## DEGREES

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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](http://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](http://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

<table>
<thead>
<tr>
<th>Year 1</th>
<th>ENGG180</th>
<th>ENMP102</th>
<th>MATH101</th>
<th>MATH102</th>
<th>COMP103</th>
<th>PHYS103 **</th>
<th>SPECIFIED 100 Level</th>
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<td>SPECIFIED</td>
<td>SPECIFIED</td>
<td>SPECIFIED</td>
<td>SPECIFIED</td>
<td>ENGG279</td>
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<td>ENGG379</td>
<td>ENGG372 *</td>
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<tr>
<td>Year 4</td>
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<td>SPECIFIED</td>
<td>SPECIFIED</td>
<td>DESIGN PROJECT</td>
<td>ENGG492</td>
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</tbody>
</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.
## DEGREES

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 | Phone: 07 838 4266 | Email: engineering@waikato.ac.nz |
| Convenor | 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>
<th>ENGG180</th>
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<th>COMP103</th>
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<tr>
<td>YEAR 3</td>
<td>ENGG381</td>
<td>ENMP321</td>
<td>ENMP323</td>
<td>ENGG285 10 points plus either MATH257 10 points, or MATH259 10 points</td>
<td>ENGG379</td>
<td>ENGG372</td>
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<td>STREAM *</td>
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</table>

- **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

<table>
<thead>
<tr>
<th>Biological Processing</th>
<th>Chemical Processing</th>
<th>Materials</th>
<th>Environmental</th>
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<tr>
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<td>BIOL101</td>
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<tr>
<td>ENMP322</td>
<td>ENMP325</td>
<td>ENMP311</td>
<td>CHEM3XX OR ERTH3XX 20 points</td>
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<td>ENMP427</td>
<td>ENMP427</td>
<td>ENMP411</td>
<td>ENMP442</td>
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<tr>
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<td>20 points</td>
<td>10 points</td>
<td>20 points</td>
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</tbody>
</table>
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 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 and First Year Mentor</th>
<th>Room: E.G.04</th>
</tr>
</thead>
<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>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Convenor</th>
<th>Room: CD.1.03</th>
</tr>
</thead>
<tbody>
<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>
</tr>
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</table>
# ELECTRONIC ENGINEERING

## Programme Details

### Structure of the Electronic Engineering Programme

| YEAR 1 | ENGG180 | 15 points | ENMP102 | 15 points | MATH101 | 15 points | MATH102 | 15 points | COMP103 | 15 points | ENEL111 | 15 points | PHYS103 | 15 points | * | 15 points |
|--------|---------|-----------|---------|-----------|---------|-----------|---------|-----------|---------|-----------|---------|-----------|---------|-----------|---|
| YEAR 2 | ENEL205 | 20 points | ENEL212 | 10 points | ENEL284 | 10 points | ENEL285 | 10 points | ENEL282 | 10 points | ENEL284 | 10 points | ENEL287 | 10 points | ENEL215 | 0 points | ENEL279 | 0 points | ENEL371 | 0 points |
| YEAR 3 | ENEL312 | 20 points | ENEL317 | 20 points | ENEL321 | 20 points | ENEL324 | 20 points | ENEL382 | 20 points | ENEL384 | 20 points | MATH257 | 0 points | ENEL372 | 0 points | ENEL379 | 0 points |
| YEAR 4 | ENGG381 | 20 points | ** | 20 points | ** | 20 points | DESIGN PROJECT | ENGG492 | 60 points |

- 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)
» ENGG285A – 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
» ENEL328B – High Speed Communications
» ENGG372C – Engineering Work Placement 2 (0 points)
» ENGG379C – 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

<table>
<thead>
<tr>
<th>Enrolment Contact Person</th>
<th>Room: E.G.04</th>
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<tbody>
<tr>
<td>and First Year Mentor</td>
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</tr>
<tr>
<td>Convenor</td>
<td>Room: EF.2.02</td>
</tr>
<tr>
<td>Associate Professor</td>
<td>Phone: 07 838 4701</td>
</tr>
<tr>
<td>Michael Walmsley</td>
<td>Email: <a href="mailto:walmsley@waikato.ac.nz">walmsley@waikato.ac.nz</a></td>
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Programme Details

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

<table>
<thead>
<tr>
<th>YEAR 1</th>
<th>YEAR 2</th>
<th>YEAR 3</th>
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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)
   » ENGG372C – Engineering Work Placement 2 (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

<table>
<thead>
<tr>
<th>Enrolment Contact Person</th>
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<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>
</tbody>
</table>

| 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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<table>
<thead>
<tr>
<th>YEAR 1</th>
<th>YEAR 2</th>
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<td>PHYS103</td>
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<td>60 points</td>
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- 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)
» ENGG372C – Engineering Work Placement 2 (0 points)
» ENNG379A – Reflection on Professional Workplace Experience (0 points)
» ENME351A – Dynamics and Mechanisms
» ENME352B – Machine Dynamics and Control
» ENME380B – Mechanical Engineering Design
» ENMP223B – Thermofluids
» ENMP313A – 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
Room: G.1.26
Professor Steve Reeves
Phone: 07 838 4398
Email: stever@waikato.ac.nz

Programme Details

General Structure of the Software Engineering Programme

YEAR 1
- COMP103 15 points
- COMP104 15 points
- MATH101 15 points
- MATH102 15 points
- ENGG180 15 points
- ENMP102 15 points
- COMP241 10 points
- COMP200 10 points

YEAR 2
- COMP219 20 points
- ENMP282 20 points
- COMP235 20 points
- COMP242 20 points
- COMP202 20 points
- ENGG282 20 points
- ENGG283 20 points

YEAR 3
- COMP314 20 points
- COMP317 20 points
- COMP340 20 points
- COMP325 20 points
- ENGG381 20 points
- ENGG372 0 points

YEAR 4
- A least one of: COMP424, COMP439, COMP448
- At least one of: COMP426, COMP452
- COMP4XX 15 points (if needed)
- COMP4XX 15 points (if needed)
- DESIGN PROJECT
  - ENGG492 60 points

- 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.
SOFTWARE ENGINEERING

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)
» ENGG284B – Differential Equations 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:

» Animal Behaviour page 31
» Biochemistry page 34
» Biological Sciences page 36
» Biotechnology page 41
» Chemistry page 43
» 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
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

<table>
<thead>
<tr>
<th>YEAR 1</th>
<th>SCIENCE MAJOR 100 Level</th>
<th>SCIENCE MAJOR 100 Level</th>
<th>SCIENCE 100 Level</th>
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<th>ELECTIVE 100 Level</th>
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<td>SCIENCE MAJOR 200 Level</td>
<td>SCIENCE 200 Level</td>
<td>ELECTIVE 200 Level</td>
<td>ELECTIVE 200 Level</td>
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<td>YEAR 3</td>
<td>SCIENCE 300 Level</td>
<td>SCIENCE MAJOR 300 Level</td>
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<td>ELECTIVE 200 or 300 Level</td>
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</table>

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>
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<th>YEAR 1</th>
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<th>SCIENCE 100 Level</th>
<th>SCIENCE 100 Level</th>
<th>SCIENCE 100 Level</th>
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### 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        *
» 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

General Structure of an Animal Behaviour Interdisciplinary Major for the BSc and BSc(Tech) degrees

<table>
<thead>
<tr>
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<th>Course Title</th>
<th>Points</th>
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<td>BIOL102</td>
<td>The Biology of Organisms</td>
<td>15 points</td>
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<td>PSYC103</td>
<td>General and Experimental Psychology</td>
<td>15 points</td>
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<tr>
<td>200 Level</td>
<td>BIOL234</td>
<td>Functional Animal Biology</td>
<td>20 points</td>
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<tr>
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<td>PSYC206</td>
<td>Animal Behaviour: Principles and Applications</td>
<td>20 points</td>
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<tr>
<td></td>
<td>PSYC225</td>
<td>Behavioural Psychology and Learning</td>
<td>10 points</td>
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<tr>
<td></td>
<td>PSYC226 or PSYC227</td>
<td></td>
<td></td>
</tr>
<tr>
<td>300 Level</td>
<td>BIOL333</td>
<td>Advanced Animal Behaviour</td>
<td>20 points</td>
</tr>
<tr>
<td></td>
<td>BIOL338</td>
<td>Advanced Zoology</td>
<td>20 points</td>
</tr>
<tr>
<td></td>
<td>PSYC314</td>
<td>Behavioural Analysis</td>
<td>20 points</td>
</tr>
</tbody>
</table>

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


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

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

<table>
<thead>
<tr>
<th>Level</th>
<th>Course</th>
<th>Points</th>
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<tbody>
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<td>100</td>
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<tr>
<td>300</td>
<td>CHEM301</td>
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</table>

100 Level – Recommended prerequisites: BIOL101 Cellular and Molecular Biology, and CHEM112 Chemical Reactivity

200 Level – BIOL210 Introduction to Genetics, BIOL251 Biochemistry, CHEM212 Organic and Physical Chemistry 1.

300 Level – BIOL310 Advanced Genetics, BIOL351 Advanced Biochemistry, CHEM301 Advanced Organic Chemistry.

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.
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

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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.
BIOLOGICAL SCIENCES

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 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 biochemistry 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**

Room: E.G.04C

Professor Janis Swan

Phone: 07 838 4049

Email: j.swan@waikato.ac.nz

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**Biotechnology Interdisciplinary Major**

### General Structure of a Biotechnology Interdisciplinary Major for the BSc and BSc(Tech) degrees

<table>
<thead>
<tr>
<th>Level</th>
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<td></td>
<td>ENGG180 or ENMP102</td>
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</table>
| **200 LEVEL** | BIOL or ENMP* | 20 points | *Choose from: BIOL241 Microbiology: Form, Function and Metabolism, BIOL251 Biochemistry, ENMP221 Engineering Thermodynamics, and ENMP222 Biotechnology: Food and Bioresources.
|          | BIOL or ENMP* | 20 points |  |
|          | BIOL or ENMP* | 20 points |  |
| **300 LEVEL** | BIOL or ENMP** | 20 points | **Choose from: BIOL341 Microbial Physiology and Ecology, BIOL351 Advanced Biochemistry, ENMP321 Process Engineering and Design, and ENMP322 Biotechnology.**
|          | BIOL or ENMP** | 20 points |  |
|          | BIOL or ENMP** | 20 points |  |

**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

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**Science International**

» page 73

**Te Pūtaiao me ngā take Māori**

» page 75
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

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

School of Science Office
Room: F.1.07
Phone: 07 838 4027
Email: chemistry@waikato.ac.nz

Undergraduate Convenor
Associate Professor
Merilyn Manley-Harris
Room: E.3.19
Phone: 07 838 4384
Email: manleyha@waikato.ac.nz

First Year Mentor
Dr Joseph Lane
Room: E.3.07
Phone: 07 838 8549
Email: j.lane@waikato.ac.nz
CHEMISTRY

Chemistry Major

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

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<td>300 Level</td>
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<td>20 points</td>
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</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.
EARTH SCIENCES

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

School of Science Office
Room: F.1.07
Phone: 07 838 4024
Email: earth@waikato.ac.nz

Undergraduate Co-ordinator
Dr Adrian Pittari
Room: E.2.06
Phone: 07 838 4191
Email: apittari@waikato.ac.nz

First Year Mentor
Dr Hazel Needham
Room: E.1.09
Phone: 07 838 4383
Email: hneedham@waikato.ac.nz
Earth Sciences Major

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

<table>
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<tr>
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<td>ERTH3XX</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 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:</th>
<th>Phone:</th>
<th>Email:</th>
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<tbody>
<tr>
<td>Rainer Künnemeyer</td>
<td>CD.1.02</td>
<td>07 838 4630</td>
<td><a href="mailto:rainer@waikato.ac.nz">rainer@waikato.ac.nz</a></td>
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**Electronics Major**

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

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- **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
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>BIOL102 or ENVS101</th>
<th>GEOG103 or ENVP106</th>
<th>ERTH103 or ERTH104</th>
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<td>15 points</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.

<table>
<thead>
<tr>
<th>200 LEVEL</th>
<th>BIOL212</th>
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<tr>
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<th>ENVP306</th>
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</table>


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

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Science International  page 73
Te Pūtaiao me ngā take Māori  page 75
ENVIRONMENTAL 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)
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
Associate Professor Karin Bryan
Room: E.2.13
Phone: 07 838 4123
Email: k.bryan@waikato.ac.nz

Environmental Sciences Interdisciplinary Major

General Structure of a Environmental Sciences Interdisciplinary Major for the BSc and BSc(Tech) degrees

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>COURSES</th>
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<td>ERTH104 15 Points</td>
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<td>300 LEVEL</td>
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</table>

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


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
- 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.

### Structure of the Environmental Microbiology Specialisation

<table>
<thead>
<tr>
<th>Level</th>
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<th>ERTH 104</th>
<th>BIOL 101</th>
<th>CHEM 112</th>
<th>ERTH 103</th>
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</table>

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

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

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.

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<thead>
<tr>
<th>Structure of the Environmental Modelling Specialisation</th>
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<tr>
<td>BIOL***</td>
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<td>20 points</td>
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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

**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; 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.
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.

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<tr>
<th>Structure of the Land and Freshwater Environments Specialisation</th>
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<td><strong>300 LEVEL</strong></td>
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</tbody>
</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.

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<thead>
<tr>
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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

*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.

Enrolment Contact Person and First Year Mentor
To be advised

Convenor
Associate Professor Michael Walmsley

<table>
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<th>Name</th>
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<tbody>
<tr>
<td>Enrolment Contact Person</td>
<td></td>
<td></td>
<td><a href="mailto:engineering@waikato.ac.nz">engineering@waikato.ac.nz</a></td>
</tr>
<tr>
<td>and First Year Mentor</td>
<td></td>
<td>07 838 4266</td>
<td></td>
</tr>
<tr>
<td>To be advised</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convenor</td>
<td>EF.2.02</td>
<td>07 838 4701</td>
<td><a href="mailto:walmsley@waikato.ac.nz">walmsley@waikato.ac.nz</a></td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Level</th>
<th>Course Code</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Level</td>
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<td>15</td>
</tr>
<tr>
<td></td>
<td>ENMP102</td>
<td>15</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Level</th>
<th>Course Code</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 Level</td>
<td>ENMP2XX</td>
<td>20</td>
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<tr>
<td></td>
<td>ENMP2XX</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>ENMP2XX</td>
<td>20</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Level</th>
<th>Course Code</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 Level</td>
<td>ENMP3XX</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>ENMP3XX</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>ENMP3XX</td>
<td>20</td>
</tr>
</tbody>
</table>

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 page 73
» Te Pūtaiao me ngā take Māori page 75

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
- ENMP212A – 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 ENMP322 Biotechnology useful. Process engineering papers, ENMP221 Engineering Thermodynamics 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 |
|---|---|---|
| **100 LEVEL** | **15 points** | **15 points** | **15 points** |
| ENEL111 | PHYS103 | MATH101 |
| **200 LEVEL** | **20 points** | **10 points** | **10 points** | **10 points** |
| PHYS204 | PHYS206 | PHYS205 |
| ENEL284 | ENEL285 |
| **300 LEVEL** | **20 points** | **20 points** | **20 points** |
| * | * | * |

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


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 page 73
» Te Pūtaiao me ngā take Māori page 75

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

General Structure of a Psychology Major for the BSc degree

<table>
<thead>
<tr>
<th>Level</th>
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<th>Points</th>
</tr>
</thead>
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<tr>
<td>200 Level</td>
<td>PSYC208</td>
<td>20</td>
</tr>
<tr>
<td>300 Level</td>
<td>PSYC3XX</td>
<td>20</td>
</tr>
</tbody>
</table>

100 Level – Prerequisites: PSYC102 Social and Developmental Psychology, PSYC103 General and Experimental Psychology.


300 Level – At least 60 points at 300 Level Psychology papers. Preferably chosen from: PSYC340 Applied Cognitive Psychology (10pts), PSYC341 Visual Neuroscience and its Applications (10pts), PSYC344 Physiology of Human Potential and Development (10pts), PSYC307 Research Methods, PSYC314 Behaviour Analysis, PSYC338 Abnormal Psychology (10pts).

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  
» Te Pūtaiao me ngā take Māori

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>
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<td>15 points</td>
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<td>200 LEVEL</td>
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<tr>
<td>300 LEVEL</td>
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<td>20 points</td>
<td>20 points</td>
<td>20 points</td>
<td>20 points</td>
<td>*</td>
<td>20 points</td>
<td></td>
</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.

<table>
<thead>
<tr>
<th>Structure of Te Pūtaiao me ngā take Māori Specialisation – Stream 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>100 LEVEL</strong></td>
</tr>
<tr>
<td>SCIENCE MAJOR 15 points</td>
</tr>
<tr>
<td>MAOR111 15 points</td>
</tr>
<tr>
<td>MAOR112 15 points</td>
</tr>
<tr>
<td>TIKA163 15 points</td>
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<tr>
<td>SCIENCE 15 points</td>
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<tr>
<td>SCIENCE 15 points</td>
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<tr>
<td>SCIENCE 15 points</td>
</tr>
<tr>
<td><strong>200 LEVEL</strong></td>
</tr>
<tr>
<td>SCIENCE MAJOR 20 points</td>
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<tr>
<td>MAOR211 20 points</td>
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<td>MAOR212 20 points</td>
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<td>MAOR213 20 points</td>
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<td>MAOR214 20 points</td>
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<tr>
<td>TIKA263 20 points</td>
</tr>
<tr>
<td><strong>300 LEVEL</strong></td>
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<tr>
<td>SCIENCE MAJOR 20 points</td>
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<tr>
<td>SCIENCE 20 points</td>
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<tr>
<td>SCIENCE 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><strong>100 LEVEL</strong></td>
</tr>
<tr>
<td><strong>200 LEVEL</strong></td>
</tr>
<tr>
<td><strong>300 LEVEL</strong></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 Tuawhakarere 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).

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
Room: FG.1.02
Phone: 07 838 4582
Email: a.campbel@waikato.ac.nz

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>Level</th>
<th>Science Major 100 Level</th>
<th>Science Major 100 Level</th>
<th>Science Major 200 Level</th>
<th>Science Major 200 Level</th>
<th>Science Major 300 Level</th>
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<th>Elective 200 Level</th>
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<tbody>
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<td>100</td>
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<td>200</td>
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</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

<table>
<thead>
<tr>
<th>Position</th>
<th>Room</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director</td>
<td>E.2.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr Karsten Zegwaard</td>
<td></td>
<td>07 838 4892</td>
<td><a href="mailto:k.zegwaard@waikato.ac.nz">k.zegwaard@waikato.ac.nz</a></td>
</tr>
<tr>
<td>All Bachelor of Science (Technology) majors</td>
<td></td>
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</tr>
<tr>
<td>Sue McCurdy</td>
<td>E.2.20A</td>
<td>07 838 4626</td>
<td><a href="mailto:s.mccurdy@waikato.ac.nz">s.mccurdy@waikato.ac.nz</a></td>
</tr>
<tr>
<td>Chemical and Biological Engineering, Materials and Process Engineering</td>
<td></td>
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</tr>
<tr>
<td>Dr Mark Lay</td>
<td>D.G.20</td>
<td>07 838 4556</td>
<td><a href="mailto:mclay@waikato.ac.nz">mclay@waikato.ac.nz</a></td>
</tr>
<tr>
<td>Computer Science, Electronic Engineering, Mechanical Engineering, Software Engineering</td>
<td></td>
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</tr>
<tr>
<td>Jewal Morrison</td>
<td>E.2.21</td>
<td>07 838 4100</td>
<td><a href="mailto:j.morrison@waikato.ac.nz">j.morrison@waikato.ac.nz</a></td>
</tr>
<tr>
<td>Administrator</td>
<td>E.2.20</td>
<td>07 838 4035</td>
<td><a href="mailto:r.oulton@waikato.ac.nz">r.oulton@waikato.ac.nz</a></td>
</tr>
</tbody>
</table>

## 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
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/](http://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†
» CAFS099 – 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.