmental Technology 1
20 Points
The Earth’s natural environment suffers from the effects of past exploitative development. This paper combines the principles of science and engineering to find technological solutions for existing problems and design processes for future sustainable development. In this introductory paper, processes for maximising the benefit of the material resources taken from the environment (minerals, water, air, fossil fuels and biomass) and minimising waste and negative impacts will be discussed.

Co-ordinator(s): Dr Mark Lay
Prerequisite(s): Any 30 points from 100 Level Science and Engineering papers, and 15 points from 100 Level Mathematics or Statistics
Assessment: Internal assessment/examination ratio: 1 : 1
MATERIALS AND PROCESSING PAPERS

ENMP282-15A (HAM) – Science and Engineering Management A
10 Points
A study of the management function and activities relating to the needs of scientists and engineers. Topics include technology and innovation, communication and financial management.
This paper will not normally be available for a major in Materials and Processing.
Co-ordinator(s): Dr James Carson
Restriction(s): ENGG280 and ENMP281
Assessment: Internal assessment/examination ratio: 1 : 1

ENMP283-15B (HAM) – Science and Engineering Management B
10 Points
This core management paper for the BSc(Tech) is normally taken before the first industry placement. It is also a useful paper for other science students who want to be familiar with management terms and concepts. This paper provides a broad introduction to the essential aspects of management functions and activities. Topics include marketing, total quality management and ethics.
This paper will not normally be available for a major in Materials and Processing.
Co-ordinator(s): Dr Johan Verbeek
Restriction(s): ENMP281
Assessment: Internal assessment/examination ratio: 1 : 1

300 Level Papers

ENME351-15A (HAM) – Dynamics and Mechanisms
20 Points
This paper is normally only available to students enrolled in the BE(Hons) degree.
Introduction to force, moment, equilibrium, free body diagram, work, energy, impulse, momentum and Newton’s Laws. Kinematics and kinetics of particles and rigid bodies, vibrations. Function and design of mechanical components. Students will learn to construct and solve mathematical models describing the effects of force and motion on a variety of structures, machines and other dynamic systems.
Co-ordinator(s): Dr Marcus Wilson
Prerequisite(s): PHYS103
Equivalent: ENGG351
Assessment: Internal assessment/examination ratio: 1 : 1

ENME352-15B (HAM) – Machine Dynamics and Control
20 Points
This paper is normally only available to students enrolled in the BE(Hons) degree.
Topics covered include vibrations of multiple degree of freedom systems, modelling and analysis for design improvements, vibration control, mathematical modelling, time, feedback and frequency response, control actions and controllers. Students will gain skills to allow them to design dynamic systems.
Co-ordinator(s): Professor Ilanko
Prerequisite(s): ENME351
Equivalent: ENGG352
Restriction(s): ENEL317
Recommended book(s): Tongue Principles of Vibration (Oxford)
Assessment: Internal assessment/examination ratio: 1 : 1
ENME380-15B (HAM) – Mechanical Engineering Design
20 Points
*This paper is normally only available to students enrolled in the BE(Hons) degree.*

Aspects of machine design and power transmission are covered. Engineering drawing and design techniques are further developed and applied through project work. The benefits and pitfalls of simulating mechanical designs is demonstrated and discussed. Electrical machines including DC, AC motors and solenoids are explained in a mechanical engineering context.

Co-ordinator(s): Associate Professor Mike Duke
Prerequisite(s): ENGG282 and ENMP213
Required book(s): Childs *Mechanical Design* 2nd ed (Arnold) 2004
Assessment: Internal assessment/examination ratio: 1 : 1

ENMP301-15A/B/S/Y (HAM) – Special Topics in Technology
20 Points
This paper consists of directed studies on an aspect of technology or technological innovation. It may involve specified topics from other papers and/or independent theoretical literature, or experimental investigations. Students require permission from the Head of School to enrol in this course.

Co-ordinator(s): Dr James Carson
Assessment: Internal assessment/examination ratio: 1 : 0

ENMP311-15B (HAM) – Materials 2
20 Points
This paper advances knowledge presented in ENMP211 on structure, property, processing relationships fundamental to materials science engineering. The paper focuses on aspects of new materials, and the concept of advanced hi-tech materials. This paper includes microstructure modification, new materials and applications. With a basic understanding of the concepts, students will now start to understand the design philosophy. By the end of the paper, students will be able to understand the requirements for a particular application and be able to select materials on the basis of their properties.

Note(s): This paper is recommended if proceeding to masters-level study in materials-related research.

Co-ordinator(s): Professor Kim Pickering
Prerequisite(s): ENMP211
Assessment: Internal assessment/examination ratio: 1 : 1

ENMP313-15A (HAM) – Mechanics of Materials 2
20 Points
This paper aims to provide students with the knowledge and skills to design components and structures at an advanced level. It examines the scientific principles and relationships underlying mechanics and performance of materials, stress and strain transformations, failure criteria, deflections and angle of twist, stress in bending and fatigue. A major design project is incorporated in the paper to give students opportunities to apply the knowledge learnt in solving practical problems. By the end of the course students will have the essential knowledge and skills needed in designing components and structures in many engineering situations.

Co-ordinator(s): Professor Brian Gabbitas
Prerequisite(s): ENMP213
Assessment: Internal assessment/examination ratio: 1 : 1
MATERIALS AND PROCESSING PAPERS

ENMP321-15B (HAM) – Process Engineering and Design
20 Points
This paper provides advanced aspects of design and process technology for commercial production of biological, chemical and mineral products. The principles of chemical and biological engineering, including designing production systems, process simulation; process economics equipment design and separation technology. Once physical processes have been reviewed, the emphasis moves to process design – how to put together an integrated process and how to assess and implement it. A key component in the paper is process economics – will the process make money or not?

Co-ordinator(s): Dr Johan Verbeek
Prerequisite(s): ENMP221
Required text(s): Seider, et al Product & Process Design Principles 2nd ed (John Wiley and Sons, Inc.) 2004
Assessment: Internal assessment/examination ratio: 1 : 1

ENMP322-15B (HAM) – Biotechnology
20 Points
The paper includes: Industrial biotechnological applications of enzymes and micro-organisms, principles of bioreactor and fermenter design and operation, industrial separation and purification of biological material, and selected unit operations for bioprocessing. Topics may also include biomass and alcohol production, enzymes in food processing, and biotechnologies in food and by-products. The computing laboratories cover aspects of bioreactor operation, fermentations and bioseparations.

Co-ordinator(s): Dr Aydin Berenjian
Prerequisite(s): One of BIOL241, ENMP221 or ENMP222
Assessment: Internal assessment/examination ratio: 1 : 1

ENMP323-15A (HAM) – Transport Processes and Unit Operations
20 Points
This paper covers analysis and application of fluid phase equilibria, heat and mass transfer and separation processes. The fundamentals of drying, evaporation, membrane separations, and distillation are discussed.

Co-ordinator(s): Dr James Carson
Prerequisite(s): ENMP223
Recommended book(s): Unit Operations of Chemical Engineers, 7th ed (McGraw-Hill)
Assessment: Internal assessment/examination ratio: 1 : 1

ENMP325-15A (HAM) – Engineering Microbiology
20 Points
This paper is normally only available to students enrolled in the BE(Hons) degree.
This paper deals almost wholly with bacteria. Its aim is to provide insight into their structure, how they are classified, how they grow and some account of their very diverse physiologies. Structure and physiology are discussed in relation to the role of bacteria in nature and how various methods (such as the use of antibiotics) may be used to control their growth.

Lecturer(s): Associate Professor Ian McDonald
Prerequisite(s): ENMP221 and either BIOL101 or BIOL102
Restriction(s): BIOL241
Required book(s): Madigan et al Brock Biology of Microorganisms 13th ed (Prentice-Hall)
Assessment: Internal assessment/examination ratio: 1 : 2
ENMP341-15A (HAM) – Environmental Technology 2
20 Points
The paper focuses on technologies for air, water and energy that maximise the efficiency of resource utilisation and minimise waste generation and environmental impact. Energy technology and fuel science, particularly the development of renewable energy sources, minimisation of carbon emissions and air quality issues (indoor and outdoor) are important themes of the paper.

Co-ordinator(s): Dr Mark Lay
Prerequisite(s): 30 points at 100 Level in Science and Engineering papers
Assessment: Internal assessment/examination ratio: 1 : 1

ENMP381-15B (HAM) – Technological Innovation and its Management
20 Points
This paper is directed towards understanding the innovation process and examines the issues and important factors that ensure the new knowledge generated by scientific research finds application. It is designed to be interactive and draws upon and develops students’ differing experiences of science and technology. Course content is organised in teaching blocks with topics including invention and creative thinking, technology evaluation, information technology, technological economics and technology project management. A feature of the paper is creating, evaluating and business planning for technological innovations, which is done in a small group environment.

The paper is internally assessed. Exercises of appropriate weighting are based upon each of the teaching blocks.

This paper will not normally be available for a major in Materials and Processing.

Co-ordinator(s): Dr Mark Lay
Prerequisite(s): 20 points from either ENMP282 or any 100 level Management subject, or 60 points from any 200 level Science and Engineering subject(s)
Assessment: Internal assessment/examination ratio: 1 : 0

400 Level Papers
ENME440-15A (HAM) – Finite Element Analysis and Applications
20 Points
*This paper is normally only available to students enrolled in the BE(Hons) degree.*

This paper explains a general computational strategy to determine the response of a physical system to loads or other stimuli, in which the system is first divided into a large number of small finite elements of regular shape whose behaviour can be numerically modelled by solving the equations governed by the relevant laws of physics. Applications include finding the stresses and displacements due to loading in a structure, or the temperature distribution in a heat exchanger due to heat input. Practical application of the theory includes computer laboratory exercises where students will develop their own computer programs for simple problems and the use of commercial software to solve more complicated problems.

Co-ordinator(s): Professor Ilanko
Prerequisite(s): ENGG285 or MATH251, and ENGG284 or MATH255, and ENMP313
Restriction(s): ENGG440, ENSC440, ENGG540 and ENSC540
Assessment: Internal assessment/examination ratio: 1 : 0
MATERIALS AND PROCESSING PAPERS

ENME451-15B (HAM) – Mechanics of Vibration
10 Points
This paper is normally only available to students enrolled in the BE(Hons) degree.
Note(s): This paper will be offered only if there is sufficient student interest.
Students will learn how to apply Newton’s laws of motion and energy principles to complex mechanical systems, including continuous systems and how to calculate natural frequencies and dynamic response of machines and machine components.
Co-ordinator(s): Professor Ilanko
Prerequisite(s): ENME351 and ENME352
Restriction(s): ENME352
Assessment: Internal assessment/examination ratio: 1 : 1

ENME480-15A (HAM) – Advanced Product Development
10 Points
This paper is normally only available to students enrolled in the BE(Hons) degree.
The paper explains the technologically-driven changes affecting modern product development. It also teaches the most common rapid prototyping technologies and when to apply them. Examples of virtual engineering and simulation are demonstrated. Advanced manufacturing techniques are explained and demonstrated.
Co-ordinator(s): Associate Professor Mike Duke
Prerequisite(s): ENGG180, ENGG282 and ENME380
Assessment: Internal assessment/examination ratio: 1 : 0

ENMP407-15A/B (HAM) – Materials and Processing Elective
10 Points
This paper is normally only available to students enrolled in the BE(Hons) degree.
An advanced study in materials and processing. Possible options include: advanced composites; metals; bioseparations processing; environmental technology. Sub-topics include: available processing options; effect of material characteristics on processing parameters.
Co-ordinator(s): Dr James Carson
Assessment: Internal assessment/examination ratio: 1 : 0

ENMP411-15A (HAM) – Advanced Materials Engineering
10 Points
This paper is normally only available to students enrolled in the BE(Hons) degree.
An advanced study of the relationships between processing and microstructure of engineering materials. Sub-topics include solidification, ceramic processing, joining and repairs of composite materials and powder metallurgy.
Co-ordinator(s): To be advised
Prerequisite(s): ENMP311
Assessment: Internal assessment/examination ratio: 1 : 4
ENMP413-15B (HAM) – Materials Performance in Service
10 Points

This paper is normally only available to students enrolled in the BE(Hons) degree.

Students will learn the importance of design to avoid fracture using fracture mechanics, advanced stress analysis, including plasticity and advanced fatigue, and creep behaviour at elevated temperature.

Co-ordinator(s): Professor Brian Gabbitas
Prerequisite(s): ENMP313
Required book(s): Jones Engineering Materials 3 (Pergamon) 1993
Assessment: Internal assessment/examination ratio: 3 : 7

ENMP422-15A (HAM) – Advanced Process Simulation and Control
20 points

This paper is normally only available to students enrolled in the BE(Hons) degree.

Process dynamics, simulation and control and modern control systems, including open and closed loop, linear and non-linear systems, PID control, stability and tuning. Includes process simulation with commercial software packages.

Convenor(s): Associate Professor Michael Walmsley
Prerequisite(s): ENMP321 or ENME352
Restriction(s): ENMP421
Required book(s): Seborg et al Process Dynamics and Control (Wiley)
Assessment: Internal assessment/examination ratio: 2 : 3

ENMP427-15A (HAM) – Biochemical Engineering
20 points

This paper is normally only available to students enrolled in the BE(Hons) degree.

This paper describes concepts of using biological materials for producing biomolecules, cell-based products and tissues, and carrying out transformations. The principles of downstream separation processes important in the bioprocess industries; modelling and costing such processes are included.

Co-ordinator(s): Dr Mark Lay
Prerequisite(s): ENMP321 and ENMP322
Restriction(s): ENMP426
Assessment: Internal assessment/examination ratio: 1 : 1

ENMP442 – Environmental Technology 3
20 points

This paper will not be offered in 2015.
PHYSICS PAPERS

100 Level Papers

ENEL111-15A (HAM) – Introduction to Electronics
15 Points
For details see Electronics ENEL11.

PHYS100-15A (HAM) – Exploring Physics
15 Points
This introductory paper requires only a basic knowledge of school mathematics or physics. This paper is of interest and importance to scientists, technologists, mathematicians, engineers and teachers in all disciplines who want to understand the laws and processes that govern the world around us. Students who successfully complete this paper can also take PHYS103.

Co-ordinator(s): Dr Michael Cree
Prerequisite(s): 14 credits at Level 2 NCEA in one of Mathematics or Physics, or a minimum of 8 credits at Level 3 in NCEA across Statistics and Modelling and/or Mathematics with Calculus and/or Physics
Assessment: Internal assessment/examination ratio: 1 : 1

PHYS103-15B (HAM) & 14B (SEC) – Physics for Scientists and Engineers 1
15 Points
An introduction to physics for scientists and engineers. Applications of physics to the real world will be emphasised. There are three modules: Module 1 – Dynamics Module; 2 – Electricity and magnetism, electromagnetic waves, optics; and Module 3 – Statics. All students will study Module 1. The choice of second module will depend on the student’s nominated degree programme.

Note(s): A minimum mark of 40% is required in the examination to receive a passing grade.

Co-ordinator(s): Associate Professor Alistair Steyn-Ross
Prerequisite(s): (14 credits NCEA Level 3 Physics OR PHYS100) AND (14 credits NCEA Level 3 Calculus OR one of MATH165, MATH101 or MATH102)
Required book(s):
  Module 1: Wolfson Essential University Physics, Vol 1 (Pearson Addison-Wesley) 2013
  Module 2: Wolfson Essential University Physics, Vol 2 (Pearson Addison-Wesley) 2013
Assessment: Internal assessment/examination ratio: 1 : 1
200 Level Papers

ENEL205-15B (HAM) – Analog Electronics and Circuit Analysis
20 Points
For details see Electronics ENEL205.

ENEL284-15B (HAM) – Electricity and Magnetism
10 Points
For details see Electronics ENEL284.

ENEL285-15A (HAM) – Quantum and Solid State Physics
10 Points
For details see Electronics ENEL284.

PHYS204-15B (HAM) – Experimental Physics
20 Points
A laboratory-based paper with emphasis on developing experimental techniques, measurement skills, analysis and organisation of results. Experiments cover measurement of fundamental constants, biophysics, scientific and industrial applications and use of physical devices and instruments.

Co-ordinator(s): Dr Marcus Wilson
Prerequisite(s): PHYS103
Recommended book(s): Kirkup Experimental Methods (Wiley) 1994; Squires Practical Physics, 4th ed (Cambridge) 2001
Assessment: Internal assessment/examination ratio: 1 : 0

PHYS205-15A (HAM) – Relativity, Nuclear and Astrophysics
10 Points
This paper covers special and general relativity, nuclear physics and elementary astrophysics and cosmology.

Co-ordinator(s): Professor Moira Steyn-Ross
Prerequisite(s): MATH101 and one 100 level Physics paper, or 24 credits at Level 3 in NCEA physics and mathematics with calculus, or equivalent.
Corequisite(s): ENEL285, MATH251, MATH253, MATH255
Restriction(s): ENEL281, PHYS202, PHYS304
Required book(s): Krane Modern Physics, 2nd ed (Wiley)
Assessment: Internal assessment/examination ratio: 1 : 2

PHYS206-15B (HAM) – Statistical and Thermal Physics
10 Points
This paper covers topics such as temperature, thermodynamics and thermal properties of matter.

Co-ordinator(s): Dr Michael Cree
Prerequisite(s): MATH101 and PHYS103
Corequisite(s): MATH251, MATH253 and 20 further points at 200 level in mathematics
Required book(s): Carter Classical and Statistical Thermodynamics (Prentice-Hall) 2001
Assessment: Internal assessment/examination ratio: 1 : 2
PHYSICS PAPERS

300 Level Papers

ENEL312-15A (HAM) – Electromagnetic Waves
20 Points
For details see ENEL312 Electronics.

ENEL324-15A (HAM) – Optoelectronics
20 Points
For details see ENEL324 Electronics.

PHYS302-15B (HAM) – Quantum Physics
20 Points
This paper covers classical Lagrangian theory, Hamilton’s equations, basic postulates of quantum mechanics, representations, Dirac notion, angular momentum, perturbation theory, conceptual problems and solid state theory.

Co-ordinator(s): Professor Moira Steyn-Ross
Prerequisite(s): PHYS205 and ENEL285 (or only PHYS202), and MATH251 and MATH253
Assessment: Internal assessment/examination ratio: 1 : 2

PHYS315-15A (HAM) – Computational Biophysics
20 Points
This is a lecture and computer laboratory paper on computational methods used in neuroscience and biophysics. Topics covered include linear and non-linear differential equations, Euler and Runge-Kutta integration methods, limit cycles, action potential generation, hysteresis and memory in simple neural systems, stability, noise simulation, and root finding. The programming language used is MATLAB.

Co-ordinator(s): Associate Professor Alistair Steyn-Ross
Prerequisite(s): PHYS103 and any two of MATH251, MATH253, MATH255, ENGG283, ENGG284, ENGG285, and ENGG287
Restriction(s): PHYS516
Assessment: Internal assessment/examination ratio: 1 : 0

PHYS318-15A/B/C/Y (HAM) – Special Topics in Physics
20 Points
A library research paper and/or experimental project in selected topics in physics, supervised on a tutorial basis and examined by written reports and/or experimental exercises.

Note(s): Available on invitation only.
Co-ordinator(s): Dr Marcus Wilson
Corequisite(s): As appropriate to topic
Assessment: Internal assessment/examination ratio: 1 : 0
PSYCHOLOGY PAPERS

Note(s): Papers marked * are considered Science papers for the BSc degree. Papers not marked with an * will contribute towards the points allowed outside Science.

100 Level Papers

PSYC101-15S (HAM) (NET) – Foundations of Psychology
15 Points
The course will introduce the student to some of the major issues and discoveries in the science of psychology. These range from the study of biological basis of behaviour, motivation and emotion; mental processes like memory, thinking and language; social perceptions and co-operation; through to abnormal psychology and the practice of clinical psychology. An overview of the many and varied careers available to people trained in psychology will also be discussed.
Assessment: Internal assessment/examination ratio: 1 : 0

PSYC102-15B (HAM) (TGA) – Social and Developmental Psychology*
15 Points
An overview of psychological research and development of the person as a social being and on the interaction between the individual person and the groups, communities and global society to which we all belong.
Required book(s): Text book to be advised
Assessment: Internal assessment/examination ratio: 6 : 4

PSYC103-15A (HAM) (TGA) – General and Experimental Psychology*
15 Points
The emphasis in this paper is on the individual human being and his or her functioning. This involves examining the processes of development; learning, perception and cognition; and an introduction to the underlying biological basis of behaviour. There is a basic statistics component. Later sections of the paper deal with more applied aspects such as psychological testing and clinical psychology.
Required book(s): Text book to be advised; Statistics and Laboratory Manual: available from Campus Copy
Assessment: Internal assessment/examination ratio: 4 : 1

200 Level Papers

PSYC206-15B (HAM) – Animal Behaviour: Principles and Applications*
20 Points
This paper is for BSc or BSc(Tech) students only. (See PSYC304 for details).
Restriction(s): PSYC304
Assessment: Internal assessment/examination ratio: 3 : 1

PSYC208-15B (HAM) (TGA) – Psychological Research: Analysis, Design and Measurement*
20 Points
As a science, psychology involves certain standard research procedures so that a particular piece of research will provide an unambiguous result. In common with other social sciences, psychology has developed research methods different to those of the physical sciences. Anyone who wishes to read and understand research reports in psychology must be aware of typical research designs and statistical techniques common to such designs. The paper covers both data analysis and research methods.
Prerequisite(s): PSYC103 or equivalent
Assessment: Internal assessment/examination ratio: 3 : 1
PSYCHOLOGY PAPERS

PSYC209-15S (HAM) – Companion Animal Behaviour*  
20 Points  
Research on contemporary issues of interest to those who own or work with companion animals will be examined, including topics surrounding human-animal interactions and companion animal welfare. Strategies for dealing with people in an advisory setting will also be covered. Determinants of problem behaviours such as stereotypies, phobias, animal-animal aggression and animal-human aggression will be examined, along with strategies to modify or manage these problems. The application of learning theory to promote desired behaviours will also be discussed.  
**Note(s):** Students would normally have taken 15 points in Psychology or Biological Sciences. This paper cannot be used as a substitute for an existing prerequisite for other courses that constitute the major in Psychology.  
**Assessment:** Internal assessment/examination ratio: 1 : 0

PSYC225-15A (HAM) (TGA) – Behavioural Psychology and Learning*  
10 Points  
This paper extends further the study of learning and behaviour given in the 100 Level paper PSYC103 and will prepare you for the 300 Level paper PSYC314. This paper covers some of the philosophy and subject matter of behavioural psychology and examines some applications. Laboratory work involving animals is required.  
**Prerequisite(s):** PSYC103 or equivalent  
**Assessment:** Internal assessment/examination ratio: 1 : 2 or 2 : 1

PSYC226-15A (HAM) (TGA) – The Psychology of Perception*  
10 Points  
You will be introduced to the problems and methods involved in the study of perceptual and cognitive processes. The aim is to make you “more observant of your environment, more aware of your own perceptions, and more appreciative of the miraculous process that transforms energy falling on receptors into the richness of experience” (Goldstein, Sensation and Perception).  
**Prerequisite(s):** PSYC103 or equivalent  
**Assessment:** Internal assessment/examination ratio: 1 : 0

PSYC227-15A (HAM) (TGA) – Foundations of Behavioural Neuroscience*  
10 Points  
This paper explores how physiological processes of the nervous system can interact with behaviour, and as important, how behaviour, cognition, and environment may exert their influence on bodily systems.  
**Assessment:** Internal assessment/examination ratio: 1 : 1

PSYC228 -15A (HAM) (TGA) – Culture, Ethnicity and Psychology  
10 Points  
This paper explores culture, with an emphasis on Māori culture, as well as ethnicity and context and how these all play a major role in understanding behaviour and how psychological knowledge is constructed and applied within Aotearoa/New Zealand. This paper explores a psychological understanding of culture and ethnicity. Topics include Aotearoa/New Zealand in the global context, the Treaty of Waitangi, cultural concepts in the Māori world, kaupapa Māori and cross-cultural research, cross-cultural interaction styles, discrimination, networking in diverse communities, and ethical issues in Māori-focused research.  
**Prerequisite(s):** PSYC102 or equivalent  
**Assessment:** Internal assessment/examination ratio: 2 : 1
PSYC229-15B (HAM) (TGA) – Contemporary Issues and Social Psychology
10 Points
Social issues can be considered using both foundational and emerging theories of psychology that focus on social behaviour. This paper examines key theories in social psychology in relation to issues in contemporary society.
Prerequisite(s): PSYC102 or equivalent
Assessment: Internal assessment/examination ratio: 3 : 2

PSYC230-15B (HAM) (TGA) – Cognitive Psychology*
10 Points
This paper will introduce you to issues, theories, and research in the study of human cognition, and give you an understanding of the mental processes underlying memory, thinking and language use.
Prerequisite(s): PSYC103 or equivalent
Assessment: Internal assessment/examination ratio: 1 : 0

300 Level Papers
HDCO340-15A (HAM) – Perspectives on Counselling
20 Points
An examination of the philosophical, psychological and sociological principles that underpin the aims and methods of the helping professions in general, and counselling in particular.
Prerequisite(s): 40 points at 200 Level in Education Studies, Human Development, Professional Education or Psychology
Assessment: Internal assessment/examination ratio: 1 : 0

PSYC301-15B (HAM) (TGA) – Community, Culture and Diversity: Applied Social Psychology
20 Points
Applied social and community psychologists cover a diverse set of research areas, theoretical stances and approaches to researching and addressing social issues. Additionally, there are connections between the topic areas studied by applied social and community psychologists and other social scientists. Thus, in applied settings, social psychologists often learn from and work with people from other disciplines. In this paper we explore different approaches to applied social and community psychologies and examine a selection of particular issues that are informed by major theoretical orientations. These include diversity, Tiriti O Waitangi, health, criminal justice, media, social power, poverty, and interventions.
Prerequisite(s): PSYC228
Restriction(s): PSYC312, PSYC313, PSYC318, PSYC327, PSYC328
Assessment: Internal assessment/examination ratio: 7 : 3

PSYC304-15B (HAM) – Animal Behaviour: Principles and Applications*
20 Points
A review of experimental evidence on the determinants of animal behaviour and animal welfare, with special emphasis on domestic animals and practical aspects of animal handling and care. The paper uses farm companion, wild and other animals as illustrations, furnishing an understanding of how to care for and handle animals with due regard to their welfare. Domestic animal behaviour is considered in relation to practical problems in animal handling and New Zealand agriculture. Laboratory and fieldwork are required.
Restriction(s): PSYC206
Assessment: Internal assessment/examination ratio: 3 : 1
PSYCHOLOGY PAPERS

PSYC307-15A (HAM) (TGA) – Research Methods*
20 Points
This paper examines research design, research methods and statistical methods additional to those covered in PSYC208. Topics include qualitative methods, single-subject designs and some multivariate analysis methods. Practicals involve training in computer-based data analysis. This paper is required for students who wish to proceed to graduate study in psychology.
Prerequisite(s): PSYC208 or equivalent
Assessment: Internal assessment/examination ratio: 1 : 0

PSYC310-15B (HAM) (TGA) – Psychology and Gender
10 Points
This paper examines the contribution of psychological research and theory to understanding issues of gender, sexual orientation, gender roles and gender relationships.
Restriction(s): PSYC309
Assessment: Internal assessment/examination ratio: 2 : 1

PSYC314-15B (HAM) – Behaviour Analysis*
20 Points
This paper examines experimental, applied and conceptual/philosophical issues in learning and behaviour analysis. The content follows from PSYC225 and extends coverage of applied behaviour analysis, introduces behaviour therapies and provides the background required for studying learning and its applications to human and animal behaviour at graduate level. Emphasis is placed on linking the experimental and applied literatures to foster a scientist-practitioner approach to problem solving. There are required readings, two 2-hour lectures per week, and practicals involving brief experiments with humans as well as experience in shaping and altering the behaviour of an animal under laboratory conditions.
Prerequisite(s): PSYC225 or equivalent
Assessment: Internal assessment/examination ratio: 2 : 1 or 1 : 2

PSYC317-15B (HAM) – Organisational Psychology
20 Points
This paper will introduce you to the psychology of work and organisational behaviour. Topics include job-relevant issues such as job design and work attitudes, career choice and personnel selection, training and performance appraisal, quality of work life and job stress. The paper also considers organisational processes such as leadership, communication, conflict management and organisational development. Emphasis is given to understanding and applying psychological theory and research.
Prerequisite(s): One of PSYC102, HRMG241, HRMG341 or HRMG342 or equivalents
Assessment: Internal assessment/examination ratio: 3 : 1
PSYC319-15B (HAM) (TGA) – Psychological Perspectives on Child Development
10 Points
This paper focuses on the psychological study of children’s cognitive, emotional, and social development, with attention to the applications and implications of these findings in the New Zealand context.
Prerequisite(s): PSYC102 or PSYC103 or HDCO100 or equivalents
Assessment: Internal assessment/examination ratio: 2 : 1

PSYC337-15A (HAM) – Psychological Measurement*
10 Points
This paper covers basic issues in psychological measurement and observation applicable across a range of psychological specialities. In addition to measurement theory topics covered include the history of measurement, intelligence and its measurement, personality theories and the measurement of personality, behavioural and clinical assessment, measurement with disability, in all topic there is an emphasis on both measures and strategies appropriate for the New Zealand context and on cultural considerations.
Prerequisite(s): PSYC208 or equivalent
Assessment: Internal assessment/examination ratio: 1 : 2 or 2 : 1

PSYC338-15A (HAM) (TGA) – Abnormal Psychology*
10 Points
This paper deals with the classification and treatment of the major classes of psychopathology.
Prerequisite(s): PSYC102 or PSYC103 or equivalent
Assessment: Internal assessment/examination ratio: 1 : 1

PSYC340-15A (HAM) – Applied Cognitive Psychology*
10 Points
This paper covers theories and research into human attention, memory, cognitive workload, situation awareness, decision-making, and their application to transportation, product design, information technologies, and forensic psychology.
Prerequisite(s): PSYC230 or equivalents
Restriction(s): PSYC305
Assessment: Internal assessment/examination ratio: 1 : 0

PSYC341-15B (HAM) – Visual Neuroscience and its Applications*
10 Points
This paper examines some of the neural mechanisms underlying our sensations and perceptions (especially vision). At the completion of the course students will have acquired an understanding of the relationship between basic research findings and a broad range of applications.
Prerequisite(s): PSYC226 or equivalent
Restriction(s): PSYC305
Assessment: Internal assessment/examination ratio: 1 : 0
PSYCHOLOGY PAPERS

PSYC344-15A (HAM) – Physiology of Human Potential and Development*
10 Points
This paper offers a continuation of the material in physiological psychology covered in PSYC227, with more coverage on physiological aspects of cognitive and physical performance and development.
Prerequisite(s): PSYC227 or equivalent
Restriction(s): PSYC305
Assessment: Internal assessment/examination ratio: 1 : 0

PSYC388-15A/B/S (HAM) (TGA) – Directed Study
10 Points
Please refer to explanatory narrative under PSYC390.
Assessment: Internal assessment/examination ratio: 1 : 0

PSYC390-15A/B/S/Y (HAM) (TGA) – Directed Study
20 Points
Students may nominate a field of study and proceed to cover it by their own reading and research under the personal direction of a staff member. Entry to a directed study requires approval from Psychology prior to enrolment. A directed study cannot be taken as part of psychology major or used to raise grade average. You should obtain the lecturer's approval and signature on a directed study enrolment sheet (available from the School of Psychology office). You are advised to refer to the psychology staff photo board or the school's website (http://psychology.waikato.ac.nz) to find out more about the research interests of individual staff members.

Note(s): A 300 Level Directed Study may only be taken by students who have enrolled in or passed taught 300 Level psychology papers to the value of 60 points. A directed study cannot be included in the 60 points which make up a major in Psychology. Furthermore, 300 Level Directed Studies may not be used to raise your grade average for entry into the graduate programme.
Assessment: Internal assessment/examination ratio: 1 : 0
WORK PLACEMENT PAPERS

Bachelor of Science (Technology) Work Placement Papers

Note(s): For contact details of Work Placement Co-ordinators please refer to page 78.

200 Level Papers

SCIE279-15B (HAM) – Preparation for the Professional Workplace
10 Points
This paper consists of preparation of students entering the science workplace as part of the BSc(Tech) work placement programme. The paper includes lectures, workshops, and one-on-one meetings with placement co-ordinators. The paper covers professional development, placement interview preparation and technique, career mentoring/direction, placement selection process, company background research, self-assessment tools, professional behaviour, technical writing, occupational health and safety, and placement interview attendance.

Convenor(s): Dr Karsten Zegwaard
Corequisite(s): ENMP282 and SCIE371
Assessment: Internal assessment/examination ratio: 1 : 0

300 Level Papers

SCIE371-15C (HAM) – Science Work Placement 1
20 points
This paper is the first work placement for the BSc(Tech) degree and typically undertaken during the summer at the end of the second year. This paper involves 400 hours of work experience at an approved subject-related organisation. Placements are secured by the Cooperative Education Unit and students are paid seasonal rates during the work placement. Assessment is based on several assessment activities during the placement, co-ordinator site visits, and employer evaluation of the work performance. Students are required to have completed SCIE279 in order to commence this paper.

Convenor(s): Dr Karsten Zegwaard
Corequisite(s): SCIE279
Assessment: Internal assessment/examination ratio: 1 : 0

SCIE372-15C (HAM) – Science Work Placement 2
20 points
This paper is the second work placement for the BSc(Tech) degree and usually the first part of the 'long placement' (400 hours). This paper commences in the summer at the end of the third year and students should have completed SCIE379 before beginning this paper. Usually students enrol in the subsequent SCIE373 paper at the beginning of the fourth year.

Students may undertake an applied project at an approved subject-related organisation. Placements are secured for you by the Cooperative Education Unit and students are paid seasonal rates during the work placement. Assessment is based on several assessment activities during the placement, co-ordinator site visits, and employer evaluation of the work performance.

There is an option of 'fast-tracking' into a masters degree by enrolling in 372, completing 10 weeks of work experience instead of six-nine months, and then commencing a masters at the beginning of the fourth year; however, this must be discussed with the course co-ordinator early in the third year.

Convenor(s): Dr Karsten Zegwaard
Corequisite(s): SCIE379
Assessment: Internal assessment/examination ratio: 1 : 0
SCIE373-15C (HAM) – Science Work Placement 3

20 points

This paper is the last part of the long placement, commencing at the beginning of the fourth year and immediately after the second summer placement (SCIE372). Usually this placement is at the same supporting organisation. Assessment is based on co-ordinator site visits, evaluation of the work performance, and a comprehensive written technical report giving an overview of the work and analysis of the outcomes.

Convenor(s): Dr Karsten Zegwaard
Prerequisite(s): SCIE371, SCIE379
Assessment: Internal assessment/examination ratio: 1 : 0

SCIE379-15A (HAM) – Reflection on Professional Workplace Experience

10 Points

This paper consists of post-placement reflection upon completion of the first science work placement and the required preparation for the second work placement. This paper includes lectures, workshops, and one-to-one meetings with placement co-ordinators. There is a focus on reflective learning from the placement experience, self-assessment outcomes initiated in the SCIE279 paper, portfolio completion, skill and skill-gap analysis, career mentoring and direction, CV updates, and the next placement selection process. Students are required to have completed a work placement paper before commencing this paper.

Convenor(s): Dr Karsten Zegwaard
Prerequisite(s): SCIE279
Assessment: Internal assessment/examination ratio: 1 : 0

Bachelor of Engineering (Honours) Work Placement Papers

Note(s): For contact details of Work Placement Co-ordinators please refer to page 78.

200 Level Papers

ENGG279-15B (HAM) – Preparation for the Professional Workplace

0 Points

This paper consists of preparation of students entering the engineering workplace as part of the BE(Hons) work placement programme. The paper includes lectures, workshops, and one-on-one meetings with placement co-ordinators. The paper covers professional development, placement interview preparation and technique, career mentoring/direction, placement selection process, company background research, self-assessment tools, professional behaviour, technical writing, occupational health and safety, and placement interview attendance.

Convenor(s): Dr Karsten Zegwaard
Corequisite(s): ENMP282 and ENGG371
Assessment: Internal assessment/examination ratio: 1 : 0
300 Level Papers

ENGG371-15C (HAM) – Engineering Work Placement 1
0 Points

The first work placement for the Bachelor of Engineering (Honours) degree is typically undertaken during summer at the end of the second year, and involves 400 hours of work experience at an approved engineering organisation relevant to your studies. Placements are secured by the Cooperative Education Unit and students are paid seasonal rates during the work placement. Assessment is based on several assessment activities during the placement, co-ordinator site visits, and evaluation of the work performance. Students are required to have completed ENGG279 before doing this paper.

Convenor(s): Dr Karsten Zegwaard
Corequisite(s): ENGG279
Assessment: Internal assessment/examination ratio: 1 : 0

ENGG372-15C (HAM) – Engineering Work Placement 2
0 Points

The second work placement for the Bachelor of Engineering (Honours) degree is typically undertaken during summer at the end of the third year, and involves 400 hours of work experience at an approved engineering organisation relevant to your studies. Placements are secured by the Cooperative Education Unit and students are paid seasonal rates during the work placement. Assessment is based on several assessment activities during the placement, co-ordinator site visits, and evaluation of the work performance. Students are required to have completed ENGG379 before doing this paper.

Convenor(s): Dr Karsten Zegwaard
Corequisite(s): ENGG379
Assessment: Internal assessment/examination ratio: 1 : 0

ENGG379-15A (HAM) – Reflection on Professional Workplace Experience
0 Points

This paper consists of post-placement reflection upon completion of the first engineering work placement and the required preparation for the second work placement. This paper will include lectures, workshops, and one-on-one meetings with placement co-ordinators. There will be focus on reflective learning from the placement experience, self-assessment outcomes initiated in the ENGG279 paper, portfolio completion, skill and skill-gap analysis, career mentoring and direction, CV updates, and the next placement selection process. To do this paper you must have completed ENGG371 or ENGG372.

Convenor(s): Dr Karsten Zegwaard
Prerequisite(s): ENGG279
Assessment: Internal assessment/examination ratio: 1 : 0
HANDY TIPS

Here are some suggestions to help you get the most out of university life:

» Sign up for tutorials early, as places fill fast
» If you wish to see a particular lecturer, check on times that he or she is available to students
» Paper outlines and book lists can be obtained in lectures or from the School office that runs the particular paper.

How Do I Check What I Am Enrolled In?

You are responsible for your programme of study and choices at enrolment. You should keep copies of any information that the University sends you confirming your enrolment status and the papers you are enrolled in. You can access your current enrolment information through iWaikato at http://i.waikato.ac.nz/ You can also visit the Faculty Office in FG.G.04.

Check Your Timetable

Science and Engineering papers normally involve attending lectures, tutorials and laboratory work. Timetable clashes can occur between papers from different subject areas, or between papers at different levels.

You are required to attend all lectures and you will not usually be permitted to take papers that have more than one lecture clash per semester. There are often several streams for laboratories, so laboratory clashes can usually be resolved. If you have a laboratory clash, you should initially contact the convenor/lecturer/co-ordinator of the papers concerned.

You can check your timetable at http://timetable.waikato.ac.nz/

If you want to change your papers before you pay your fees, then you can call the Faculty Registrar on 0800 438 254. The change can normally be made immediately and a new invoice sent within 24 hours.

If you need to make changes after you have paid your fees (ie after you become officially enrolled), you can apply to do a “change of enrolment” on iWaikato at http://i.waikato.ac.nz

CHANGING PAPERS

Withdrawals must be made by the required date to obtain a fees refund.

You can add or withdraw from an industry paper or any C Semester paper with a full fees refund at any time before those papers begin.

Withdrawals on medical or compassionate grounds may be made after these periods, and fees may be refunded on a pro-rata basis. Some conditions apply, and you should consult with the Faculty Registrar by calling 0800 438 254 or by dropping into the Faculty Office.
IMPAIRED PERFORMANCE

Internal Assessment
If you miss an internal assessment (eg a test or laboratory), or need an extension because you are ill, have an accident or someone close to you becomes seriously ill or dies, you can be given special compassionate consideration. You must let the lecturer or paper co-ordinator know as soon as possible, complete a Special Consideration Form and provide a medical certificate or other relevant documentation. The administrator of the subject will be able to provide you with the required forms.

Final Examinations
If you miss the final examination for any of the above reasons or if you have a medical problem that will affect your performance, you can apply for special consideration. You must apply within three days of the examination. The staff in the Student Centre can advise you on the relevant procedures.

SUPPORT NETWORKS

Science Help
These are small weekly group tutorials that are additional to the mainstream tutorials offered in all core 100 Level Science papers. These are advertised in the first week of each semester.

Te Pūtahi o te Manawa
Whānau Support in Science and Engineering
Māori students who enrol in the Faculty are assigned a kaitiaki, or mentor, who keeps in regular contact with them throughout the year. Kaitiaki are involved in the academic and social life of the Faculty and assist in the development of a sense of whānau for students. Students who identify themselves as New Zealand Māori when they enrol are contacted and offered the opportunity of kaitiaki support early in the academic year.

For more information, contact the Science Support Unit via Kevin Eastwood, keastwoo@waikato.ac.nz. Alternatively, make a visit to the Faculty Office.

International Students
Under the Ministry of Education’s Code of Practice for the Pastoral Care of International Students there are statutory requirements in regards to the information we must include in our publications. These are:

Code
The University of Waikato has agreed to observe and be bound by the Code of Practice for the Pastoral Care of International Students. Copies of the Code are available from the New Zealand Ministry of Education website at www.minedu.govt.nz/international

Immigration
Full details of immigration requirements, advice on rights to employment in New Zealand while studying, and reporting requirements are available from Immigration New Zealand, and can be viewed on their website at www.immigration.govt.nz
Eligibility for Health Services
Most international students are not entitled to publicly funded health services while in New Zealand. If you receive medical treatment during your visit, you may be liable for the full costs of that treatment. Full details on entitlements to publicly funded health services are available through the Ministry of Health, and can be viewed on their website at www.moh.govt.nz

Accident Insurance
The Accident Compensation Corporation provides accident insurance for all New Zealand citizens, residents and temporary visitors to New Zealand, but you may still be liable for all other medical and related costs. Further information can be viewed on the ACC website at www.acc.co.nz

Medical and Travel Insurance
International students (including group students) must have appropriate and current medical and travel insurance while in New Zealand. Contact the International Student’s Office: 07 838 4610.

Disability Support
The University’s Disability Support Service works with students and the University to remove barriers to learning for students with a disability. Email disability@waikato.ac.nz to discuss any support you may need or to arrange a meeting.

If you have a disability and apply to the Faculty of Science & Engineering, you may also contact the Faculty Office to arrange appropriate support, phone: 0800 438 254 or email science@waikato.ac.nz

Disabled Access
Disabled access to the blocks housing the Faculty of Science & Engineering is by way of the lifts in D, F and FG Blocks. The ground floors of these blocks can be entered by ramps from the respective car park area.
The following are some of the scholarships available to students enrolling in the Faculty of Science & Engineering.

For further information contact the Scholarships Office:
» Phone: 07 838 4489 or 07 858 5195
» Email: scholarships@waikato.ac.nz
» Website: www.waikato.ac.nz/scholarships

School Leaver Scholarships
The Vice-Chancellor’s Academic Excellence School Leaver Scholarship
$5,000 towards fees or accommodation, awarded to students in their first year of study who gain NCEA Level 3 Certificate with an Excellence endorsement*, University Entrance and meet the criteria for entry to their programme and in their first year are enrolled in a full-time programme.
*or equivalent in CIE or IB

The University of Waikato Academic Merit School Leaver Scholarship
$3,000 towards fees or accommodation, awarded to students in their first year of study who gain NCEA Level 3 Certificate with a Merit endorsement*, University Entrance and meet the criteria for entry to their programme and in their first year are enrolled in a full-time programme.
*or equivalent in CIE or IB

Science Admission Fees Scholarships
These scholarships are offered to new students applying to the Faculty of Science & Engineering. Ten scholarships of up to $4,000 each are awarded on academic and social grounds.

Bachelor of Engineering Fees Scholarships
These scholarships are offered to new students applying for the Bachelor of Engineering (Honours) degree. Ten scholarships of up to $4,000 each are awarded on academic grounds.

Brian Perry Charitable Trust Undergraduate Scholarship
Two scholarships are available to new students enrolling in the Faculty of Science & Engineering. The scholarships include the possibility of summer work with the Perry Group of companies.

Undergraduate Scholarships
Hamilton Zoo – Science and Engineering Studentship
Opportunity for students of the BSc(Tech) degree to gain work experience at the zoo. The work takes form of an internship for an agreed length of time.

Fisher and Paykel Healthcare Undergraduate Scholarship in Physics
Up to two scholarships of $500 will be offered annually to students enrolled at the University of Waikato for full-time third-year undergraduate study towards a BSc with a major in Physics.

Smartrak Software Development Scholarship
This scholarship is offered to support a high achieving academic student who is majoring in software development. The student may be enrolled in a Bachelor of Engineering(Honours), Bachelor of Computing and Mathematical Sciences or a Bachelor of Science(Technology) at the University of Waikato. One scholarship will be awarded annually and will have a value of $4,000.
UNDERGRADUATE PRIZES

This is a selection of some of the prizes available to undergraduate students.

Beca Award
Offered to students in their third year of a Bachelor of Engineering (Honours), based on academic performance and an interview.

Bruce Liley Prize in Physics
The best overall performance.

Dow AgroSciences Prize
The top third-year Chemistry student in three of CHEM301, CHEM302, CHEM303 or CHEM306.

Earth and Ocean Sciences’ Excellence Award
The award is conferred annually to students studying Earth Sciences at any level, who, in the year of the award, have shown outstanding ability in the subject.

H S Gibbs Prize in Earth Sciences
Awarded for the best field trip report for any second or third-year student in Earth Sciences.

Jared Simpson Memorial Prize in Biological and/or Earth Sciences
Awarded to a student who has taken 200 Level papers in Biological Sciences and/or Earth Sciences for a first degree and who has submitted practical work of a meritorious nature.

Jeanette Gillespie Memorial Prize
The most outstanding 100 Level student in Earth Sciences.

New Zealand Institute of Chemistry J E Allan Memorial Prize
The best overall second-year Chemistry student.

New Zealand Soil Science Undergraduate Prize
Undergraduate Prize awarded to the top student in soil science.

Orica ChemNet First Year Chemistry Prize
Awarded to the top first-year Chemistry student, who will be advancing in Chemistry.

Scenz – IChemE in New Zealand Prize
Awarded to the best third-year student studying Chemical and Biological Engineering or Materials and Process Engineering for the BE(Hons) degree.

Shannon Young Award
Awarded to the best overall third-year student who has majored in Earth Sciences.

Society of Materials Group New Zealand Incorporated (SMNZI) Student Prizes
Awarded to students who have the highest grade point average from the materials-related papers ENMP211, ENMP311, ENMP214 and ENMP215.

Tom Shaw Memorial Prize
Awarded to the best Botany and Ecology undergraduate student who has majored in Biological Sciences.
UNDERGRADUATE PRIZES

WAIKATO BOTANICAL SOCIETY UNDERGRADUATE PRIZE
This prize is awarded annually to the student enrolled in the Level 2 botany paper, who is the highest-achieving student in the paper and who also receives not less than an ‘A’ grade.

WAIKATO GEOLOGICAL AND LAPISTRARY SOCIETY PRIZE IN EARTH AND OCEAN SCIENCES
Awarded yearly to the best geological field trip report submitted by an undergraduate student studying Earth sciences.

WAIKATO GRADUATE WOMEN ENGINEERING PRIZE
The prize will be awarded annually to the most outstanding woman student in their third year of study towards a Bachelor of Engineering (Honours).

WAIKATO REGIONAL COUNCIL WATER SCIENCE PRIZE
The outstanding 300 Level student dealing with water in the natural environment.

AFTER-HOURS ACCESS
After-hours access to the Faculty complex for undergraduate students is normally not available. Undergraduate students may be allowed access after hours only with the written permission of a member of University staff, granted for a specific occasion.

GENERAL RULES
Smoking is not permitted in any part of the University campus.
Dogs (except guide dogs) and bicycles are not allowed in University buildings.
Only those who have enrolled in the paper, except with the written permission of the lecturer, may attend lectures.
Photocopying is available for undergraduate students in the Student Centre. Lecturers will tell you if you can use the School photocopier for a piece of assessment.
Footwear must be worn at all times in the Science & Engineering buildings.

COMPUTER LABS
Computer Labs in rooms F1.14, R1.22 and LSL1.16 may be used by undergraduate students when not booked for a taught class. Graduate students have priority of access. The Computer System Regulations as set out in the 2015 University of Waikato Calendar must be read and adhered to.
DISCIPLINE POLICY

The University Discipline Regulations are set out in the 2015 University of Waikato Calendar and apply to misconduct, including cheating, plagiarism, misuse of computer facilities, or other breach of the University regulations. Plagiarism is unacknowledged copying or paraphrasing of someone else’s work, whether published or not. It may be heavily penalised and can even result in refusal of credit for the paper.

SAFETY POLICY

1. Footwear must be worn inside all Faculty of Science & Engineering buildings. Some laboratories and workshops restrict entry to those wearing reinforced shoes. Read the notices on the door of any room you are about to enter to see the restrictions that apply.

2. When the fire alarm sounds, you must obey the instructions of the laboratory supervisor and floor warden, leave by the nearest exit, and go down the nearest staircase to the assigned assembly point outside. Lifts must not be used in a fire. If you have a medical condition or a disability, please let your laboratory supervisor know, so they may provide you with assistance during an emergency.

3. You must wear safety glasses and other protective equipment as directed by the laboratory supervisor. Prescription glasses are NOT safety glasses. There are specific requirements for some specialised laboratories. Laboratory coats and ‘covered in’ shoes must be worn in laboratories and workshops where hazardous substances are used.

4. You must not eat or drink in any laboratory.

5. You may not enter any laboratory outside the times scheduled for laboratory classes except with the permission of the supervisor or technician in charge.

6. You are not permitted to take any chemicals, equipment or any other material from any laboratory for private use.

7. Laboratory equipment, chemicals, or materials may be taken out of laboratories only with the written permission of the supervisor or technician in charge.

8. Visitors may be allowed in laboratories only with the permission of the supervisor or technician in charge. ALL visitors must sign in at the Faculty Office, or a School office, or the entrance to the Large Scale Laboratory.

9. For their own safety, children under 16 are not permitted in laboratories or workshops, unless on a visit organised in conjunction with the Laboratory Safety Supervisor.

10. Before going on a field trip, you must read and adhere to the field trip safety regulations supplied to you by the lecturer in charge. Please note that it is not permitted to take alcohol, drugs, or firearms on any field trip.

11. Accidents, incident, and near misses that occur in laboratories, workshops, or on field trips, must be reported as soon as possible (within 48 hours for non-serious, or immediately for serious accidents) to the appropriate supervisor and the prescribed form must be filled in. Accidents in the University grounds should be reported to Student Services.
COMMON UNIVERSITY TERMS

100, 200, 300, 400 Levels
These refer to the different levels at which papers are taught and are usually associated with years of study. First year (100 Level) papers are more general while fourth year (400 Level) papers are more advanced.

Bachelors Degree
This is a first degree. It is sometimes also called an undergraduate degree. It takes a minimum of three or four years of full-time study to complete.

Calendar
The University's official record of rules and regulations, staff, papers, dates, etc. It is available online at [http://calendar.waikato.ac.nz](http://calendar.waikato.ac.nz)

Corequisites
Corequisites are papers that are complementary to each other. While the knowledge gained from one paper is not required to take the other, students are required to complete both papers.

Conjoint Degree
This is a special programme in which you study for two bachelors degrees at the same time, eg BSc/LLB (Science and Law). Some universities call this a double degree.

Degree
A degree is a structured course of study in a particular area such as science or management. Each degree has a different structure with a set number of papers (or courses) at different levels. To complete a degree, a student must take the papers required for that degree.

Graduate
A person who has been awarded a university degree.

Graduate Qualifications
Students who have successfully completed an undergraduate qualification may be eligible to take a graduate qualification. Graduate qualifications include the Master of Engineering, Master of Science, Master of Science (Environmental Sciences), Master of Science (Research), Master of Science (Technology), Postgraduate Diploma and Graduate Diploma.

Lectures, Labs and Tutorials
Lectures start in the first week of term and are detailed in the University’s Catalogue of Paper Offerings and Timetable. Laboratory sessions normally start in the first or second week of teaching. Lab sessions for first-year students are normally assigned by the Faculty Office prior to the start of the first week of A Semester. You can select your tutorial times during the first week of teaching from a list of options included in the timetable and available at the first lecture.

Major
This is the main subject in your degree. To major in a subject, you study it to a higher level, ie 300 or 400 Level. A double major is when you study two subjects in depth.
Paper
A paper is a series of lectures, tutorials and assessment tasks that relate to a specific topic.

Paper Codes
An explanation of paper codes can be found on page 85.

Points
Degree requirements are expressed in terms of points (e.g. a three-year degree generally requires 360 points). Points bear a direct relationship to workload: one point equates to approximately 10 hours’ total work; so a student might expect to spend about 150 hours on a 15-point paper during a semester.

Prerequisites
Some papers build upon the knowledge gained in earlier papers. Because of this, it is necessary to take these earlier papers first. Papers that must be taken before you can progress to other papers are known as prerequisites for the later papers.

Programme
A set of compulsory papers most commonly used for the Bachelor of Engineering (Honours).

Restriction
A restriction against a paper means you cannot do that paper if you have done a paper with similar content, e.g. ENMP281 is restricted against ENMP283.

Room Numbers
A numbering system applies to every building on campus. Note that the L and S Blocks are Lecture Blocks only. For example: FG.G.04 – Dean’s Office
  » FG = ‘FG’ block
  » G = Floor level ‘ground’
  » 04 = Room number ‘04’

Science Papers
Science papers are defined as papers offered by the Faculty of Computing & Mathematical Sciences and the Faculty of Science & Engineering with the exception of MATH168 Preparatory Mathematics. Some Philosophy and Psychology papers are also defined as Science papers. The Philosophy papers are PHIL102 Introduction to Logic and PHIL208 Understanding Science: How and Why it Works. Psychology papers considered to be Science papers are marked * throughout this handbook.

Specialisation
A specialisation is a study theme within a major that enables you to focus on a particular area of interest, e.g. you can do a Bachelor of Science majoring in Environmental Sciences and with a specialisation in Marine Sciences.

Undergraduate
A person who is studying at university for a first degree is known as an undergraduate.
### TEACHING AND ASSESSMENT PERIODS 2015

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AT THE UNIVERSITY OF WAIKATO, THE POSSIBILITIES ARE ENDLESS.
TŌ TE WHARE WĀNANGA O WAIKATO, HE KURA TOI E KORE E MIMITI.

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