



THE UNIVERSITY OF  
**AUCKLAND**  
Te Whare Wānanga o Tāmaki Makaurau  
NEW ZEALAND

# Faculty of Engineering

Undergraduate Handbook 2021



# Welcome to the Faculty of Engineering *Nau mai, haere mai, kuhu mai!*

Engineers are problem solvers and innovators who work on real world problems to make the world a better place. At New Zealand's leading engineering faculty\* you will be empowered with the core techniques for solving complex problems, within an environment that creates opportunity for innovation and leadership.

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*Gerard B Rowe*

Professor Gerard Rowe  
Acting Dean of Engineering  
The University of Auckland

The ten specialisations in our BE(Hons) are all taught on our central city campus in our brand-new state-of-the-art engineering building, which embraces the theme of “visible engineering” to illustrate engineering concepts inherent in the building. A recent curriculum refresh, coupled with active blended-learning opportunities in our 26 new multi-disciplinary learning spaces, and study and breakout areas designed to encourage student collaboration, ensure we provide you with the best possible foundations for success.

Engineering is both ubiquitous and of significant value to the economy, with a recent estimate\*\* that Engineering contributes around \$15.0 billion per year to New Zealand, or about five percent of GDP. Conservative growth figures imply 1500 engineers need to be added to the workforce each year, excluding replacements for those who retire.

A degree in engineering offers unparalleled opportunities to contribute to global challenges. On behalf of our faculty, I invite you to join us to make a positive difference in our world.

#### Footnotes:

\* <https://www.topuniversities.com/subject-rankings/2020>

\*\* Economic Contribution of Engineering report at <https://www.engineeringnz.org/big-deal/>



# Contents

## Nau mai, haere mai ki Te Whare Wananga o Tamaki Makaurau

|                                       |           |
|---------------------------------------|-----------|
| Dates to remember                     | 2         |
| Map                                   | 3         |
| General information and facilities    | 4         |
| Health and safety                     | 4         |
| Faculty support services              | 7         |
| <b>Academic Information</b>           | <b>9</b>  |
| <b>Admission</b>                      | <b>11</b> |
| BE(Hons) degree information           | 13        |
| Biomedical Engineering                | 26        |
| Chemical and Materials Engineering    | 28        |
| Civil Engineering                     | 30        |
| Computer Systems Engineering          | 32        |
| Engineering Science                   | 34        |
| Electrical and Electronic Engineering | 36        |
| Mechanical Engineering                | 38        |
| Mechatronics Engineering              | 40        |
| Software Engineering                  | 42        |
| Structural Engineering                | 44        |
| Course descriptions                   | 46        |
| APPENDIX                              | 84        |
| Find out more                         | 88        |

### **Disclaimer**

This publication intends to guide you through your time at the Faculty of Engineering. All information, including locations, hyperlinks and courses, are accurate at the time of print. Please regularly check [www.engineering.auckland.ac.nz](http://www.engineering.auckland.ac.nz) and our social media pages for any important updates.

All students at the University of Auckland are additionally advised to consult its official document, the University of Auckland Calendar, to ensure that they are fully aware of, and can comply with, all academic regulations, requirements and policies. This is available at [www.calendar.auckland.ac.nz](http://www.calendar.auckland.ac.nz).

# Dates to remember

## Summer School 2021

|             |   |
|-------------|---|
| 06 Jan      | Summer School begins                                    |
| 12 Jan      | Last day to add, change or delete Summer School Courses |
| 01 Feb      | Auckland Anniversary Day                                |
| 08 Feb      | Waitangi Day  |
| 12 Feb      | Lectures end  |
| 13 Feb      | Study Break   |
| 15 - 17 Feb | Examinations  |
| 17 Feb      | Summer School ends                                      |

## Semester One 2021

|                 |   |
|-----------------|---|
| 22+ Feb         | Orientation - Semester One                                  |
| 01 Mar          | Semester One begins   |
| 12 Mar          | Last day to add, change or delete Semester One Courses      |
| 26 Mar          | Last day to add or delete double semester (A and B) courses |
| 2-16 Apr        | Mid-semester/Easter break                                   |
| 26 Apr          | ANZAC Day   |
| 03, 05, 07 May  | Autumn Graduation   |
| 04 Jun          | Lectures end  |
| 07 Jun          | Queen's Birthday  |
| 08 - 09 Jun     | Study Break   |
| 10 - 23 Jun     | Examinations  |
| 28 Jun          | Semester One ends   |
| 29 Jun - 16 Jul | Inter Semester Break  |

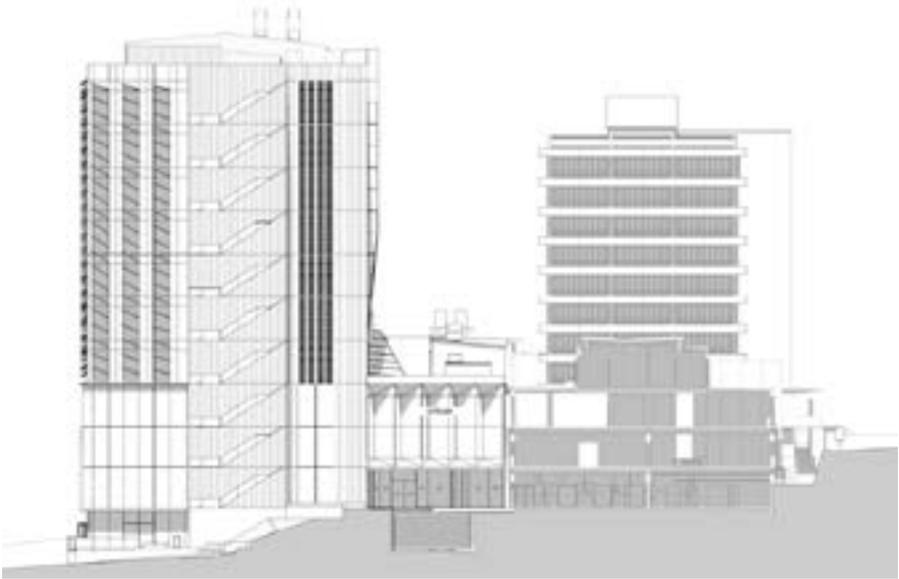
## Semester Two 2021

|                 |   |
|-----------------|---|
| 12+ Jul         | Orientation - Semester Two                                  |
| 19 Jul          | Semester Two begins   |
| 30 Jul          | Last day to add, change or delete Semester Two Courses      |
| 13 Aug          | Last day to add or delete double semester (A and B) courses |
| 28 Aug          | Open Day  |
| 30 Aug - 10 Sep | Mid-semester break  |
| 28 Sep          | Spring Graduation   |
| 22 Oct          | Lectures end  |
| 25 Oct          | Labour Day  |
| 26-28 Oct       | Study Break   |
| 28 Oct - 15 Nov | Examinations  |
| 15 Nov          | Semester Two ends   |

## Summer School 2022

|        |                      |
|--------|----------------------|
| 03 Jan | Summer School begins |
| 28 Feb | Semester One begins  |

# Engineering Buildings: Useful student spaces



## New Building 405

|          |  |
|----------|--|
| Level 10 | Chemical and Materials Engineering Department  |
| Level 8  | Mechanical Engineering Department  |
| Level 7  | Electrical, Computer, and Software Engineering Department  |
| Level 5  | Multi-Disciplinary Learning Spaces (MDLS) E&I Rooms and Soldering Workshop: 405-521; 405-522; 405-536; 405-541; 405-552; 405-559; 405-564; 405-569               |
| Level 4  | Seminar Rooms: 405-422; 405-430; Lecture Theatres: 405-460; 405-470  |
| Level 3  | MDLS Computer Labs: 405-326; 405-328; 405-336 (BYOD); 405-344 (BYOD); MDLS 3D Printers 405-347   |
| Level 2  | MDLS Laser Cutters: 405-221<br>MDLS Flexible Rooms: 405-222; 405-236; 405-240; 405-249;<br>MDLS Wet Chemistry Rooms: 405-252; 405-268; 405-292; 405-297; 405-298 |
| Level 1  | MDLS Wet Non-Chemistry, Dirty Prep Rooms: 405-122; 405-136; 405-139; 405-188; 405-188A   |

## Engineering Building 402

|         |  |
|---------|--|
| Level 4 | Lecture Theatres: 401-401; 401-439<br>Engineering Student Centre;<br>Student Engagement Team |
| Level 2 | MDLS Flexible Rooms: 402-211; 402-220 402-221; 402-225; 402-231                              |

## Engineering Tower B401

|                   |   |
|-------------------|---|
| Level 11          | Civil and Environmental Engineering Department        |
| Level 3           | MDLS Computer Labs 401-301; 401-307; 401-311; 401-312 |
| 70 Symonds Street | Engineering Science Department                        |

# General information and facilities

## Building access

All engineering students are allowed to enter the City Campus Engineering buildings 401 and 402 (20 Symonds Street) and building 405 (5 Grafton Road) between 6am and midnight seven days a week, including public holidays. These hours also apply to all study areas and computer labs. The following rules also apply:

- The main doors to the building will be open between 7.30am-6.30pm.
- You will need your access card to enter and exit the building between 6.00-7.30am and 6.30pm-midnight. During these times, you may enter and exit the building via door 401.300L1/1 (Level 3 leading in from the underpass).
- You are required to start packing up your belongings and vacate the building by 11:45pm, as doors will lock at midnight. Security will ensure that the buildings are clear of occupants.
- Access cards will not open any internal or external doors after midnight, seven days a week, including public holidays. If you are in the building at this time, you must call Security. A guard will establish why you are still in the building, record your ID number, and will need to inform the Faculty. This could result in your after-hours access being suspended.

Access to the labs is based on your specialisation and year of study. You are required to have permission from lab managers to gain access.

Newmarket Campus is open to students with access cards between 7am and 11pm seven days a week.

Always carry your valid access card and ID card with you. Do not lend your access card to anyone – this is considered as a breach of the University Security Policy and may result in immediate deactivation of your card until further notice.

## Access cards

To gain access to the building after hours, and to certain labs that will be required, you must activate the card by completing the online

application form via <https://accesscard.foe.auckland.ac.nz>. It may take up to two weeks for your card to be activated and your card must be renewed at the beginning of every year. To renew it, follow the same process as your initial application.

Access/Campus cards are not transferable under any circumstances. Please report loss or theft to the Security Office on extension 85000. You will need to buy a replacement card, once you have reported the loss. This is not a deposit and there are no refunds. For any questions please contact [foe-facilities@auckland.ac.nz](mailto:foe-facilities@auckland.ac.nz).

## Health and safety

Smoking is prohibited in all Faculty of Engineering campuses, outdoor spaces and buildings, in accordance with the University's smoke-free policy.

Please read the following health and safety information carefully. This is intended for all students within the Faculty of Engineering. It is not a complete guide to safety matters but details basic safety practices and procedures that need to be followed to ensure the health and safety of everyone within the faculty.

The University's health and safety policy and the faculty's safety information are available at [www.engineering.auckland.ac.nz/safety](http://www.engineering.auckland.ac.nz/safety). You must ensure you are familiar with all provided Health and Safety information.

## Essential safety personnel

Your first point of contact is your academic leader, lecturer, tutor or supervisor. If they cannot address your concerns, you may contact the Faculty's Health, Safety and Wellbeing Manager, Tracey McGall at [hsw@auckland.ac.nz](mailto:hsw@auckland.ac.nz) or the **Engineering Facilities team at [foe-facilities@auckland.ac.nz](mailto:foe-facilities@auckland.ac.nz)**

## Your responsibilities

The University is committed to providing a safe and healthy environment for you to work and study in. As a student, you have the following responsibilities:

- Stop activities that are dangerous to you and others

- Complete any required health and safety training
- Follow health and safety instructions. If you are unsure, in doubt of what to do, or have concerns you must seek help from your lecturer, tutor or supervisor
- Speak to your lecturer, tutor or supervisor as soon as possible about any personal health and safety concerns
- Report all accidents, near misses, ill health and building/equipment damage
- Where required, wear personal protective clothing, personal protective equipment, and use provided safety equipment
- Familiarise yourself with the procedures and limitations for working alone
- Do not interfere with health and safety equipment, devices or signage. If you find damage, or there is a malfunction, please alert your supervisor/leader immediately

Please note that it is *a condition of your enrolment to cooperate* with the University in regards to health and safety. Failure or refusal to carry out your responsibilities may have consequences for your further study.

## Risk Assessments

As you advance in your studies and in your future engineering career, you will be required to participate in the risk assessment process. You will initially be obliged just to follow risk assessments, but will later be required to write them. Risk assessment training and guidance will be provided to you as the need arises.

## Right of refusal to participate in dangerous activities

Some activities performed by the faculty will possess a high health and safety risk if they are not properly managed. In the vast majority of cases, risks will be identified and appropriately controlled to an acceptable level and you will be informed of what you need to do to remain safe before you start any activity.

You have the right to not proceed with any activity if you feel, on reasonable and objective grounds, that it poses a danger to yourself or others. You

must then immediately raise your concerns with your academic leader or the health and safety manager so that we can address the issues before any activity begins.

## Faculty safety rules

In order to manage risks, we need to limit your access to equipment, labs and workshops until you have been provided with information about the possible hazards you may encounter, and the safe methods of work you must follow.

The following rules apply to all students:

1. If you create a risk, you own the risk. If your research or work could potentially cause harm or damage, you must work with your supervisor, or academic leader, to reduce risk as far as it is reasonably practicable before you start.
2. You must not enter a laboratory, workshop or store room unless given specific authorisation, or are escorted by an authorised person. In either case, you should seek advice on any hazards you may encounter before you enter.
 

**Note:** Having access cards or keys *does not* mean you are authorised to access a facility, nor permit you to allow another person into that area.
3. You must not attempt to operate any equipment or apparatus unless you have been authorised and shown how to use it safely.
4. When working, keep your work area clean and tidy, and make sure your bags and/or personal items do not cause trip hazards.
5. When you have finished for the day, make sure all tools and equipment are returned to their proper storage, the area is tidy, and equipment is properly shut down. Wash your hands if you need to.
6. You must not eat or drink while you are in workshops and laboratories.

## Laboratories and Workshops

Students may only use the laboratories and workshops where they have been given specific authority to work by their course coordinators and/or academic supervisors and technical staff in charge.

All students will be required to wear appropriate personal protective equipment depending on which laboratory and workshop you work. Personal protective equipment, such as safety glasses, lab coats, masks, hearing protection will be provided by laboratories and workshops. Some laboratories might require students to wear protective laboratory coat, students are permitted to wear their own if they wish (boiler suits/overalls or similar protective clothing are also acceptable for most labs: the student will need to confirm the suitability with their course tutor/lab coordinator).

Because there are hazardous substances and various types of equipment in the laboratories and workshops, there are guidelines around their use:

1. You should not work alone in a laboratory or workshop
2. You should only carry out work you are familiar with. Specific in-person training will be required and provided for undertaking hazardous operations. This includes (but not limited to):
  - Handling or mixing chemicals
  - Wiring up electrical equipment
  - Using machine tools other than battery powered ones
  - Using equipment designated by the technicians in charge of the laboratory as hazardous
  - Using welding or oxy-acetylene equipment
3. When leaving a laboratory or workshop, students and staff are responsible for making sure that all equipment and services are in a safe condition. This means, for example, turning off any electricity, gas and water that have been used.

If you have any questions relating to MDLS, please contact the MDLS Core Technical Services Team at **MDLS@uoa.auckland.ac.nz**

## Inductions

Many teaching and learning spaces areas such as lecture theatres are considered low risk, and you may only need a quick briefing to know where the emergency exits are.

The laboratories and workshops present increased risks. Anyone who needs to access laboratories

and workshops will be invited to participate in an induction with a staff member. These inductions are generally facilitated by a technical staff in charge. After an induction and before starting work in these areas, you should be able to answer the following questions:

- Who are my academic leaders or supervisors?
- How do I get out of the building in the event of an evacuation?
- What are the likely emergencies I will encounter and what will I need to do?
- What are the emergency contact numbers?
- Where is the nearest fire alarm, first aid kit and defibrillator?
- Where are the isolation controls/emergency shut-off procedures for the equipment I am going to use?
- Do I need specific training to use items, equipment or machinery?
- What protective or safety equipment do I need to use to do my work safely?
- What other work is being performed nearby? Will it interfere with my work? Will my work affect others?
- Am I allowed to perform low risk work alone, or do I need a supervisor while I am working?
- Can I do my work after normal working hours, or do I need to leave when the staff go home?

If you can't answer these questions, please see your academic leader or supervisor or the technical staff in charge of the laboratory or workshop.

## What to do if you have an accident or incident

Students should report incidents, injuries and observations to the Student Contact Centre via Ask Auckland or via their academic supervisor.

For emergency assistance contact University Security (24 hours) at 0800 373 7550

More information can be found at: **<https://www.auckland.ac.nz/en/health-safety-wellbeing/report-concerns-hazards/injury-incidents-observations-reporting-students.html>**

# Faculty support services

## Course planning and enrolment advice

The Engineering Student Centre may be your first point of contact for all engineering programme enquiries, including course planning and enrolment advice. Email [foe-enquiries@auckland.ac.nz](mailto:foe-enquiries@auckland.ac.nz) or visit us at:

**Location:** Level 4, Faculty of Engineering Building, City Campus, 20 Symonds Street

**Opening hours:** 8:30am-4:30pm, Monday-Friday (excluding University holidays).

## Personal guidance

We recognise that there are various factors that may impact your studies. The University offers a range of support mechanisms for you. This includes support for anxiety and stress, learning needs, financial stress, and unforeseen events.

The Faculty of Engineering Student Engagement team provides individual support if you are struggling, stressed, or have experienced a traumatic event which may impact your study. Feel free to drop in and see us, or email [foe-engagement@auckland.ac.nz](mailto:foe-engagement@auckland.ac.nz).

In general, we provide academic and pastoral services, and are able to link you to key support services such as health and counselling, career development, and our library and learning staff.

Our experienced staff work closely with the faculty's student clubs and associations to provide social, professional and academic opportunities for students. The initiatives we support and operate include: Orientation; the Part I Assistance Centre; wellbeing resources; student clubs; SPIES; Tuākana tutoring and mentoring for Māori and Pacific students; the Women in Engineering and Rainbow Engineering networks; recruitment evenings with prospective employers; and special support for international students, students with disabilities and refugee students.

## Academic issues

If matters arise that affect your study, you should

feel confident discussing them with your lecturer or course coordinator. You may also like to speak with the relevant Departmental UG Adviser and/or the Deputy Head of Department (Academic). If the situation is not dealt with to your satisfaction, these may then be referred to your Head of Department. Find contact details for the Departmental UG Advisers here: [www.auckland.ac.nz/en/engineering/study-with-us/study-options/courses/academic-advisers.html](http://www.auckland.ac.nz/en/engineering/study-with-us/study-options/courses/academic-advisers.html).

For issues of a more general nature, or if ever there is an occasion when you wish to dispute how a matter has been handled by a department, you may bring these to the attention of the SSCC, Associate Deans or the AUSA Advocacy Service.

## Faculty Staff-Student Consultative Committee (SSCC)

SSCC contains two student representatives nominated from each department's SSCC, representatives from major student groups, administrative staff and academics. The Faculty SSCC addresses faculty-wide issues affecting academic life, resources and services. SSCC serves as a liaison between the students and the faculty. Two meetings are usually held per semester, but urgent issues may be brought to the attention of the Chair at any time. You are encouraged to talk to your class representatives to bring matters to the attention of the SSCC. You can email them at: (code)-rep(year of study)@auckland.ac.nz, where 'code' refers to the relevant course, such as 'chemmat'. Part I students may be able to contact their representative at [eng-rep1@auckland.ac.nz](mailto:eng-rep1@auckland.ac.nz)

## Part I Assistance Centre

The faculty employs high-achieving Part II and III students to provide academic assistance to Part I students. The Part I Assistance mentors are trained and maintain close contact throughout the Semester with the course coordinators for all Part I courses.

The Part I Assistance Mentors are located in the Leech Study Area level 3 in building 402 from 2-5pm, Monday to Friday, during Semester One and Two.

The service is also provided at O'Rorke Hall and

University Hall for engineering students living there. For information, contact Alcione Fagundes at [a.fagundes@auckland.ac.nz](mailto:a.fagundes@auckland.ac.nz).

## Part II Assistance Centre

The Faculty employs current high-achieving Part III and IV students to provide free academic assistance and tutoring to Part II students on a drop-in basis

This initiative is available to help you with all your courses throughout Semesters One and Two if you're specialising in the following:

- Civil and Structural Engineering
- Mechanical Engineering
- Mechatronics Engineering
- Electrical and Electronic Engineering
- Computer Systems
- Software Engineering

The Part II Assistance Centre is located in the Leech Study Area in Level 3, Building 401 of the Faculty of Engineering.

For more details, please visit our webpage :

**<https://www.auckland.ac.nz/en/engineering/current-students/student-support/part-ii-assistance-centre.html>**

## Tuākana Tutorial Programme

The Faculty employs high-achieving Undergraduate and Postgraduate students to provide targeted tutorials and academic support for Māori and Pacific Engineering students. Tutorials start in the second week of semester. Your timetable is set by the faculty by way of a special Tuākana-only stream of classes to make sure there are no clashes in your class schedule. Access to this stream of classes is granted for all MAPTES entry students and by registration with the Māori and Pacific adviser for all General Entrants. Please note that General Entry students who do not register will not be able to choose the Tuākana class timetable on enrolment, will have timetable clashes, and will not be able to make use of all the Tuākana tutorial sessions and academic support. We strongly recommend registering for access to the Tuākana class stream timetable.

There are Tuākana tutorials for all seven core Part I

Engineering courses. For more information please email [foe-engagement@auckland.ac.nz](mailto:foe-engagement@auckland.ac.nz)

## Scholarships and prizes

More than 40 scholarships ranging from \$1,000 to \$7,500 are gifted annually by individuals, societies, businesses and industry to promising undergraduate engineering students.

The Faculty of Engineering also offers up to 22 Kick Start scholarships specifically for school-leavers applying to Part I of BE(Hons).

These scholarships are a one-year award of \$2,000 aimed at helping students with "set up" costs for their first year at the University of Auckland. The closing date for all Kick Start scholarships is 15 January

**Visit [www.engineering.auckland.ac.nz/scholarships](http://www.engineering.auckland.ac.nz/scholarships) to find out more about engineering undergraduate scholarships, or get further assistance by contacting the Scholarships Office at [scholarships@auckland.ac.nz](mailto:scholarships@auckland.ac.nz).**

## Contact for academic issues

Associate Dean (Academic)

Dr Michael Hodgson

Room 405.943, 20 Symonds Street

+64 9 923 8218

[ma.hodgson@auckland.ac.nz](mailto:ma.hodgson@auckland.ac.nz)

**We're here  
to help you  
succeed!**

# Academic Information

## Course details and requirements

You will receive detailed course outlines in Canvas describing the material covered; how it will be assessed; the percentage of assessments contributing to your final grades, and assessment due dates. This information may also be provided as a handout in your first lecture or in your coursebook, if one is provided. Be sure to put any assessment dates in your diary. All course outlines can be accessed at <https://courseoutline.auckland.ac.nz/dco/course>.

## Student Services Stall

There are various methods of submitting and returning assignments, and you will be informed of the right procedure. Many courses use the Student Services Stall in the atrium on Level 3 between B401 and B405, 20 Symonds Street, to collect and return coursework. You need to produce your ID card before collecting assignments. Any assignments not collected within two weeks are returned to the relevant department office.

## Academic misconduct, cheating and plagiarism

The University of Auckland views cheating as a serious offence. Penalties for cheating in examinations are administered by the Discipline Committee of the Senate and may include suspension or expulsion from the University.

Cheating in on-course work is usually handled within the faculty or department, and may result in the assignment being marked as zero or a course being failed. The student's name and details of the case may be added to the University's Register of Academic Misconduct.

Learn more about how to avoid various forms of cheating in the Exam Regulations of the *University of Auckland Calendar* and the compulsory Academic Integrity course in Part I of the BE(Hons). The full guidelines on procedures and penalties for academic dishonesty are available at

[www.auckland.ac.nz/academic\\_honesty](http://www.auckland.ac.nz/academic_honesty).

## Grading and Honours

For each Part of the BE(Hons) degree, your Grade Point Average (GPA) is calculated using the following formula:

$$\text{GPA} = \frac{\sum g_i \cdot P_i}{\sum P_i}$$

Where  $P_i$  is the points for course  $i$  and  $g_i$  is the numerical value of the grade awarded in course  $i$ . The numerical values for the grades are:

|    |   |      |   |
|----|---|------|---|
| A+ | 9 | B-   | 4 |
| A  | 8 | C+   | 3 |
| A- | 7 | C    | 2 |
| B+ | 6 | C-   | 1 |
| B  | 5 | Fail | 0 |

It should be noted that failing grades as well as grades for repeated courses are included in the GPA. If all courses are worth 15 points, the GPA can be calculated easily as the average of the grade values for all courses (including failed courses).

## Examinations

Examinations take place at the end of each semester. Students can access their examination timetable on Student Services Online after it is published during the semester. Final exams are administered by the University's Examinations Office. See [www.auckland.ac.nz/exams](http://www.auckland.ac.nz/exams) for more information.

## Restricted Calculators

There are specific regulations about the type of calculator you may use during tests and exams. If your exam specifies a "Restricted Calculator" the following defines the type permitted for engineering courses:

- Your calculator must comply with the general calculator requirements in the University of Auckland Calendar
- No alphanumeric calculators. Your calculator must not have the full alphabet on or available

from the keyboard

- No graphing ability
- Your calculator must not have wireless/wired communication capability to another calculator or computer
- Your department may have further requirements for calculator specifications
- A typical complying calculator is the Casio fx-82AU PLUS II.

If in doubt, check with your course coordinator well in advance of exams. If you bring a suspect or non-complying calculator into a test or exam, it will be removed and held for checking, and your name will be recorded in case further action is necessary.

### Missed exams

Students who report too late for admission to the exam room or who miss the exam completely cannot sit that exam at another time. If you missed your exam due to illness or unforeseen circumstances then you may be eligible to apply for an aegrotat or compassionate consideration. Strict criteria applies.

For more information visit: <https://www.auckland.ac.nz/en/students/academic-information/exams-and-final-results/during-exams/aegrotat-and-compassionate-consideration.html>

### Missing a test

Tests that contribute to your final grade, and are held under examination conditions, are subject to the same rules for aegrotat and compassionate consideration as examinations. If you miss a test, you should complete Form AS-46 and submit it within seven days of the test. The application costs \$10 and is available online at: <https://tinyurl.com/y7chwh6w0>, or at [www.engineering.auckland.ac.nz/exams](http://www.engineering.auckland.ac.nz/exams).

### Missing an on-course assessment

For on-course assessments or coursework other than a test, you should first request an extension of the due date from the course coordinator. If an extension is not given or is considered inappropriate, you may submit an exemption

request through the “Application for Exemption from On-course Assessment” form available online at [https://uoa.custhelp.com/app/answers/detail/a\\_id/10972](https://uoa.custhelp.com/app/answers/detail/a_id/10972)

Contact the Engineering Student Centre or the Engineering Student Engagement team for further help.

### Conceded passes

If you fail a course, you may be eligible for a conceded pass, which carries a passing numerical grade of 1 (equivalent to a C-). You cannot apply for a conceded pass; eligible students will be automatically considered and conceded passes will be confirmed at the end of each year. If granted, you will see a ‘CP’ on your academic record. No more than two courses can be conceded, to a maximum of 30 points, in any one degree.

You will only be considered for a conceded pass if:

- The award of the conceded pass allows you to complete a Part.
- You have a D+ grade in the failed course(s). Note: “Withdraw”, “Did Not Complete” and “Did Not Sit” constitute failures and are not considered for conceded passes.
- Your overall GPA (grade point average) for the year, including the failed courses, is 2.5 or above (C = 2, C+ = 3).
- The failed course(s) belong to Parts I, II or III of the BE(Hons) degree (Part IV courses can not be conceded).
- One course to a maximum of 20 points per Part and a maximum of 20 points in any one academic year may be conceded.

### Alternative exam arrangements

#### • Special exam conditions

If you need support for an ongoing condition, (including temporary or permanent disabilities) while sitting an examination, you can apply for special exam conditions. This will require an application via University Health Services or Student Learning Services.

#### • Out-of-time or out-of-centre exams

There are strict criteria in place for approving an exam to be sat at a different time (referred to as out-of-time) or place (out-of-centre). Applications for personal commitments or travel will not be accepted. You should not book any travel during the exam period until after your finalised exam timetable is published. [www.auckland.ac.nz/en/students/academic-information/exams-and-final-results/before-exams/special-conditions.html](http://www.auckland.ac.nz/en/students/academic-information/exams-and-final-results/before-exams/special-conditions.html)

Applications must be submitted at least 1 month before your first affected exam; otherwise your application may not be considered in time.

You need to contact the Exams Office (Email: [exams@auckland.ac.nz](mailto:exams@auckland.ac.nz), or for in-person queries please visit AskAuckland Central) not your lecturers for this.

### Late deletion

Late deletion is available to students who are unable to continue studying due to exceptional circumstances such as illness, injury, or events beyond your control. The deadline to submit a late deletion request is on the final day of lectures. If you wish to apply for late deletion, consider seeking support from the University's Counselling Service or student advisers first. Contact the Engineering Student Engagement Team for more information.

## Admission

### Admission to Part I

Places available in Part I (first year) of the BE(Hons) are limited and subject to selection. For further information, including entry requirements and alternative pathways, visit [www.engineering.auckland.ac.nz/entry](http://www.engineering.auckland.ac.nz/entry).

### Admission to Part II

Part II of the BE(Hons) programme is divided into nine specialisations. Entry into each specialisation is strictly limited: the faculty will not exceed the University Council's approved limitations on entry into Part II specialisations, as stated in the *University of Auckland Calendar*.

Places available in 2021 are:

|                                       |             |
|---------------------------------------|-------------|
| Biomedical Engineering                | 35          |
| Chemical and Materials Engineering    | 85          |
| Civil Engineering                     | 180*        |
| Computer Systems Engineering          | 80          |
| Electrical and Electronic Engineering | 100         |
| Engineering Science                   | 75          |
| Mechanical Engineering                | 125         |
| Mechatronics Engineering              | 100         |
| Software Engineering                  | 120         |
| Structural Engineering                | <b>100*</b> |

\*In 2021 a new specialisation called Structural Engineering has been added. At Part II, Civil and Structural share the same courses and have a combined maximum of 280 places. Some flexibility will be allowed around numbers, and may take up to 180 places into Structural, or up to 200 into Civil. Because the two specialisations share the same Part II courses, there will be some opportunity for Civil and Structural students to swap between specialisations at the end of Part II.

Priority placement is given to current University of Auckland students who have recently completed Part I of the BE(Hons).

Subject to availability of places, students who have completed the first year of a BE(Hons) programme at another tertiary institution may be considered for admission directly into Part II, dependent on their academic performance (at least a B average) and the equivalence and relevance of their prior study. There is no automatic acceptance or transfer of credit for engineering qualifications and each case will be considered individually.

The prior completion of certain qualifications may also provide direct entry into Part II, subject to a Grade Point Average (GPA) of at least 5.0 B average and places remaining available. Such qualifications include a completed New Zealand Diploma of Engineering, Bachelor of Science, Bachelor of Technology with appropriate subjects.

Students wishing to transfer need to complete an application via Student Services Online and indicate the specialisation for which they wish to be

considered under Major/Specialisation, eg, Civil Engineering.

Students who are offered direct entry into Part II from another degree and/or institution must still complete the requirements for ENGGEN 199 English Language Competency and ACADINT A01 Academic Integrity Course without exemption (more information on page 26). International applicants must also meet certain English language requirements as per University policy. Further information can be found at [www.auckland.ac.nz/english-language-requirements](http://www.auckland.ac.nz/english-language-requirements).

The faculty will not permit entry into Part II of the BE(Hons) in Semester Two, unless students have prior study elsewhere which can be substituted for the courses they have missed in Semester One.

## Part II selection criteria

Current Part I students will nominate their top five choices of specialisation before the end of Semester Two. The faculty offers a variety of resources to help you consider your specialisation of choice, including editorials written by current students at <https://student-editorials.blogs.auckland.ac.nz>

To be considered for admission into your preferred specialisation, you must have:

- Completed a minimum of 90 points of Part I, including ENGSCI 111 (your General Education course can be included in the points requirement).
- Completed or received credit for any specified Part I course regarded as a prerequisite for your preferred specialisation (e.g. CHEMMAT 121 for Chemical and Materials; ELECTENG 101 for Computer Systems Engineering and Electrical and Electronic; ENGGEN 121 for Civil, Mechanical and Mechatronics; and ENGGEN 131 for Biomedical, Engineering Science and Software).
- Completed requirements for ENGGEN 199.
- Completed requirements for ACADINT A01.

If demand exceeds the number of places available in a specialisation, all students will be ranked according to their GPA in Part I BE(Hons) courses (excluding their General Education course). Students will not be ranked unless they complete

the above requirements.

Places in your preferred specialisations are not guaranteed and you may be offered a place in another specialisation if places are no longer available in your first (or lower) choice/s.

If you fail up to 30 points of courses in Part I, you are advised to repeat them at Summer School. Similarly, if you only began the BE(Hons) in Semester Two (and have only completed 60 points of Part I) you are required to make up your remaining 30 points for Part I at Summer School. In order to be considered for entry into Part II the following year.

If you are admitted to Part II in Semester One, before you have completed all of Part I, you will be required to complete any outstanding Part I courses in Summer School of the following year. You will not normally be permitted to enrol in the outstanding Part I courses during Semester One or Two.

Any student who does not complete Part I within two years of initial enrolment may not be permitted to continue in the BE(Hons).

More information can be found at: [www.auckland.ac.nz/en/engineering/current-students/undergraduate/choosing-engineering-specialisation.html](http://www.auckland.ac.nz/en/engineering/current-students/undergraduate/choosing-engineering-specialisation.html).

## BE(Hons) degree information

### Bachelor of Engineering (Honours) degree structure

The BE(Hons) degree at the University of Auckland is a four-year programme consisting of 480 points and divided into four Parts (equivalent to one year each). Each Part consists of courses totalling 120 points.

In general, each Part must be completed in chronological order – Part I must be completed before Part II, for example. Any exceptions must be approved by the Associate Dean (Academic) on a

semester-by-semester basis.

### Calculation of the Honours GPA (HGPA)

The award of Honours is dependent on the value of your Honours GPA. This is calculated using the formula below and then rounded to one decimal place.

$$\text{HGPA} = 0.1 \times \text{PART II GPA} + 0.3 \times \text{PART III}$$

$$\text{GPA} + 0.6 \times \text{PART IV GPA}$$

### Award of Honours

Honours is awarded in four classes: First Class, Second Class (First Division), Second Class (Second Division) and Third Class\*.

Your class of Honours will depend upon you achieving the following GPA:

- **First Class Honours:**  $7.0 \leq \text{HGPA}$
- **Second Class Honours (First Division):**  
 $5.5 \leq \text{HGPA} < 7.0$
- **Second Class Honours (Second Division):**  
 $4.0 \leq \text{HGPA} < 5.5$

### Third Class Honours\*: HGPA < 4.0

A GPA of 4.0 is equivalent to a B- and a GPA of 7.0 is equivalent to an A-, so First Class Honours can be

recognised as being in the A grade range while Second Class honours can be recognised as being in the B grade range.

Students with  $\text{HGPA} < 4.0$  will be awarded the BE degree without Honours or 3rd Class Honours\*.

\* Third Class Honours was added in 2020. 3rd Class Honours can only be awarded to students who have completed their final academic (non-zero pt) course, required for the degree, no earlier than Semester One 2020 (Note that ENGGEN 199, 299, 499 are NOT considered to be academic courses)



# Study in the first year

## Part I

Part I is a common year – all students take the same courses. You gain exposure to each of the ten different engineering specialisations and study a broad base of Engineering and professional fundamentals.

Part I of the BE(Hons) consists of 120 points comprising:

**Part I - BE(Hons)** 120 points

## Conjoint degree

A conjoint degree enables you to complete a BE(Hons) and another degree at the same time, with a reduction in the total points required for each degree component. It can be an excellent choice if you know that the other degree will be beneficial in your proposed career, or if you are a capable student with skills in various areas, or considering postgraduate studies.

Part I of the BE(Hons) conjoint consists of at least 105 points.

**Part I - BE(Hons) conjoint** 105 points

### Semester One

### Semester Two

|  |   |
|--|---|
| ENGGEN 140<br>Energy and Society                                     | CHEMMAT 121<br>Materials Science  |
| ENGGEN 121<br>Engineering Mechanics                                  | ELECTENG 101<br>Electrical and Digital Systems                          |
| ENGSCI 111<br>Mathematical Modelling 1                               | ENGGEN 131<br>Intro to Engineering Computation and Software Development |
| ENGGEN 115 (Semester One or Two)<br>Principles of Engineering Design |   |
| GEN ED Course<br>(Semester One or Two)                               |   |
| ENGGEN 199 (0 points)<br>English Language Competency                 |   |
| ACADINT A01 (0 points)<br>Academic Integrity Course                  |   |

### Semester One

### Semester Two

|  |   |
|--|---|
| ENGGEN 140<br>Energy and Society                                     | CHEMMAT 121<br>Materials Science  |
| ENGGEN 121<br>Engineering Mechanics                                  | ELECTENG 101<br>Electrical and Digital Systems                          |
| ENGSCI 111<br>Mathematical Modelling 1                               | ENGGEN 131<br>Intro to Engineering Computation and Software Development |
| ENGGEN 115 (Semester One or Two)<br>Principles of Engineering Design |   |
| GEN ED or CONJOINT Course<br>(Semester One or Two)                   |   |
| CONJOINT Course<br>(Semester One or Two)                             |   |
| ENGGEN 199 (0 points)<br>English Language Competency                 |   |
| ACADINT A01 (0 points)<br>Academic Integrity Course                  |   |

- All courses listed in tables above are 15 points unless otherwise stated
- Visit <https://courses.foe.auckland.ac.nz/course> for detailed course information, or see the back of this handbook.

*Further conjoint information is on page 22*

## Enrolment - Part I Students

After you have accepted your offer of place, you will be sent documents detailing how to enrol.

Students enrol in their courses through Student Services Online. Instructions on how to do this can be found at <https://www.auckland.ac.nz/en/study/applications-and-admissions/enrolment.html>

It is recommended that you complete your enrolment as early as possible as classes fill up quickly. Enrolment deadlines can be found in the Important Dates section of the University Calendar: [www.calendar.auckland.ac.nz/en/keydates/enrol-dates.html](http://www.calendar.auckland.ac.nz/en/keydates/enrol-dates.html).

## MAX (MATHS 153 or MATHS 199) students

Students who obtain a B+ or better as part of the MAX (Mathematics acceleration and extension) programme can choose to cross credit their MAX course (MATHS 153 or MATHS 199) towards their engineering degree and can then enrol in an approved Part II course during their first year in engineering\*. Those who received a grade lower than a B+ are required to enrol in the standard first year in engineering courses.

| Course    | Grade required to cross credit | Course MAX replaces | Alternative course to fill part 1* |
|-----------|--------------------------------|---------------------|------------------------------------|
| MATHS 153 | B+ or better                   | ENGSCI 111          | ENGSCI 211                         |
| MATHS 199 | B+ or better                   | ENGSCI 131          | ENGGEN 204                         |

MAX students can contact Peter Bier for part I engineering course advice by emailing [p.bier@auckland.ac.nz](mailto:p.bier@auckland.ac.nz).

**\* Those student enrolled in a conjoint degree may wish to consider completing a course from their other degree other than the suggested alternatives above.**

## General Education courses

General Education courses are designed to broaden your education. They give you an opportunity to mix with students from different disciplines and develop your awareness of interdisciplinary research.

You must pass one approved General Education course (15 points) in Part I of your degree. Special arrangements may apply for conjoint students or students who have transferred from another tertiary institution with credit.

You MUST choose from a range of courses from either the "General Education Open Schedule" or the "Engineering, Medical and Health Sciences, and Science Schedule (EMHSS)". You cannot enrol in a General Education course with the same course subject as any you will take within the degree, such as ENGGEN 100G, ENGGEN 101G, CHEMMAT 100G.

Refer to [www.auckland.ac.nz/generaleducation](http://www.auckland.ac.nz/generaleducation) for more details.

In some cases, courses are available both as part of the General Education programme and as part of regular degree programmes. If you choose such a course, you MUST enrol in the G version of the course (e.g. HISTORY 103G). Enrolment in the non-"G" version may not be counted as fulfilling the General Education requirement.

## Academic English Language Requirement (AELR)

In 2016, the University introduced an Academic English Language Requirement (AELR) into all its bachelors degree programmes. The AELR aims to ensure that you have a sufficient level of competence in academic English to support your study at University. This will not affect whether you are offered a place in a programme, being separate to University Entrance English requirements.

Applicants who have not met the AELR through their entrance qualification will be provided with advice at the time of enrolment. Students required to complete a course for AELR may substitute one of the approved courses in the place of a General Education course. For further information, see [www.auckland.ac.nz/aelr](http://www.auckland.ac.nz/aelr).

## English Language Competency – ENGGEN 199

This is separate from, and in addition to, AELR and University Entrance English requirements. All students entering the BE(Hons) degree are required to complete ENGGEN 199 (English Language Competency) as a compulsory component of their Part I requirements, even if they are entering the degree at a Part II level.

In order to fulfil the requirements of ENGGEN 199, firstly you must complete the 30 minute Diagnostic English Language Needs Assessment (DELNA) screening. For most students, the completion of this screening will be sufficient.

Results are not graded, except for an indication of whether you have completed (CPL) the requirements for ENGGEN 199.

If a full assessment is requested by the DELNA team, you will be required to complete a two-hour diagnosis, which you must book as soon as possible, or at least before the semester ends. If this diagnosis indicates that you need to work on your academic language skills, you will need to do a programme of language skill development coordinated by the University's English Language Enrichment centre (ELE). You will not be allocated a specialisation unless you have met the requirements for ENGGEN 199.

The DELNA screenings take place on campus in one of the University's computer labs. We strongly encourage you to book a screening during Orientation and complete this. Visit [www.delna.auckland.ac.nz](http://www.delna.auckland.ac.nz) for more information.

## Academic Integrity Course – ACADINT A01

All new students are required to complete an online academic integrity course. This is also a requirement to be allocated a specialisation, and so BE(Hons) students (single and conjoint) are required to complete this in Part I. More details are provided at [www.auckland.ac.nz/academic\\_honesty](http://www.auckland.ac.nz/academic_honesty).

## Parts II, III and IV students

Before enrolling, read our guidelines for returning students at [www.auckland.ac.nz/en/engineering/current-students/undergraduate/course-enrolments.html](http://www.auckland.ac.nz/en/engineering/current-students/undergraduate/course-enrolments.html)

You should also consider the guidelines on the main University website at [www.auckland.ac.nz/enrolment](http://www.auckland.ac.nz/enrolment).

**Electives not listed in your degree structure will require approval of your department course advisor.**

If you fail a course, you will only be able to enrol in the courses you have yet to complete in that Part.

If you need to enrol in a course at a higher level, or encounter a timetable clash with no alternative options, you will need to apply for an enrolment concession via Student Services Online. If approved, Student Centre staff will enrol you in the appropriate course(s). **Only in exceptional circumstances will a student be permitted to enrol for Part III unless Part I has been completed, or to enrol for Part IV unless Part II has been completed.**

## Repeating a course for a third time

A concession request will need to be made to repeat a failed course for a third time. Third time repeats of Part I courses are likely to be declined, and will require the student to find another course of study, other than Engineering. Requests to repeat failed courses at Part II - IV for a third time will be assessed against the students overall performance in the programme and in their coursework and may be declined. If a core course cannot be repeated for a third time this will result in discontinuation from study in the BE(Hons). A full semester of DNS or DNC will also likely result in not being permitted to continue study in the BE(Hons). Contact the Faculty of Engineering Student Centre for advice.

## Field trips

As part of your course, you may need to go on field trips to study engineering plants and works. You will be given details about these requirements as soon as they are available. Any field trips specified as compulsory form part of the requirements for obtaining your degree.

## Workshop Practice (ENGGEN 299)

ENGGEN 299 is carried out in year 2 of the BEHONS programme.

In 2021 we are changing the delivery of this course. These changes will be aligned to what your specialisation needs and what you are likely to use in internships.

Health and safety in the workplace and around tool-use will remain a core component. You will still attend sessions in basic tool use and specialisations will be undertaking activities more relevant to the specialisation. There will still be a need for workshop attendance.

For students who are selected into Mechanical, Mechatronics and Biomed you will be required to attend the MIT workshops as per our previous ENGGEN 299. For all other students selected into the other specialisations, you will do some online modules and a series of shorter workshops at our Auckland and Newmarket campus over 2021.

More information about what ENGGEN 299 will look like for you in 2021 will be sent out to students via e-mail explaining the process for your specialisation for 2021, and how this will fit into your schedules.

We will also post information on our website as soon as it comes available at [www.engineering.auckland.ac.nz/workshop-practice](http://www.engineering.auckland.ac.nz/workshop-practice)

Any exemption requests must be supported by documentary evidence of having attended a similar course elsewhere.

## Practical Work (ENGGEN 499)

As part of your BE(Hons) degree you are required to experience some of the trade and/or sub-professional skills relevant to your engineering specialisation. This complements your formal

studies and contributes to your professional training, providing you with trade and sub-professional skills relevant to your engineering specialisation.

You must complete at least 800 hours of approved engineering employment (paid or unpaid) before graduation. After each period of work, you will submit a report detailing your experience. Students will not be considered to have met the requirements to graduate until both Workshop Practice (ENGGEN299) and Practical Work (ENGGEN499) have been completed.

As it is a formal requirement of your degree, strict assessment criteria apply. You can find detailed information and FAQs about practical work requirements as well as the impact of COVID-19 on Practical Work at [www.engineering.auckland.ac.nz/practical-work](http://www.engineering.auckland.ac.nz/practical-work).

### Important points to note:

- **When:** To meet the requirements for the award of the BE or BE(Hons) degree, you must complete 800 hours of practical work (which may be made up of either all general hours, or all sub-professional hours, or a combination of both general and sub-professional hours) AND write a practical work report that critically appraises your experience.
- **When:** Practical work experience will usually be undertaken during the study summer breaks following Parts II and III (400 hours in each).
- **Types of work:** Appropriate types of practical work are outlined in the following section. Non-engineering work will not be accepted. Concerns about the suitability of a particular type of work should be discussed with your department representative on the Practical Work Committee.
- **Employers:** Except for work associated with scholarships or internships, each work experience period should be with a different employer.
- **Summer scholarships:** If you participate in a project for a University Summer Research Scholarship, you may count up to 400 hours of this towards your practical work experience.

- **Registration:** You must register your practical work employment online through the Practical Work Portal prior to, or during the first week of employment, so the Employer Liaison Manager can validate the company. If you miss this deadline please contact **foe-enquiries@auckland.ac.nz**.
- All completed practical hours and tasks must be verified online by your supervisor through the Practical Work Portal. In the unlikely event that your supervisor doesn't have an email address you may request a pdf certificate to be attached to your report by contacting **foe-enquiries@auckland.ac.nz**.
- **Report:** A separate report is required for each company.
- **Due dates:** Check the Practical Work web page for submission dates, especially around dates to make sure you are eligible to attend graduation ceremonies. See **www.engineering.auckland.ac.nz/practical-work**.
- **Exemptions:** If you have had substantial relevant work experience prior to entering the faculty, you may be required to complete only 400 hours of practical work experience. Any exemptions or exceptions to any of the aforementioned requirements are to be approved by the appropriate departmental representative of the Practical Work Committee or the Faculty Chair.

### Types of practical work suitable for each department

Although most students will complete 800 hours over two summers for a 400 + 400 hour split, other hour splits are acceptable.

Check the Practical Work web page for the impact of COVID-19 on practical work

Practical work has historically been categorised as General or Sub-Professional

- **General engineering:** This is often undertaken in the first period of practical work period and should allow you to become familiar with engineering processes and trade skills, particularly those appropriate to your specialisation.

- **Sub-professional engineering:** This is more likely to be part of the second period of practical work period, when your knowledge of engineering subjects will be more extensive. Work of this type is of a sub-professional nature; the work of a junior engineer in a company with some responsibilities and technical expertise, which takes advantage of the academic training gained from your courses completed in your engineering degree.

The following are meant as guidelines for types of acceptable work; other types may be acceptable. If in doubt, check with your departmental representative.

Ideally with your practical work you will undertake some work in each category, but there is now no minimum (or maximum) number of hours required in each category

### Practical work reports

The practical work component of your degree requires you to:

- Complete 800 hours of practical work experience.
- Write and submit a practical work report for each period of employment.
- Please refer to the Practical Work web page for the required content and further details on the structure of the practical work reports. Visit **www.engineering.auckland.ac.nz/practical-work**.





## The Practical Work Committee for 2021

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**Practical Work Committee Chair:** Dr Vicente Gonzalez (v.gonzalez@auckland.ac.nz)

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**Biomedical Engineering:** Associate Professor Iain Anderson (i.anderson@auckland.ac.nz)

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**Chemical and Materials Engineering:**  
Dr Wei Yu (w.yu@auckland.ac.nz)  
Dr Thomas Loho (thomas.loho@auckland.ac.nz)

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**Civil and Environmental Engineering:**  
Dr Conrad Zorn (conrad.zorn@auckland.ac.nz)

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**Computer Systems, Electrical and Electronic, and Software Engineering:**  
Associate Professor Waleed Abdulla (w.abdulla@auckland.ac.nz)

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**Engineering Science:** Dr Michael O'Sullivan (michael.osullivan@auckland.ac.nz)

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**Mechanical and Mechatronics Engineering:** Dr Jonathan Stringer (j.stringer@auckland.ac.nz)

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**(ex officio) Student Centre Manager:** Jamie Protheroe (j.protheroe@auckland.ac.nz)

# Additional Amenities

## Student Collaboration Spaces

There are multiple Student Collaboration Spaces in Building 405 which can be used for group project discussions and presentations. These Collaboration Spaces can be found in the following locations: 405-321, 405-323, 405-325, 405-421, 405-423, 405-425, 405-427. These spaces can be booked by using the tablet outside the Collaboration rooms.

## Leech Study area

The Leech Study Area is a space for Engineering students to complete individual or group work. Is it located on Level 3 of Building 401.

## Smart Lockers

There are Smart lockers located across the Engineering building in the following locations: These lockers can be used during the day between the hours of 7.30am to 12:00am. Smaller lockers can be used for up to 3 hours and larger lockers can be used for the day. These lockers are for daily use only need to be cleared and released by the end of day.

Access to these lockers are granted at the same time as building access by providing the barcode on your student ID card. If you have any issues accessing the lockers, please contact the Facilities Team at [foe-facilities@auckland.ac.nz](mailto:foe-facilities@auckland.ac.nz).

The lockers can be found in the following locations: B405 Level 1 Lift Lobby, B405 Level 2 Opposite of MDLS Flexi 5-6, B401 L2 Lift Lobby at MDLS Flexi 1, B405 L3 North Corridor at MDLS Computer 5 & 6

## Printing, Copying and Scanning

For your convenience, there are multiple Follow-Me printers, installed on most levels of B405. In B405 Levels 1-3 and 5 printers can be found in the central atrium areas and on Levels 6-11 in the print resource rooms.

## Examples of practical work

|   | General Engineering   | Sub-professional Engineering   |
|---|---|--|
| <b>Biomedical Engineering</b>             | Work associated with skilled trades people or technicians such as: laboratory work, mechanical installation, equipment maintenance, data gathering or analysis, and assistance in software or website development, database design or inventory control.                  | Work associated with professional engineers, medical professionals or medical researchers, involving product or instrument design; development and testing, medical imaging technology; CAD draughting; software development; data gathering or analysis.  |
| <b>Chemical and Materials Engineering</b> | Work associated with skilled trades people, involving machining, structures, building construction, design, welding, quality control, production assembly or electronics.   | Work associated with professional engineers in your specialisation, such as operating plants or laboratories in: metal; materials; chemicals; fertilisers; paints; soaps; foods; petrochemical; pulp and paper; dairy; water treatment; environmental or pollution control.  |
| <b>Civil and Structural Engineering</b>   | Work associated with skilled trades people, involving trade skills in: construction, earthmoving; mining, water and wastewater treatment; surveying; roads; traffic and transportation; asset condition; minerals and resources; and environmental monitoring industries. | Work associated with professional engineers, including surveying; contract documentation; design and/or draughting; bore hole logging; construction and construction supervision; buildings and structures; geotechnical; earthworks; mining; roads; traffic and transportation; water/wastewater; hydrology/ hydraulics; and environmental engineering. |
| <b>Computer Systems Engineering</b>       | Work associated with skilled trades people, involving the fabrication, manufacture, installation, maintenance and configuration of mechanical, electrical and computer systems.   | Work associated with professional engineers, involving the installation, design, fabrication and testing of computer-based components; development, maintenance and support of software packages; application of computer-based systems to embedded and/or real-time problems; communication systems and the installation and configuration of networks. |

## Examples of practical work

|  | <b>General Engineering</b>  | <b>Sub-professional Engineering</b>   |
|--|---|---|
| <b>Electrical and Electronic Engineering</b> | Work associated with skilled trades people involving the use of hand tools and machine tools associated with the fabrication, manufacture and/or maintenance of electrical instruments, components or equipment.  | Work associated with professional engineers, involving the installation of lines, trunking systems, switchboards and machines; design, fabrication and testing of electrical components; electrical draughting, computing; application of wiring regulations and electrical safety. |
| <b>Engineering Science</b>                   | Work associated with skilled trades people, including laboratory work; mechanical installation or maintenance; computer or testing; data gathering or analysis; assistance in software or website development; surveying or construction site work.                         | Work associated with professional engineers, involving product design; systems/applications analysis; analysis of optimisation and simulation models; or software development.  |
| <b>Mechanical Engineering</b>                | Work associated with skilled trades people such as mechanical tradesmen and/or machine tool operators, involving the fabrication, manufacture, maintenance and repair of mechanical components or equipment.  | Work associated with professional engineers, involving design, draughting, inventory control, production planning, administrative/managerial processes and coordinating labour.   |
| <b>Mechatronics Engineering</b>              | Work associated with skilled trades people involving hand and machine tools for metal cutting/ forming; manufacturing/ assembly of mechanical components or equipment; fabrication, manufacture maintenance of electrical components and configuration of computer systems. | Work associated with professional engineers including mechanical design, draughting, inventory control, production planning, administrative/managerial processes and the design, implementation and testing of electrical, computer or software systems.                            |
| <b>Software Engineering</b>                  | Work associated with skilled trades people involving the fabrication, manufacture, installation, maintenance and configuration of mechanical, electrical and computer systems.  | Work associated with professional engineers involving the installation of software systems; design, implementation/ testing of software systems; backup and system support; network configuration; computer security and web services.  |

# Conjoint degrees

Most BE(Hons) conjoint programmes can be completed in five years. They generally consist of 420\* points' worth of courses in engineering, 255 points from the other degree courses, and 15 points from approved General Education courses. Exceptions include conjoins with the LLB and LLB (Hons) and the BAdvSci (Hons).

## Combinations currently available

- BE(Hons)/Bachelor of Arts (BA)
- BE(Hons)/Bachelor of Commerce (BCom)
- BE(Hons)/Bachelor of Design(BDes)
- BE(Hons)/Bachelor of Global Studies (BGlobalSt)
- BE(Hons)/Bachelor of Property (BProp)
- BE(Hons)/Bachelor of Law (LLB)
- BE(Hons)/Bachelor of Laws (Honours) (LLB(Hons))
- BE(Hons)/Bachelor of Music (BMus)
- BE(Hons)/Bachelor of Advanced Science (Hons) (BAdvSci(Hons))
- BE(Hons)/Bachelor of Science (BSc)
- BE(Hons)/ Bachelor of Fine Arts (BFA) - *subject to approval*

The workload for a conjoint programme is higher than for a single degree (usually 135 points per year, compared to 120 points per year for a single degree). The BE(Hons) programme alone is considered to have a high workload, so keep in mind when considering a conjoint programme that:

- There are higher entry requirements for BE(Hons) conjoint programmes: a GPA of at least 5.5 in the last year of full-time study is required if entry to the conjoint is not obtained at Part I.
- You will be dropped from the conjoint programme if you fail to maintain at least a GPA of 4.0 across your most recent academic year of study.

As per the regulations of the University of Auckland, students cannot enrol for courses that have substantially similar content. Thus, certain conjoint programmes (such as a BSc major in Computer Science, Physics, Applied Mathematics, or Statistics) must have formal prior approval from the Faculty of Engineering and may even be declined.

Please note the following restrictions when planning your BE(Hons) conjoint:

## Not Permitted

### Software Engineering:

- BSc in Computer Science
- BSc in Data Science
- BAdvSci(Hons) in Computer Science
- BCom in Information Systems
- BCom in Information Management

## Approval required\*

### Biomedical Engineering:

- BSc in Physiology or Pharmacology

### Computer Systems Engineering:

- BSc in Computer Science
- BAdvSci(Hons) in Computer Science

### Electrical and Electronic Engineering:

- BAdvSci(Hons) in Physics
- BSc in Physics
- BAdvSci(Hons) in Applied Physics

### Engineering Science:

- BSc in Mathematics
- BSc in Applied Mathematics
- BAdvSci(Hons) in Mathematics
- BSc in Physics
- BAdvSci(Hons) in Physics
- BAdvSci(Hons) in Applied Physics
- BSc in Statistics

- BAdvSci(Hons) in Statistics
- BA in Logic and Computation
- BSc in Logic and Computation

#### **Mechanical Engineering:**

- BAdvSci(Hons) in Applied Physics

#### **Mechatronics Engineering:**

- BSc in Computer Science
- BAdvSci(Hons) in Computer Science
- BSc in Physics
- BAdvSci(Hons) in Physics
- BAdvSci(Hons) in Applied Physics

#### **Software Engineering:**

- BA in Logic and Computation
- BSc in Logic and Computation

*\*Approval required from your Specialisation Advisor to plan courses taken.*

## **BE(Hons) conjoint degree regulations**

The requirements of the BE(Hons) component of a conjoint degree are the same for all combinations.

You must pass at least 420\* points' worth of courses made up of:

- 105 points at Part I: CHEMMAT 121, ELECTENG 101, ENGGEN 115, 121, 131, 140, 199, ENGSCI 111, ACADINT A01
- 210 points at Parts II and III (including ENGGEN 204) from courses listed in the schedule of your chosen BE(Hons) specialisation + ENGGEN 299
- 105 points at Part IV (including ENGGEN 403) from courses listed in the schedule of your chosen BE(Hons) specialisation + ENGGEN 499.

This is 60 points less than the full BE(Hons). This reduction in points is accounted for by:

- Not including the 15 point General Education course in the Engineering component of the conjoint degree
- Omitting a 15 points elective course at Part II or III
- Completing course (or courses) in your other component degree that covers content related

*\*for students starting a conjoint with BE(Hons) in 2019 or later*

to ENGGEN 303, so you do not do ENGGEN 303. (These courses are noted on the conjoint planners, see later in this section).

- Omitting 15 points from Part IV electives

There are specific regulations related to the other degree component of your conjoint programme. Please consult the Conjoint Degrees' Regulations in the *University of Auckland Calendar* and relevant faculty handbooks to ensure you fulfil the requirements.

## **Planning a conjoint programme**

Planning a conjoint degree can be complex. Your timetable will be a major constraint when selecting your courses. As a conjoint student you will choose your preferred Engineering specialisation at the end of Part I, along with single BE(Hons) students. This choice will guide your course selection for Parts II- IV of your BE(Hons). You are advised to select your BE(Hons) courses first and then fill your points with courses from your other degree, as the latter usually provides more timetable flexibility. Depending on the conjoint programme, you may be exempt from courses in the other component if an Engineering course covers similar content. It is recommended that you discuss your courses each year with advisers from both faculties, as well as consulting your programme requirements in Student Services Online.

The BE(Hons) degree regulations specify that Part I be completed before Part II, which must be completed before Part III, and so forth. While this may not be possible for conjoint enrolments, you should try to follow the principle as closely as possible. When selecting your Engineering courses, discuss your courses with the departmental course adviser to ensure you are covering all necessary prerequisites for your chosen specialisation. You can find the list of course advisers online here:

**[www.auckland.ac.nz/en/engineering/study-with-us/study-options/courses/academic-advisers.html](http://www.auckland.ac.nz/en/engineering/study-with-us/study-options/courses/academic-advisers.html)**

## Conjoint planners

Detailed conjoint planners specific to each BE(Hons) specialisation are available at the Engineering Student Centre and on the Faculty of Engineering website here: [www.auckland.ac.nz/en/engineering/study-with-us/study-options/courses/conjoint-degrees.html](http://www.auckland.ac.nz/en/engineering/study-with-us/study-options/courses/conjoint-degrees.html). Information on the requirements of your other degree components can be found in the University of Auckland Calendar. You are advised to visit the relevant Student Centres to ensure you are enrolling in the correct courses, or see the tables for your specialisation later in this handbook.

## Enrolment - Conjoint Students

It is advised that you prioritise enrolment in your BE(Hons) courses, as these course schedules can be inflexible and places fill quickly. Remember that you are still required to meet the requirements to be allocated to a specialisation in the following year, and should try to focus on keeping your GPA high in your Engineering courses.

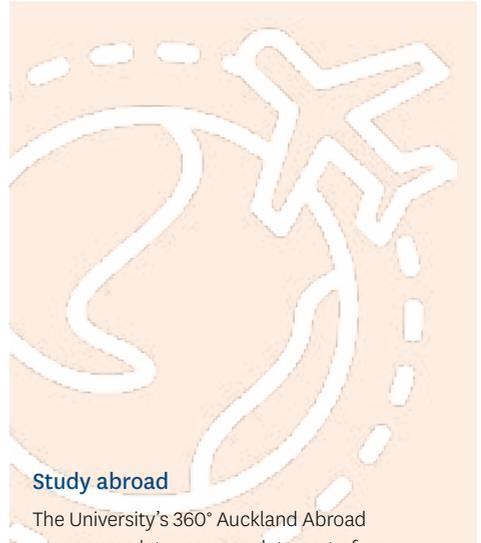
## Further opportunities for undergraduate students

### Auckland Programme for Space Systems (APSS)

The APSS is designed for students of any area of study throughout the University to collaborate in teams to contribute broadly towards the field of space research. It features an annual student-led competition leading to the construction and launch of a satellite into low orbit. For more information, visit [www.space.ac.nz](http://www.space.ac.nz)

### Dean's Leadership Programme (DLP)

This is the Faculty of Engineering's initiative for Part II and III students to develop non-academic skills relevant to an engineering career. It involves mentoring sessions, networking opportunities and internships. Former Vice Chancellor, and Faculty of Engineering alumni, Sir Colin Maiden is the patron of this programme. Interested students are encouraged to contact [foe-dlp@auckland.ac.nz](mailto:foe-dlp@auckland.ac.nz).



## Study abroad

The University's 360° Auckland Abroad programme lets you complete part of your degree overseas, with a choice of more than 100 universities in 24 countries. As a University of Auckland student,

you may be able to study at an overseas partner university of equal standing for a semester. You can enjoy the benefits of the exchange agreement – you'll pay tuition only to the University of Auckland, be eligible to apply for scholarships, and bring credits you've earned overseas to your BE(Hons).

- To be eligible to study abroad, you must have a cumulative GPA of 5.0 from your BE(Hons) study, a 5.0 term GPA in the semester prior to departure, and be approved by the faculty.
- BE(Hons) students are permitted to credit a maximum of 60 points of Engineering courses while on exchange. Exchange for BE(Hons) is permitted only in Semester Two of Part II, or either semester of Part III of the degree. Conjoint students may take courses to credit towards their other degree component or a separate period of exchange if permitted by their other degree.
- You can't study abroad during Part IV of a BE(Hons). The faculty will not sanction the omission of any points from your GPA at Part IV, as this counts highly for Honours. No Part IV

courses are to be taken abroad.

- Courses taken on exchange are ungraded, they cannot contribute to your Honours GPA, but are recorded on the Student Transcript as “credit”.
- Covid-19 may limit opportunities for exchange.
- Please note there are also Virtual opportunities.

For more information visit

[www.engineering.auckland.ac.nz/student-exchange](http://www.engineering.auckland.ac.nz/student-exchange) or [www.auckland.ac.nz/360](http://www.auckland.ac.nz/360).

## Beyond your degree

### Graduation

Once you have completed all requirements for your programme you can attend your graduation ceremony and receive your degree in person, or have your degree conferred in absentia. See [www.auckland.ac.nz/graduation](http://www.auckland.ac.nz/graduation).

### Qualification as a professional engineer

To be a fully-qualified professional engineer, you must meet two separate requirements. One of these relates to academic qualifications and the other to subsequent work experience. Satisfying the academic requirements normally means holding a degree which has been approved by Engineering New Zealand (formerly IPENZ), such as the University of Auckland BE(Hons) degree. After graduation you must demonstrate your competence as a practising engineer through work experience. This experience must be of an appropriate type and duration to enable you to apply for professional membership with Engineering NZ. Typically this membership requires a minimum of three years’ experience in the workforce including field, plant and design experience, and at least one year in a responsible position. For further information, visit [www.engineeringnz.org](http://www.engineeringnz.org).





# Biomedical Engineering

Pūhanga Koiora Rongoā

## What will I study?

In Parts II and III of the Biomedical Engineering specialisation, you will take courses that provide you with a solid foundation in:

- mathematics
- mechanics
- bioinstrumentation
- engineering design and computation

In addition to medical science courses in biology and physiology.

Part IV provides scope to specialise: you can focus on areas that interest you most, such as:

- biomedical imaging
- biotechnology
- medical devices
- computational physiology
- sports science

You will also carry out your own research project based on problems relevant to industry or research.

In the past, students have worked on a wide variety of projects including:

- orthopaedic implant design
- needle-free jet injection
- respiratory technologies
- tissue and genetic engineering
- instrument design
- sports biomechanics
- cardiac diagnostic imaging

You will have excellent facilities and outstanding expertise at your fingertips within the Faculty of Engineering, the Auckland Bioengineering Institute, the Faculty of Medical and Health Sciences, and the Faculty of Science.

## Keen to find out more?

Find out more online at

<https://www.auckland.ac.nz/en/study/study-options/find-a-study-option/biomedical-engineering.html>

## Undergraduate course advisor

Dr Vinod Suresh

[bme-undergrad-adviser@auckland.ac.nz](mailto:bme-undergrad-adviser@auckland.ac.nz)



“I’ve always been interested in biology and physics but never really chemistry. I wanted to know how the human body worked and maybe how I could help improve it, using science and engineering. Because of this, coming into university I always knew I wanted to pursue Biomedical Engineering.”

**Misha Garg**

**Biomedical Engineering student**

Courses outlined here for Parts II, III and IV of the Biomedical Engineering specialisation are being taught in 2021.

| Part II  |   | Part III   |   | Part IV   |                                   |
|--|---|--|---|---|-----------------------------------|
| 120 points   |   | 120 points   |   | 120 points  |                                   |
| Semester One   | Semester Two  | Semester One   | Semester Two                                  | Semester One  | Semester Two                      |
| BIOMENG 221<br>Mechanics of Engineered and Biological Materials                  | BIOMENG 241<br>Instrumentation and Design                   | BIOMENG 321<br>Continuum Modelling in Bioengineering | BIOMENG 341<br>Bio-instrumentation and Design | ENGSCI 700A<br>Research Project                       | ENGSCI 700B<br>Research Project   |
| BIOSCI 107<br>Biology for Biomedical Science: Cellular Processes and Development | BIOMENG 261<br>Tissue and Biomolecular Engineering          | ENGGEN 303<br>Managing Projects and Innovation       | ENGSCI 331<br>Computational Techniques 2      | BIOMENG 791<br>Advanced Biomedical Engineering Design | ENGGEN 403<br>Managing a Business |
| ENGSCI 211<br>Mathematical Modelling 2   | ENGGEN 204<br>Professional Skills and Communication         | ENGSCI 314<br>Mathematical Modelling 3ES             | MEDSCI 309<br>Biophysics of Nerve and Muscle  | Elective  | Elective                          |
| ENGSCI 233<br>Computational Techniques and Computer Systems                      | MEDSCI 142<br>Biology for Biomedical Science: Organ Systems | MEDSCI 205<br>The Physiology of Human Organ Systems  | Elective                                      | Elective  | Elective                          |
| Part III Elective Options:   |   |  | Part IV Elective Options:                     |   |                                   |
|  |   | Semester One   | Semester Two                                  | Semester One  | Semester Two                      |
|  |   | CHEM 392   | CHEM 380                                      | CHEMMAT 753   | BIOMENG 771                       |
|  |   | MECHENG 313  | COMPSYS 303                                   | ELECTENG 722  | CHEMMAT 754                       |
|  |   |  | ENGSCI 344                                    | ELECTENG 733  | CHEMMAT 757                       |
|  |   |  | ENGSCI 355                                    | ENGSCI 711  | COMPSYS 705                       |
|  |   |  | EXERSCI 303                                   | ENGSCI 740  | ENGSCI 712                        |
|  |   |  | MATHS 362                                     | ENGSCI 753  | ENGSCI 741                        |
|  |   |  | MECHENG 352                                   | MECHENG 743   | MATHS 765                         |
|  |   |  | MECHENG 371                                   | MEDSCI 703  | MEDSCI 737                        |
|  |   |  | MEDSCI 305*                                   | Or up to 30 points from an approved 700 level course  |                                   |
|  |   |  | MEDSCI 312                                    |   |                                   |
|  |   |  | MEDSCI 314                                    |   |                                   |

► **Please note:**

- Students are also required to complete ENGGEN 299 Workshop Practice in Part II and ENGGEN 499 Practical Work before and during Part IV
- \* Not offered in 2021
- All courses in table above are 15 points in value
- For further information on elective courses or for detailed information on all courses, visit <https://courses.foe.auckland.ac.nz/course>, or see the back of this handbook
- Please consult the Biomedical Engineering study tracks for a list of Part II and Part III elective suggestions: [www.des.auckland.ac.nz/uoa/bme-tracks](http://www.des.auckland.ac.nz/uoa/bme-tracks)

# Chemical and Materials Engineering

## Pūhanga Matū

### What will I study?

Many universities offer separate chemical engineering and materials engineering programmes, so the combination of both disciplines offered by the University of Auckland is aimed at providing a real-world skills advantage for our graduates..

Throughout your specialisation, you will gain a solid grounding in:

- applied chemistry
- materials characterisation
- process engineering
- energy
- mathematical modelling

You will also learn about chemical reactor engineering, food process engineering and biotechnology.

You will gain a well-rounded qualification and specialist knowledge that can be applied to a

number of key industries, both in New Zealand and abroad.

With a BE(Hons) in Chemical and Materials Engineering, you will have skills that are particularly important to industries typical to chemical engineering – e.g. food production, pharmaceuticals, cosmetics, steel, polymers, ceramics, and waste process and recovery.

### Keen to find out more?

Find out more online at

<https://www.auckland.ac.nz/en/study/study-options/find-a-study-option/chemical-materials-engineering.html>

### Undergraduate course advisor

A/Prof Woo Meng Wai

[wai.woo@auckland.ac.nz](mailto:wai.woo@auckland.ac.nz)

“Chemical and Materials Engineering at the University of Auckland is a unique degree – most other universities offer either materials science or process engineering, but not both. The combination of these two disciplines gives us a much broader knowledge of chemical engineering, which will be invaluable in industry.”

**Emily Badley**

**Chemical and Materials student**



Courses outlined here for Parts II, III and IV of the Chemical and Materials Engineering specialisation are being taught in 2021.

| Part II  |  | Part III  |   | Part IV                                     |                                   |  |
|--|--|---|---|---|-----------------------------------|--|
| 120 points   |  | 120 points  |   | 120 points                                  |                                   |  |
| Semester One                                       | Semester Two   | Semester One  | Semester Two                                | Semester One                                | Semester Two                      |  |
| CHEMMAT 201<br>Process Engineering 1: Introduction | CHEMMT 202<br>Process Engineering 2: Energy and Processing | CHEMMAT 301<br>Transfer Processes 2                 | CHEMMAT 302<br>Advanced Process Engineering | CHEMMAT 750A<br>Design Project              | CHEMMAT 750B<br>Design Project    |  |
| CHEMMAT 204<br>Materials                           | CHEMMAT 203<br>Process Engineering 3: Transfer Processess  | CHEMMAT 305<br>Materials Processing and Performance | CHEMMAT 303<br>Chemical Reactor Engineering | CHEMMAT 751A<br>Research Project            | CHEMMAT 751B<br>Research Project  |  |
| CHEMMAT 206<br>Applied Chemistry                   | CHEMMAT 205<br>Process Design 1                            | CHEMMAT 306<br>Process Design 2                     | ENGSCI 311<br>Mathematical Modelling 3      | CHEMMAT 752<br>Process Dynamics and Control | ENGGEN 403<br>Managing a Business |  |
| ENGSCI 211<br>Mathematical Modelling 2             | ENGGEN 204<br>Professional Skills and Communication        | ENGGEN 303<br>Managing Projects and Innovation      | Elective                                    | Elective                                    | Elective                          |  |
|  |  |   | Part III Elective Options:                  |   | Part IV Elective Options:         |  |
|  |  |   | Semester Two                                |   | Semester One                      |  |
|  |  |   | CHEMMAT 304                                 |   | CHEMMAT 724                       |  |
|  |  |   | CHEMMAT 754                                 |   | CHEMMAT 753                       |  |
|  |  |   | CHEMMAT 755                                 |   | CHEMMAT 756                       |  |
|  |  |   | CHEMMAT 757                                 |   | CHEMMAT 760                       |  |
|  |  |   |   |   | CHEMMAT 763                       |  |
|  |  |   |   |   | CHEMMAT 754                       |  |
|  |  |   |   |   | CHEMMAT 755                       |  |
|  |  |   |   |   | CHEMMAT 757                       |  |
|  |  |   |   |   | CHEMMAT 758                       |  |
|  |  |   |   |   | CHEMMAT 759                       |  |
|  |  |   |   |   | ENGGEN 701                        |  |
|  |  |   |   |   | ENGGEN 705                        |  |

► **Please note:**

- Students are also required to complete ENGGEN 299 Workshop Practice in Part II and ENGGEN 499 Practical Work before and during Part IV
- All courses in table above are 15 points in value
- For further information on elective courses or for detailed information on all courses, visit <https://courses.foe.auckland.ac.nz/course>, or see the back of this handbook.



# Civil Engineering

Pūhanga Metaraahi

## What will I study?

In Part II of the Civil Engineering specialisation, you will learn the fundamentals of:

- environmental principles
- fluid mechanics
- geotechnical engineering
- material science
- civil engineering design
- construction management

In Parts III and IV, you will be able to tailor your electives to focus on either civil or environmental engineering, or maintain a broad coverage of both if preferred.

Regardless of your focus, you will learn how to apply technical maths and science knowledge to the designs of major construction projects, while practising skills in teamwork, management, creativity and communication.

## Keen to find out more?

Find out more online at

<https://www.auckland.ac.nz/en/study/study-options/find-a-study-option/civil-engineering.html>

## Undergraduate course advisors

Direct Entry: Dr Tam Larkin

[t.larkin@auckland.ac.nz](mailto:t.larkin@auckland.ac.nz)

Part II: Dr Febelyn Reguyal

[f.reguyal@auckland.ac.nz](mailto:f.reguyal@auckland.ac.nz)

Parts II/III and III: Dr Lucas Hogan

[lucas.hogan@auckland.ac.nz](mailto:lucas.hogan@auckland.ac.nz)

Parts III/IV and IV: Dr Gary Raftery

[g.raftery@auckland.ac.nz](mailto:g.raftery@auckland.ac.nz)

Conjoints: Dr Quincy Ma

[q.ma@auckland.ac.nz](mailto:q.ma@auckland.ac.nz)

Exchange: Dr Minh Kieu

[minh.kieu@auckland.ac.nz](mailto:minh.kieu@auckland.ac.nz)

“The most valuable thing I’m getting out of my studies is a broader knowledge of how the world works; in the first year you get a taste of nine engineering disciplines, so you get an appreciation for how everything works. Another highlight is being independent and learning about things I enjoy, plus meeting a range of people – it’s such a diverse community here.”

**Joel Kavenga**

**Civil Engineering student**



Only courses outlined here for Parts II will be occurring in 2021 (Part III in 2022, Part IV in 2023). Students enrolled in the BE(Hons) prior to 2020 will complete their degree under the 2019 Calendar Regulations. See Appendix for more details.

| Part II  |   | Part III  |   | Part IV                                       |                                   |
|--|---|---|---|---|-----------------------------------|
| 120 points   |   | 120 points  |   | 120 points                                    |                                   |
| Semester One                                       | Semester Two  | Semester One  | Semester Two                                    | Semester One                                  | Semester Two                      |
| CIVIL 202<br>Fluid Mechanics and Pipe Flow         | CIVIL 200<br>Intro to Geotechnical Engineering          | CIVIL 300<br>Geotechnical Engineering                   | CIVIL 302<br>Hydrology and Open Channel Flow    | CIVIL 705A<br>Research Project                | CIVIL 705B<br>Research Project    |
| CIVIL 203<br>Transport Design and Geomatics Design | ENGGEN 204<br>Professional Skills and Communication     | ENGGEN 303<br>Managing Projects and Innovation          | CIVIL 303<br>Transport Operations and Pavements | CIVIL 791<br>Construction Management          | CIVIL 756<br>Capstone Project     |
| ENGSCI 211<br>Mathematical Modelling 2             | ENVENG 200<br>Fundamentals of Environmental Engineering | ENVENG 300<br>Natural and Built Environmental Processes | ENGSCI 311<br>Mathematical Modelling 3          | CIVIL 790<br>Civil Engineering Administration | ENGGEN 403<br>Managing a Business |
| STRCTENG 200<br>Introductory Structural Mechanics  | STRCTENG 201<br>Civil Engineering Materials and Design  | STRCTENG 304<br>Structural Design for Civil Engineers   | Elective  | Elective                                      | Elective                          |

Part III Elective Options:

| Semester Two |
|--------------|
| CIVIL 301    |
| CIVIL 304    |
| CIVIL 305    |

Or other approved stage III courses

Part IV Elective Options:

| Semester One |
|--------------|
| CIVIL 700    |
| CIVIL 722    |
| CIVIL 726    |
| CIVIL 729    |
| CIVIL 731    |
| CIVIL 733    |
| CIVIL 735    |
| CIVIL 736    |
| CIVIL 741    |
| CIVIL 750    |
| CIVIL 782    |
| ENVENG 701   |
| ENVENG 740   |
| ENVENG 747   |

Or an approved 700 level course

► **Please note:**

- Students are also required to complete ENGGEN 299 Workshop Practice in Part II and ENGGEN 499 Practical Work before and during Part IV
- All courses in table above are 15 points in value
- For further information on elective courses or for detailed information on all courses, visit <https://courses.foe.auckland.ac.nz/course>, or see the back of this handbook.



# Computer Systems Engineering

Pūnaha Rorohiko

## What will I study?

As it's not possible to provide a lasting professional education based on the technology alone, a BE(Hons) in Computer Systems Engineering provides a well-rounded foundation that will equip you for this dynamic and rapidly changing field.

You will study a combination of fundamental knowledge in computer systems, practical skills in hardware and software design and general problem solving skills required for designing and building systems.

You will undertake stimulating project work and be exposed to a variety of existing and innovative electronic, hardware and software technologies.

You will learn about:

- embedded systems
- computational intelligence
- computer architecture
- distributed computing
- information engineering

- intelligent robotics
- industrial decision support systems
- home automation
- automobiles
- instrumentation

All of this is supplemented with a solid grounding in electrical and electronic engineering.

## Keen to find out more?

Find out more online at

<https://www.auckland.ac.nz/en/study/study-options/find-a-study-option/computer-systems-engineering.html>

## Undergraduate course advisor

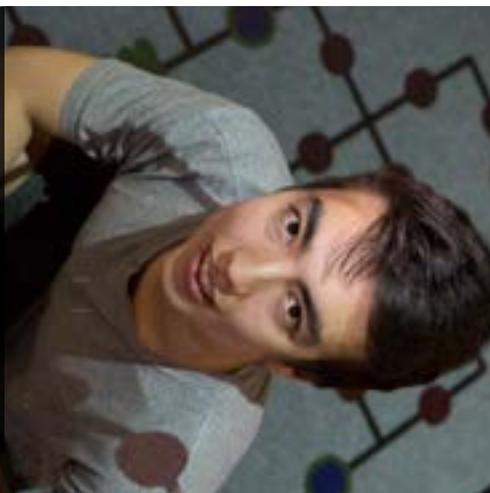
Dr Kevin Wang

[kevin.wang@auckland.ac.nz](mailto:kevin.wang@auckland.ac.nz)

“Computer Systems Engineering is an intersection between Electrical and Software Engineering, so we cover a wide range of topics. I feel this helped me quickly learn new and unfamiliar skills, and to define the specific areas I'd like to work in when I finish University. “

**Forest Fraser**

**Computer Systems student**



Only courses outlined here for Parts II will be occurring in 2021 (Part III in 2022, Part IV in 2023). Students enrolled in the BE(Hons) prior to 2020 will complete their degree under the 2019 Calendar Regulations. See Appendix for more details.

| Part II  |  | Part III                                       |  | Part IV   |   |
|--|--|--|--|---|---|
| 120 points   |  | 120 points                                     |  | 120 points  |   |
| Semester One   | Semester Two   | Semester One                                   | Semester Two   | Semester One  | Semester Two  |
| COMPSYS 201<br>Fundamentals of Computer Engineering    | COMPSYS 209<br>Computer Systems Design                     | COMPSYS 305<br>Digital Systems Design          | COMPSYS 301<br>Design: Hardware Software Systems   | COMPSYS 700A<br>Research Project  | COMPSYS 700B<br>Research Project                            |
| ELECTENG 291<br>Fundamentals of Electrical Engineering | ELECTENG 292<br>Electronics                                | ENGGEN 303<br>Managing Projects and Innovation | Elective A   | COMPSYS 770<br>Capstone Project   | ENGGEN 403<br>Managing a Business                           |
| ENGSCI 211<br>Mathematical Modelling 2                 | ENGGEN 204<br>Professional Skills and Communication        | ENGSCI 313<br>Mathematical Modelling 3ECE      | Elective A   | Elective A  | Elective A  |
| SOFTENG 281<br>Object-Oriented Programming             | Elective   | Elective B                                     | Elective A or B  | Elective A or B   | Elective A or B   |
| Part II Elective Options:                              |  | Part III Elective A Options:                   |  | Part IV Elective A Options:   |   |
|  | Semester Two<br>ELECTENG 204<br>SOFTENG 283<br>SOFTENG 284 |  | Semester Two<br>COMPSYS 303<br>COMPSYS 304<br>COMPSYS 306                                  | Semester One<br>COMPSYS 701<br>COMPSYS 723<br>COMPSYS 726   | Semester Two<br>COMPSYS 704<br>COMPSYS 705<br>COMPSYS 725   |
|  |  | Part III Elective B Options:                   |  | Part IV Elective B Options:   |   |
|  |  | Semester One<br>COMPSYS 302<br>SOFTENG 350     | Semester Two<br>ELECTENG 305<br>ELECTENG 331<br>ELECTENG 332<br>SOFTENG 325<br>SOFTENG 364 | Semester One<br>ELECTENG 722<br>ELECTENG 732*<br>ELECTENG 733<br>ELECTENG 734<br>SOFTENG 701<br>SOFTENG 751 | Semester Two<br>ELECTENG 704<br>ELECTENG 726<br>SOFTENG 761 |
|  |  | Or other approved 700 level course             |  |   |   |

► **Please note:**

- Students are also required to complete ENGGEN 299 Workshop Practice in Part II and ENGGEN 499 Practical Work before and during Part IV
- \* Not offered in 2021
- All courses in table above are 15 points in value
- For further information on elective courses or for detailed information on all courses, visit <https://courses.foe.auckland.ac.nz/course>, or see the back of this handbook



# Engineering Science

Pūtaiao Pūhanga

## What will I study?

In addition to core courses in mathematics, design, mechanics and computational techniques, you will be able to choose elective courses in areas that interest you most. You might align with one of the themes of Engineering Science: Operations Research involves mathematically describing and optimising real-world scenarios in order to design the best solutions to practical problems, such as optimising the positioning of ambulances around a city.

Computational Mechanics uses mathematics, physics and computers to examine the response of materials and components - for instance, how a car is damaged when it crashes, or how a bubble rises. Other study areas include:

- environmental modelling
- biomedical engineering
- data analytics
- financial mathematics

The diverse range of options available throughout

your degree will directly contribute to your own professional versatility.

## Keen to find out more?

Find out more online at  
<https://www.auckland.ac.nz/en/study/study-options/find-a-study-option/engineering-science.html>

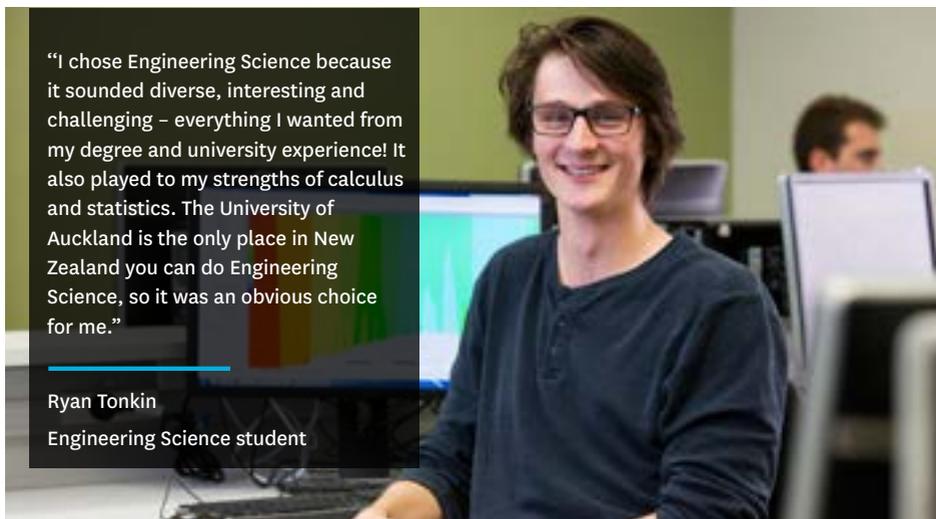
## Undergraduate course advisor

Dr Tony Downward  
[engsci-undergradadviser@auckland.ac.nz](mailto:engsci-undergradadviser@auckland.ac.nz)

Conjoint/Exchange: A/Prof. Cameron Walker  
[cameron.walker@auckland.ac.nz](mailto:cameron.walker@auckland.ac.nz)

“I chose Engineering Science because it sounded diverse, interesting and challenging – everything I wanted from my degree and university experience! It also played to my strengths of calculus and statistics. The University of Auckland is the only place in New Zealand you can do Engineering Science, so it was an obvious choice for me.”

Ryan Tonkin  
Engineering Science student



Courses outlined here for Parts II, III and IV of the Engineering Science specialisation are being taught in 2021.

| Part II   |  | Part III  |  | Part IV   |  |
|---|--|---|--|---|--|
| 120 points  |  | 120 points  |  | 120 points  |  |
| Semester One  | Semester Two   | Semester One  | Semester Two   | Semester One  | Semester Two   |
| BIOMENG 221<br>Mechanics of Engineered and Biological Materials | ENGGEN 204<br>Professional Skills and Communication                    | ENGGEN 303<br>Managing Projects and Innovation1                     | ENGSCI 331<br>Computational Techniques 2                               | ENGSCI 700 A<br>Research Project  | ENGSCI 700 B<br>Research Project   |
| ENGSCI 211<br>Mathematical Modelling 2                          | ENGSCI 263<br>Engineering Science Design 1                             | ENGSCI 314<br>Mathematical Modelling 3ES                            | ENGSCI 363<br>Engineering Science Design II                            | Elective  | ENGGEN 403<br>Managing a Business  |
| ENGSCI 233<br>Computational Techniques and Computer Systems     | Elective   | ENGSCI 343<br>Mathematical and Computational Modelling in Mechanics | Elective   | Elective  | Elective   |
| ENGSCI 255<br>Modelling and Analytics in Operations Research    | Elective   | ENGSCI 391<br>Optimisation in Operations Research                   | Elective   | Elective  | Elective   |
| Part II Elective Options:                                       |  | Part III Elective Options:  |  | Part IV Elective Options:   |  |
| Semester One<br>COMPSCI 225<br>STATS 210<br>SOFTENG 281         | Semester Two<br>BIOMENG 241<br>COMPSCI 225<br>MECHENG 211<br>STATS 210 |   | Semester Two<br>BIOMENG 341<br>ENGSCI 309*<br>ENGSCI 344<br>ENGSCI 355 | Semester One<br>ENGSCI 711<br>ENGSCI 740<br>ENGSCI 753<br>ENGSCI 760<br>ENGSCI 761*<br>ENGSCI 762 | Semester Two<br>BIOMENG 771<br>ENGSCI 712<br>ENGSCI 721<br>ENGSCI 741<br>ENGSCI 755*<br>ENGSCI 763<br>ENGSCI 768 |
| Or other approved course above stage I                          |  | Or other approved course above stage II                             |  | Or other approved 700 level course  |  |

► **Please note:**

- Students are also required to complete ENGGEN 299 Workshop Practice in Part II and ENGGEN 499 Practical Work before and during Part IV
- \* Not offered in 2021
- All courses in table above are 15 points in value
- Please consult the Engineering Science study tracks for a list of Part II and Part III elective suggestions: <https://www.auckland.ac.nz/en/engineering/about-the-faculty/engineering-science/study-options/engineering-science-study-tracks.html>
- For further information on elective courses or for detailed information on all courses, visit <https://courses.foe.auckland.ac.nz/course>, or see the back of this handbook”



# Electrical and Electronic Engineering

Pūhanga Hiko me te Tāhiko

## What will I study?

The pace of change in electrical and electronic engineering is so rapid it's neither possible nor desirable to cover all aspects of current technology within a four-year degree programme, even in a focused field of specialisation. With our programme you will get a solid foundation of basic science, electrical engineering fundamentals, engineering project management and selected fields of emerging electrical/electronic technologies and platforms. You can later build upon this as you progress in your career as a professional engineer.

In Part II, you'll learn about:

- electrical materials and electronic devices
- circuit theory
- software design and mathematical modelling tools

We provide an introduction to engineering electromagnetics and computer systems.

The programme is broadened by examining how engineers communicate material of a complex and

technical nature.

These strands of knowledge are further developed in core courses of Part III. Elective courses of your choice throughout Parts III and IV allow you to further specialise in specific areas that interest you.

## Keen to find out more?

Find out more online at

<https://www.auckland.ac.nz/en/study/study-options/find-a-study-option/electrical-electronic-engineering.html>

## Undergraduate course advisor

Dr Mark Andrews

[m.andrews@auckland.ac.nz](mailto:m.andrews@auckland.ac.nz)



“One of the things that stands out to me in my studies is the different ways of thinking to solve engineering problems. We don't just consider economic impacts but also environmental, social and cultural aspects. The lecturers and teaching assistants here are outstanding. They genuinely care and want students to succeed. They really go out of their way to help us develop as engineers.”

**Murali Krishna Magesan**

**Electrical and Electronic student**

Only courses outlined here for Parts II will be occurring in 2021 (Part III in 2022, Part IV in 2023). Students enrolled in the BE(Hons) prior to 2020 will complete their degree under the 2019 Calendar Regulations. See Appendix for more details.

| Part II  |   | Part III   |   | Part IV   |  |
|--|---|--|---|---|--|
| 120 points   |   | 120 points   |   | 120 points  |  |
| Semester One   | Semester Two  | Semester One   | Semester Two  | Semester One  | Semester Two   |
| COMPSYS 201<br>Fundamentals of Computer Engineering        | ELECTENG 204<br>Engineering Electro-magnetics       | ELECTENG 310<br>Electrical Engineering Design 1                              | ELECTENG 311<br>Electrical Engineering Design 2   | ELECTENG 700A<br>Research Project   | ELECTENG 700B<br>Research Project  |
| ELECTENG 291<br>Fundamentals of Electrical Engineering     | ELECTENG 209<br>Analogue and Digital Design         | ENGGEN 303<br>Managing Projects and Innovation                               | Elective A  | ELECTENG 770<br>Capstone Project  | ENGGEN 403<br>Managing a Business  |
| ENGSCI 211<br>Mathematical Modelling 2                     | ENGGEN 204<br>Professional Skills and Communication | ENGSCI 313<br>Mathematical Modelling 3ECE                                    | Elective A  | Elective  | Elective   |
| SOFTENG 281<br>Object-Oriented Programming                 | Elective  | Elective B   | Elective A or B   | Elective  | Elective   |
| Part II Elective Options:                                  |   | Part III Elective A Options:   |   | Part IV Elective A Options:   |  |
| Semester Two<br>ELECTENG 292<br>SOFTENG 283<br>SOFTENG 284 |   | Semester Two<br>ELECTENG 305<br>ELECTENG 309<br>ELECTENG 331<br>ELECTENG 332 |   | Semester One<br>COMPSYS 723<br>COMPSYS 726<br>ELECTENG 721<br>ELECTENG 722<br>ELECTENG 731<br>ELECTENG 732* | Semester Two<br>COMPSYS 705<br>COMPSYS 725<br>ELECTENG 701*<br>ELECTENG 703<br>ELECTENG 704<br>ELECTENG 726<br>ELECTENG 735*<br>ELECTENG 736<br>ELECTENG 738 |
|  |   | Part III Elective B Options:   |   | Or other approved 700 level course  |  |
|  |   | Semester One<br>COMPSYS 302<br>COMPSYS 305<br>ELECTENG 307<br>SOFTENG 350    | Semester Two<br>COMPSYS 303<br>COMPSYS 304<br>COMPSYS 306<br>SOFTENG 325<br>SOFTENG 364 |   |  |
|  |   | Or other approved course above stage II                                      |   |   |  |

► **Please note:**

- Students are also required to complete ENGGEN 299 Workshop Practice in Part II and ENGGEN 499 Practical Work before and during Part IV
- \* Not offered in 2021
- All courses in table above are 15 points in value
- For further information on elective courses or for detailed information on all courses, visit <https://courses.foe.auckland.ac.nz/course>, or see the back of this handbook



# Mechanical Engineering

Pūhanga Pūrere

## What will I study?

As a Mechanical Engineering student, you will learn the fundamentals of:

- dynamics
- fluid mechanics and thermodynamics
- industrial engineering
- control systems
- solid mechanics and materials

You will then apply this theory to practical problems, while practising essential aspects of professional engineering including design, communication and project management.

In Part IV, you will be able to choose elective courses to specialise in a field that interests you. Throughout our specialisation we emphasise design and project work, so that you are able to practice applying your knowledge to the development of new products.

## Keen to find out more?

Find out more online at

<https://www.auckland.ac.nz/en/study/study-options/find-a-study-option/mechanical-engineering.html>

## Undergraduate course advisors

Dr Jaspreet Dhupia

[j.dhupia@auckland.ac.nz](mailto:j.dhupia@auckland.ac.nz)

Conjoints: Stuart Norris

[s.norris@auckland.ac.nz](mailto:s.norris@auckland.ac.nz)

Exchange: Dr Vladislav Sorokin

[v.sorokin@auckland.ac.nz](mailto:v.sorokin@auckland.ac.nz)

“I love learning about the world we live in and how things work. It’s the simplest way to say what I enjoy about studying Mechanical Engineering – discovering how to get from the start of something with some manufactured parts to a system that works together to complete a function. Engineering offers many possibilities, and doing a conjoint degree opens up even more options for me.”

**Claire Wang**  
Mechanical student



Courses outlined here for Parts II, III and IV of the Mechanical Engineering specialisation are being taught in 2021.

| Part II                                 |   | Part III                                       |  | Part IV   |  |
|---|---|--|--|---|--|
| 120 points                              |   | 120 points                                     |  | 120 points  |  |
| Semester One                            | Semester Two  | Semester One                                   | Semester Two                                     | Semester One  | Semester Two   |
| ENGSCI 211<br>Mathematical Modelling 2  | ENGGEN 204<br>Professional Skills and Communication | ENGGEN 303<br>Managing Projects and Innovation | ENGSCI 311<br>Mathematical Modelling 3           | MECHENG 700A<br>Research Project  | MECHENG 700B<br>Research Project   |
| MECHENG 235<br>Design and Manufacture 1 | MECHENG 211<br>Thermofluids                         | MECHENG 322<br>Control Systems                 | MECHENG 311<br>Thermal Engineering               | MECHENG 731<br>Engineering Design 4M  | ENGGEN 403<br>Managing a Business  |
| MECHENG 242<br>Mechanics of Materials 1 | MECHENG 222<br>Dynamics                             | MECHENG 334<br>Engineering Design 3M           | MECHENG 325<br>Dynamics of Fluids and Structures | Elective  | Elective   |
| Elective                                | MECHENG 236<br>Design and Manufacture 2             | MECHENG 340<br>Mechanics of Materials 2        | MECHENG 352<br>Manufacturing Systems             | Elective  | Elective   |
| Part II Elective Options:               |   |  |  | Part IV Elective Options:   |  |
| Semester One<br>MECHENG 201             |   |  |  | Semester One<br>MECHENG 712<br>MECHENG 713<br>MECHENG 722<br>MECHENG 743<br>MECHENG 752 | Semester Two<br>ENGGEN 705<br>MECHENG 715<br>MECHENG 724<br>MECHENG 726<br>MECHENG 747 |
| Or other approved 700 level course      |   |  |  |   |  |

► **Please note:**

- Students are also required to complete ENGGEN 299 Workshop Practice in Part II and ENGGEN 499 Practical Work before and during Part IV
- All courses in table above are 15 points in value
- For further information on elective courses or for detailed information on all courses, visit <https://courses.foe.auckland.ac.nz/course>, or see the back of this handbook.



# Mechatronics Engineering

Pūhanga Pūrere Tāhiko

## What will I study?

In Part II, Mechatronics students are provided with a strong foundation in core mechanical engineering subjects. This is supplemented with an emphasis on software design and electronics courses.

During Part III, the balance between mechanical, electrical and computer engineering courses is almost equal.

You will study topics including:

- software design
- sensors and actuators
- signal processing
- analogue and digital circuit design
- systems modelling
- digital control
- industrial automation

These will guide you towards various projects in Part IV that require comprehensive knowledge across the disciplines.

A particular feature of the degree programme is

the strong emphasis placed on design and project work, in which students apply their knowledge to the development of new products, and learn to develop skills in teamwork and communication.

## Keen to find out more?

Find out more online at

<https://www.auckland.ac.nz/en/study/study-options/find-a-study-option/mechatronics-engineering.html>

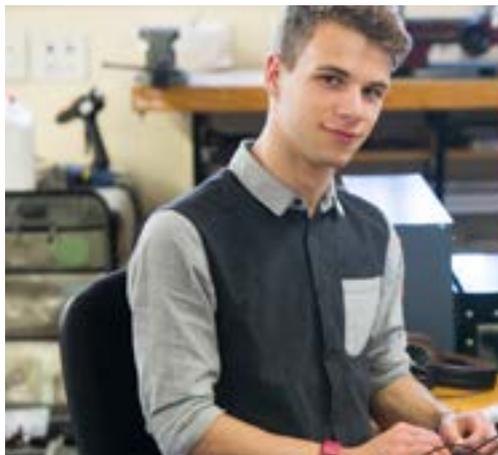
## Undergraduate course advisors

Dr Yusuke Hioka

[y.hioka@auckland.ac.nz](mailto:y.hioka@auckland.ac.nz)

Exchange: Dr Vladislav Sorokin

[v.sorokin@auckland.ac.nz](mailto:v.sorokin@auckland.ac.nz)



“Getting into a specialisation is competitive, but the great thing is that engineers are all very supportive of each other. People are very interested in working together rather than working against each other. In terms of lecturers, the passion in what people do is definitely present and that’s what I really enjoy about the faculty.”

**Tomas Haver**

**Mechatronics student**

Courses outlined here for Parts II, III and IV of the Mechatronics Engineering specialisation are being taught in 2021.

| Part II                                 |   | Part III   |  | Part IV  |  |
|---|---|--|--|--|--|
| 120 points                              |   | 120 points                                       |  | 120 points   |  |
| Semester One                            | Semester Two  | Semester One                                     | Semester Two                                     | Semester One   | Semester Two   |
| ENGSCI 211<br>Mathematical Modelling 2  | ENGGEN 204<br>Professional Skills and Communication | ENGGEN 303<br>Managing Projects and Innovation   | ENGSCI 311<br>Mathematical Modelling 3           | MECHENG 700A<br>Research Project   | MECHENG 700B<br>Research Project   |
| MECHENG 235<br>Design and Manufacture 1 | MECHENG 211<br>Thermofluids                         | MECHENG 313<br>Design of Real-Time Software      | MECHENG 312<br>Sensor and Actuators              | MECHENG 705<br>Mechatronics Systems  | ENGGEN 403<br>Managing a Business  |
| MECHENG 242<br>Mechanics of Materials 1 | MECHENG 222<br>Dynamics                             | MECHENG 322<br>Control Systems                   | MECHENG 325<br>Dynamics of Fluids and Structures | MECHENG 706<br>Mechatronics Design   | Elective   |
| Elective                                | MECHENG 270<br>Software Design                      | MECHENG 370<br>Electronics and Signal Processing | MECHENG 371<br>Digital Circuit Design            | Elective   | Elective   |
| Part II Elective Options:               |   |  | Part IV Elective Options:                        |  |  |
| Semester One<br>MECHENG 201             |   |  |  | Semester One<br>COMPSYS 726<br>MECHENG 709<br>MECHENG 712<br>MECHENG 722<br>MECHENG 743<br>MECHENG 752 | Semester Two<br>ENGGEN 705<br>MECHENG 715<br>MECHENG 724<br>MECHENG 726<br>MECHENG 735<br>MECHENG 736<br>MECHENG 747 |
| Or other approved 700 level course      |   |  |  |  |  |

► **Please note:**

- Students are also required to complete ENGGEN 299 Workshop Practice in Part II and ENGGEN 499 Practical Work before and during Part IV
- All courses in table above are 15 points in value
- For further information on elective courses or for detailed information on all courses, visit <https://courses.foe.auckland.ac.nz/course>, or see the back of this handbook



# Software Engineering

Pūhanga Pūmanawa

## What will I study?

The Software Engineering specialisation produces graduates capable of engineering creative, usable, complex, and secure systems that function reliably and can be effectively developed and maintained.

You will build on the general engineering literacy you acquired in Part I by developing specialist software knowledge. You will learn fundamentals of:

- software design and development
- programming languages
- software development processes
- computer organisation and architecture
- operating systems
- data communications
- algorithm design and analysis
- mathematics
- project management
- customer collaboration
- professional ethics

Our degree is co-taught by the Department of Electrical, Computer and Software Engineering and by the School of Computer Science. This means you will receive a strong engineering perspective in addition to skills and knowledge relating to modern computing applications, technology, and systems.

By the end of Part IV, you'll not only have superior software development training, but also an ability to understand and work through the entire lifecycle of software development and maintenance.

## Keen to find out more?

Find out more online at

<https://www.auckland.ac.nz/en/study/study-options/find-a-study-option/software-engineering.html>

## Undergraduate course advisor

Dr Nasser Giacaman

[n.giacaman@auckland.ac.nz](mailto:n.giacaman@auckland.ac.nz)

## Choosing Part II Electives:

Students must carefully choose their electives in Part II as this could allow completion of the requirements of two specialisations (Computer Systems and Software Engineering), thus allowing the potential to change specialisations at the end of Part II.

“I picked the University of Auckland because of its excellent reputation for engineering and computer science. I'd like to get into user interface or games. I enjoy looking at how easy things are to use – being able to work with people to make things accessible and intuitive is really interesting.”

Hannah Sampson

Software Engineering student



Only courses outlined here for Parts II will be occurring in 2021 (Part III in 2022, Part IV in 2023). Students enrolled in the BE(Hons) prior to 2020 will complete their degree under the 2019 Calendar Regulations. See Appendix for more details.

| Part II   |   | Part III  |  | Part IV  |  |
|---|---|---|--|--|--|
| 120 points  |   | 120 points  |  | 120 points   |  |
| Semester One  | Semester Two  | Semester One  | Semester Two   | Semester One   | Semester Two   |
| COMPSYS 201<br>Fundamentals of Computer Engineering | ENGGEN 204<br>Professional Skills and Communication         | ENGGEN 303<br>Managing Projects and Innovation            | SOFTENG 306<br>Software Engineering Design 2   | SOFTENG 700A<br>Research Project   | SOFTENG 700B<br>Research Project   |
| ENGSCI 211<br>Mathematical Modelling 2              | SOFTENG 206<br>Software Engineering Design 1                | SOFTENG 350<br>Human Computer Interaction                 | SOFTENG 325<br>Software Architecture   | ELECTENG 770<br>Captstone Project  | ENGGEN 403<br>Managing a Business  |
| SOFTENG 281<br>Object-Oriented Programming          | SOFTENG 283<br>Software Quality Assurance                   | Elective A  | Elective A   | Elective   | Elective   |
| Elective  | Elective  | Elective A or B   | Elective A or B  | Elective   | Elective   |
| Part II Elective Options:                           |   | Part III Elective A Options:                              |  | Part IV Elective A Options:  |  |
| Semester One<br>ELECTENG 291<br>SOFTENG 282         | Semester Two<br>ELECTENG 204<br>ELECTENG 292<br>SOFTENG 284 | Semester One<br>SOFTENG 310<br>SOFTENG 351<br>SOFTENG 370 | Semester Two<br>SOFTENG 364  | Semester One<br>COMPSYS 723<br>COMPSYS 726<br>ELECTENG 733<br>ENGSCI 760<br>SOFTENG 701<br>SOFTENG 750<br>SOFTENG 751<br>SOFTENG 754 | Semester Two<br>COMPSYS 705<br>SOFTENG 702<br>SOFTENG 752<br>SOFTENG 753<br>SOFTENG 761<br>SOFTENG 762 |
|   |   | Part III Elective B Options:                              |  | Or other approved 700 level course   |  |
|   |   | Semester One<br>COMPSCI 373<br>COMPSYS 305<br>ENGSCI 313  | Semester Two<br>COMPSCI 367<br>COMPSYS 303<br>COMPSYS 304<br>COMPSYS 306<br>ELECTENG 305<br>ELECTENG 331<br>ELECTENG 332 |  |  |
|   |   | Or other approved course above stage II                   |  |  |  |

► **Please note:**

- Students are also required to complete ENGGEN 299 Workshop Practice in Part II and ENGGEN 499 Practical Work before and during Part IV
- All courses in table above are 15 points in value
- For further information on elective courses or for detailed information on all courses, visit <https://courses.foe.auckland.ac.nz/course>, or see the back of this handbook



# Structural Engineering

Pūhanga Rangaranga

## What will I study?

Our newest specialisation responds to the increasing demand for professionals who can tackle the complex structural and geotechnical nuances within the broader civil engineering profession.

You'll be learning from exceptional academics about various aspects of seismic setting, such as:

- mechanical properties and design consideration of common construction material
- design philosophy and verification methods for everyday loading and rare extreme events such as wind storm and earthquakes
- influence of ground condition to structural design
- design and analysis of low-rise and multistorey buildings
- structural response due to dynamic loading

## Keen to find out more?

Find out more online at

<https://www.auckland.ac.nz/en/study/study-options/find-a-study-option/structural-engineering.html>

## Undergraduate course advisors

Dr Quincy Ma

[q.ma@auckland.ac.nz](mailto:q.ma@auckland.ac.nz)

Dr Lucas Hogan

[lucas.hogan@auckland.ac.nz](mailto:lucas.hogan@auckland.ac.nz)

**New  
specialisation  
introduced  
from 2021**



Only courses outlined here for Parts II will be occurring in 2021 (Part III in 2022, Part IV in 2023).

| Part II   |   | Part III  |  | Part IV                                       |                                   |
|---|---|---|--|---|-----------------------------------|
| 120 points  |   | 120 points  |  | 120 points                                    |                                   |
| Semester One                                      | Semester Two  | Semester One  | Semester Two                               | Semester One                                  | Semester Two                      |
| CIVIL 202<br>Fluid Mechanics and Pipe Flow        | CIVIL 200<br>Intro to Geotechnical Engineering          | CIVIL 300<br>Geotechnical Engineering                           | ENGSCI 311<br>Mathematical Modelling 3     | CIVIL 705A<br>Research Project                | CIVIL 705B<br>Research Project    |
| CIVIL 203<br>Transport Design and Geomatics       | ENGGEN 204<br>Professional Skills and Communication     | ENGGEN 303<br>Managing Projects and Innovation                  | STRCTENG 302<br>Steel Structures Design    | STRCTENG 710<br>Low Rise Structures Design    | CIVIL 756<br>Capstone Project     |
| ENGSCI 211<br>Mathematical Modelling 2            | ENVENG 200<br>Fundamentals of Environmental Engineering | STRCTENG 300<br>Design Loads and Dynamic Response of Structures | STRCTENG 303<br>Concrete Structures Design | STRCTENG 711<br>Multistorey Structures Design | ENGGEN 403<br>Managing a Business |
| STRCTENG 200<br>Introductory Structural Mechanics | STRCTENG 201<br>Civil Engineering Materials and Design  | STRCTENG 301<br>Timber Structures Design                        | Elective                                   | CIVIL 790<br>Civil Engineering Administration | Elective                          |
| Part III Elective Options:                        |   |   | Part IV Elective Options:                  |   |                                   |
|   |   |   | Semester Two                               | Semester One                                  |                                   |
|   |   |   | CIVIL 301                                  | CIVIL 700                                     |                                   |
|   |   |   | CIVIL 302                                  | CIVIL 722                                     |                                   |
|   |   |   | CIVIL 303                                  | CIVIL 726                                     |                                   |
|   |   |   | CIVIL 305                                  | CIVIL 729                                     |                                   |
|   |   |   |  | CIVIL 731                                     |                                   |
|   |   |   |  | CIVIL 733                                     |                                   |
|   |   |   |  | CIVIL 735                                     |                                   |
|   |   |   |  | CIVIL 736                                     |                                   |
|   |   |   |  | CIVIL 741                                     |                                   |
|   |   |   |  | CIVIL 750                                     |                                   |
|   |   |   |  | CIVIL 782                                     |                                   |
|   |   |   |  | ENVENG 701                                    |                                   |
|   |   |   |  | ENVENG 740                                    |                                   |
|   |   |   |  | ENVENG 747                                    |                                   |
|   |   |   |  | Or other approved 700 level course            |                                   |
|   |   |   | Or other approved stage III courses        |   |                                   |

► **Please note:**

- Students are also required to complete ENGGEN 299 Workshop Practice in Part II and ENGGEN 499 Practical Work before and during Part IV
- All courses in table above are 15 points in value
- For further information on elective courses or for detailed information on all courses, visit <https://courses.foe.auckland.ac.nz/course>, or see the back of this handbook.

# Course descriptions

## Biomedical Engineering

### Part II

#### BIOMENG 221 (15 Points)

##### Mechanics of Engineered and Biological Materials

Introduction to the laws of conservation of mass, linear momentum, angular momentum and energy and their application to engineering problems. Topics include control volume analysis, fluid statics, Bernoulli's equation, heat conduction, diffusion, linear elasticity, stresses and strains specific to direct and torsional loading, material constitutive relationships (including anisotropy, nonlinearity, and viscoelasticity), axial and transverse loading, and pressure loading of engineering structures and biomaterials.

*Prerequisite: ENGGEN 150, or ENGSCI 111, or B+ or higher in MATHS 108 or 110 or 150 or 153, or B+ or higher in MATHS 120 and 130.*

#### BIOMENG 241 (15 Points)

##### Instrumentation and Design

An introduction to engineering instrumentation related to the measurement of biological signals. Topics include: Fundamentals of measurement systems (electric circuits, basic electronics, frequency domain signal analysis and transient analysis, measurement systems). This course will cover the design methodology of instrumentation systems and include an instrumentation design project.

*Prerequisite: ELECTENG 101*

#### BIOMENG 261 (15 Points)

##### Tissue and Biomolecular Engineering

Overview of molecular and tissue engineering principles emphasising biochemical kinetics, gene regulation, cell behaviour and biomedical ethics. Laboratory practice and design project in cell culture and molecular biology techniques. Topics

include enzymes and regulation of metabolic pathways, thermodynamic principles of biochemical reactions, systems biology and regulatory motifs in biochemical networks, cell culture techniques, research and medical ethics.

*Prerequisite: BIOSCI 107, ENGSCI 211*

*Restriction: BIOMENG 361*

### Part III

#### BIOMENG 321 (15 Points)

##### Continuum Modelling in Bioengineering

An introduction to continuum modelling approaches to bioengineering problems across a range of spatial scales. Topics include: tensor analysis, molecular and cellular mechanics of striated muscle; finite deformation elasticity and constitutive relations for soft biological materials; conservation equations for momentum, mass and heat transfer in fluids; viscous flow; boundary layers; pure conduction and diffusion; advective transport of mass and heat.

*Prerequisite: BIOMENG 221, ENGSCI 211*

*Restriction: ENGSCI 343*

#### BIOMENG 341 (15 Points)

##### Bioinstrumentation and Design

Sensors and actuators (temperature, position, force, pressure, flow, bioelectric, optical sensors and instruments). Signals, systems and controls (s-domain signal notation, transfer functions, frequency response functions, block diagrams, the Laplace transform, first and second order systems, characterisation methods, fundamentals of control). Bioinstrumentation design methodology, Biomedical instrumentation design project.

*Prerequisite: BIOMENG 241*

### Part IV

#### BIOMENG 771 (15 Points)

##### Musculoskeletal and Orthopaedic Biomechanics

Topics that biomechanical and orthopaedic engineers use in research and industry. Includes

guest lectures from practitioners. Orthopaedic engineering topics cover implant design, material choice, implant stress shielding and bone loss, implant wear and bone remodelling. Musculo-skeletal biomechanics topics cover motion capture, inverse kinematics and dynamics, muscle force evaluation, electromyography (EMG), inertial sensors and applications in sports medicine and rehabilitation.

*Prerequisite: 15 points from ENGSCI 311, 313, 314*

## **BIOMENG 791 (15 Points)**

### **Advanced Biomedical Engineering Design**

An engineering project requiring the application and integration of material taught in lecture courses to the design of medical devices and software to meet client needs. The project also requires consideration of ethical issues, social impact, safety risks, and international regulations.

*Prerequisite: BIOMENG 341*

## **Chemical and materials Engineering**

### **Part I**

#### **CHEMMAT 121 (15 Points)**

##### **Materials Science**

Introduction to materials science starting with the fundamentals of atomic structure and bonding and how this builds up a microstructure to create a solid. Metals, polymers, ceramics, electronic materials, composite and biomaterials will be covered and the properties, advantages and disadvantages of each discussed. Considerations such as corrosion, degradation and failure will be studied with a focus on improving design and creating new materials for our future world.

### **Part II**

#### **CHEMMAT 201 (15 Points)**

#### **Process Engineering 1: Introduction**

Materials and energy balances with and without chemical reaction, materials and energy balances in multiphase systems such as crystallisation, evaporation, drying, humidification, dehumidification, absorption, distillation, extraction and filtration. An introduction to the most important unit operations in the chemical industry, design concept and safety as applied to processing.

*Prerequisite: CHEM 110 or 120 or ENGGEN 140*

*Restriction: CHEMMAT 211*

#### **CHEMMAT 202 (15 Points)**

##### **Process Engineering 2: Energy and Processing**

Introduction to thermodynamics for process engineering. The first and second laws of thermodynamics. Application of thermodynamic concepts in closed systems, flow processes and cycles, refrigeration and liquefaction. Classical chemical thermodynamics including concepts of chemical potential, fugacity and activities; their applications to vapour-liquid equilibria and reacting systems. Multi-component physical equilibria. Multiple reaction equilibria and system-free energy minimisation. Practical examples and applications.

*Restriction: CHEMMAT 212*

#### **CHEMMAT 203 (15 Points)**

##### **Process Engineering 3: Transfer Processes**

Fluid properties and statics (specific gravity, viscosity, surface tension, flow types, manometry). Modelling fluid motion (Bernoulli equation). Dimensional analysis and similitude: Reynolds Number, Friction factor, Prandtl number). Flow measurement (pumps/pumping and valves). Heat transfer: including steady state conduction, convection and radiation; and effects of geometry, force and natural convection. Heat transfer processes (correlation with flow processes, heat transfer coefficients). Applications.

*Restriction: CHEMMAT 213*

## **CHEMMAT 204 (15 Points)**

### **Materials**

Solid state transformation – diffusion, vacancies, solidification, nucleation and growth. Dislocations and plastic deformation, strengthening mechanisms. Mechanical performance of materials. Iron-carbon alloy systems and transformations (including pearlitic, austenitic, bainitic and martensitic), effects of alloying elements. Analytical methods: X-ray diffraction and electron microscopy.

*Prerequisite: CHEMMAT 121*

*Restriction: CHEMMAT 221*

## **CHEMMAT 205 (15 Points)**

### **Process Design 1**

Mechanics of solids and analysis of stress and strain. Introduction to materials selection. Design of thin walled pressure vessels. Application to the design of vessels, tanks, reactors, piping and heat transfer equipment. Introduction to the chemical industry, unit operations, line diagrams and process equipment. Report writing and oral communication skills.

*Prerequisite: ENGGEN 121 or equivalent*

*Restriction: CHEMMAT 231, 232*

## **CHEMMAT 206 (15 Points)**

*(previously CHEMMAT 242)*

### **Applied Chemistry**

Fundamental chemistry required for chemical engineering and materials engineering. Topics may include phase equilibrium, reaction kinetics, thermodynamics, surface chemistry, electrochemistry and polymer chemistry. This course will have an emphasis on problem definition and solution.

*Prerequisite: 15 points from ENGGEN 140, CHEM 110, 120*

*Restriction: CHEMMAT 242*

## **Part III**

## **CHEMMAT 301 (15 Points)**

### **Transfer Processes 2**

Principles of continuous and staged processes. Mass transfer in various media, systems and phases. Interrelating equipment design to mass transfer processes. Studies of selected separation processes such as absorption, solvent extraction, and distillation, and membrane processes

*Prerequisite: CHEMMAT 203 or 213, and CHEMMAT 242 or 206*

*Restriction: CHEMMAT 312*

## **CHEMMAT 302 (15 Points)**

### **Advanced Process Engineering**

An in-depth analysis of selected topics that influence the design, operation, and performance of process plants. Topics include: particulate technology, particle mechanics and particle motions, non-Newtonian fluid flow, two-phase solid-liquid and gas-liquid flow, computational fluid dynamics, flow through porous media and packed beds, filtration, centrifugation, fluidisation, variable-analysis of variations in materials and product processing, membrane separation methods and optimisation techniques.

*Prerequisite: CHEMMAT 203 or 213*

*Restriction: CHEMMAT 313, 316, 411*

## **CHEMMAT 303 (15 Points)**

### **Chemical Reactor Engineering**

Kinetics of multiple reactions, analysis of basic reactors – batch, plug flow, and continuous stirred tank. Performance under isothermal, adiabatic, and varying temperature. Effect of semi-continuous, counterflow and recycle on performance. Heterogeneous reactions and catalysis, diffusion and reaction in porous catalysts, effects of external mass transfer resistance, fixed and fluidised bed reactors, gas-liquid reactors. Reactor engineering for biological and electrochemical systems.

*Prerequisite: CHEMMAT 202 and 206,*

or CHEMMAT 212 and 242

Restriction: CHEMMAT 315

### **CHEMMAT 304 (15 Points)**

#### **The Future of Energy**

Discussion of topical and significant developments in the field of energy transformation, usage and storage in the context of climate change, both globally and in New Zealand. Topics include: energy efficiency, energy storage and applications, sustainability, non-renewable and renewable power generation.

*Prerequisite:* CHEMMAT 201 or 211

*Restriction:* CHEMMAT 317

### **CHEMMAT 305 (15 Points)**

#### **Materials Processing and Performance**

Materials processing and performance are critical components of a materials science and engineering degree. This course examines the processing and performance of metals, polymers and ceramics. Topics include metal-making, casting, forming, and forms of degradation, such as corrosion. Emphasis is placed on materials applications for process engineering.

*Prerequisite:* CHEMMAT 204 or 221

*Restriction:* CHEMMAT 321, 322, 421

### **CHEMMAT 306 (15 Points)**

#### **Process Design 2**

The nature and function of design – process conception, alternatives, constraints and their simulation. Raw materials, safety and environmental considerations. Flow sheet representation of information. Separation systems, heat exchanger networks, and specification of equipment. Process economics and project documentation.

*Prerequisite:* CHEMMAT 201 or 211, and CHEMMAT 205 or 232

*Restriction:* CHEMMAT 331, 756

## **Part IV**

### **CHEMMAT 724 (15 Points)**

#### **Advanced Materials Characterisation**

The underlying theory essential to understanding modern methods of advanced materials analysis including: electron microscopy, surface analysis, atomic force microscopy and nanoindentation. Teaching is highly research informed with examples drawn from the Research Centre for Surface and Materials Science (RCSMS) and involves principles, practical experience and independent project work related to the application of these techniques.

*Prerequisite:* CHEMMAT 305 or 322

### **CHEMMAT 750A (15 Points)**

### **CHEMMAT 750B (15 Points)**

#### **Design Project**

Specification, planning and executing a specific process design project. The detailed considerations in the project to include environmental impact, safety and occupational health issues, material selection, process energy demand and efficiency, costing and economics, process start-up and operation.

*Prerequisite:* CHEMMAT 306 or 331

*Restriction:* CHEMMAT 431, 432

*To complete this course students must enrol in CHEMMAT 750 A and B*

### **CHEMMAT 751A (15 Points)**

### **CHEMMAT 751B (15 Points)**

#### **Research Project**

Students are required to submit a report on independent investigation carried out on a topic assigned by the Head of Department of Chemical and Materials Engineering. The work shall be supervised by a member of staff.

*Restriction:* CHEMMAT 441, 442

*To complete this course students must enrol in CHEMMAT 751 A and B*

## **CHEMMAT 752 (15 Points)**

### **Process Dynamics and Control**

Application of mathematical modelling and simulation for understanding modern methods of process control via open-ended workshop study projects. Includes rigorous treatment of control fundamentals (dynamics, hardware, transient analysis, feedback, tuning), advanced classical control (feed-forward, cascade), and advanced control (multiple variable control, whole plant control and model predictive control). Research informed with examples from the Industrial Information and Control Centre (I2C2).

*Prerequisite: ENGSCI 211*

*Restriction: CHEMMAT 311, 411, 412*

## **CHEMMAT 753 (15 Points)**

### **Biological Materials and Biomaterials**

Fundamentals of biological materials from small-scale building blocks (genes, proteins) to large-scale biological entities (organs, joints). Biomaterial design, material selection and functionalisation and the interaction between biomaterials and the biological tissue. Critique and review recent research on selected topics. Individual and team research projects apply advanced concepts and methods to design and implement a scaffold or implant prototype.

*Prerequisite: BIOMENG 221, or CHEMMAT 204 and 205, or CHEMMAT 221 and 232*

*Restriction: CHEMMAT 422*

## **CHEMMAT 754 (15 Points)**

### **Materials Performance Enhancement**

Materials under extreme service conditions – surface engineering, high-temperature corrosion/oxidation. Nanomaterials and nanotechnology – special properties, synthesis and processing techniques, applications in sensing, catalysis and biomedical areas. Advanced manufacturing technology – additive manufacturing, powder metallurgy, and sustainable/green manufacturing. Selected advanced concepts in materials performance enhancement are taught through

research based individual projects.

*Prerequisite: CHEMMAT 121, and 305 or 322 or equivalent*

*Restriction: CHEMMAT 423*

## **CHEMMAT 755 (15 Points)**

### **Materials for Energy and Environmental Applications**

Electronic properties of materials. Applications in energy storage. Smart materials and devices – magnetic and dielectric materials, sensors and actuators, recording devices. Materials for environmental applications – photo-catalysis and environmental cleaning, membrane materials, and eco-materials. Core concepts related to energy and environmental applications are extended by individual research projects on selected topics.

*Prerequisite: CHEMMAT 121, and 305 or 322 or equivalent*

*Restriction: CHEMMAT 424*

## **CHEMMAT 756 (15 Points)**

### **Food Process Engineering**

Application of engineering principles to food processing. Topics include: heating and thermal processing, cooling, freezing and thawing, evaporation, dehydration, the use of membranes and packaging. Innovative food processes: high pressure, pulsed electric, UV, ultrasounds and ohmic heating/cooking), and fundamental areas of engineering relevant for food processing such as heat and mass transfer. Process impact on food safety, quality and preservation.

*Prerequisite: CHEMMAT 201 or 211, and 15 points from ENGGEN 150, ENGSCI 111, MATHS 108, 110*

*Restriction: CHEMMAT 463*

## **CHEMMAT 757 (15 Points)**

### **Engineering Biotechnology**

Principles of biochemical engineering. Exploitation of bioreaction and bioprocess systems. Enzyme and microbial reaction kinetics, bioreactor design

and downstream processing. Examples of biochemical process and food industry applications.

*Prerequisite: ENGSCI 111 or equivalent*

*Restriction: CHEMMAT 361, 464, FOODSCI 704*

### **CHEMMAT 758 (15 Points)**

#### **Resource Recovery Technologies**

Selection and application of resource recovery processes. Examination of a variety of resource recovery technologies. Critical evaluations of the latest research and development in innovative resource recovery techniques. Social and economic aspects as catalysts or obstacles to resource recovery. Includes an independent research project.

### **CHEMMAT 759 (15 Points)**

#### **Industry 4.0 for Chemical Engineering**

In-depth coverage of digitalisation and Industry 4.0 in the context of modern biological, chemical, food and materials processing industries. Topics include model building, digital models and digital twins using process simulators, scripting, open source software and data-driven analysis using machine learning concepts, and the application of these to modelling a virtual plant.

*Prerequisite: ENGSCI 311*

### **CHEMMAT 760 (15 Points)**

#### **Advanced Microbial Technology in Bioprocess Engineering**

Microbiological, biochemical, and molecular approaches crucial for analysing, developing, and optimising engineering bioprocesses. Fundamentals of microbial growth and the effect of environmental factors, molecular tools for quantifying bacterial cells and activities, bioinformatics, and in vitro enzymatic reactions. Applications of microbiology in engineering processes for chemical production, food engineering, bioenergy, and waste treatment.

### **CHEMMAT 763 (15 Points)**

#### **Waste Reduction and Recycling Technologies**

Principles, concepts, and technologies in waste minimisation and recycling. Topics include implementation of waste management and recycling technologies, economic analysis of waste recycling and minimisation and the three pillars of sustainability.

## **Civil Engineering**

### **Part II**

#### **CIVIL 200 (15 Points)**

##### **Introduction to Geotechnical Engineering**

The basic concepts and principles governing the mechanical behaviour of soil. Engineering geology, site investigation and soil classification. The principle of effective stress, permeability and seepage, and soil shear strength.

*Restriction: CIVIL 220, 331*

#### **CIVIL 201 (10 Points)**

##### **Land Information Systems**

Aspects of elementary engineering surveying as used for gathering site information for the design and setting out of works. Land information systems, modern methods of gathering, processing and presenting information for engineering purposes.

#### **CIVIL 202 (15 Points)**

##### **Fluid Mechanics and Pipe Flow**

Fluid properties and definitions, hydrostatics and stability of floating bodies. Fluid flow, energy, continuity and momentum relationships. Dimensional analysis and similarity. Pipe flow: Fluid resistance, friction factor, steady-state pipe flow, simple pipe systems and pipe network analysis, waterhammer

*Restriction: CIVIL 230, 331*

## **CIVIL 203 (15 Points)**

### **Transport Design and Geomatics**

Introduction to Transportation Engineering (mobility for people and goods, sea, land and air transportation systems). Design and construction of longitudinal infrastructure (plans, longitudinal sections and cross sections, earthworks, quantities, mass haul). Transport geometric design (horizontal, vertical and cross sectional design). Geomatic surveying systems (levelling, theodolites, GPS, drones, digital topographical survey systems and remote sensing).

*Restriction: CIVIL 201, 360*

## **CIVIL 210 (15 Points)**

### **Introduction to Structures**

Structural forms and systems. Analysis of determinate systems, elasticity. Engineering beam theory, elasticity, failure theories. Introduction to structural design.

*Prerequisite: ENGGEN 121 or 150*

*Restriction: ENVENG 210*

## **CIVIL 211 (10 Points)**

### **Structures and Design 1**

Introduction to structural design – philosophy, loads, codes; design of simple structural elements in various materials.

## **CIVIL 220 (10 Points)**

### **Introductory Engineering Geology**

Principles of physical and structural geology. Elementary stratigraphy. Applied geomorphology. Geologic surveying and mapping. Elementary seismology; microzoning and seismotectonic hazard evaluation. Engineering properties, description and identification of geologic materials. General applications of geology to engineering.

## **CIVIL 221 (10 Points)**

### **Geomechanics 1**

The basic concepts and principles governing the mechanical behaviour of soil, including phase relationships, permeability and seepage, the principle of effective stress, soil strength, compressibility and basic stability analysis.

## **CIVIL 230 (10 Points)**

### **Fluid Mechanics 1**

Fluid properties and definitions. Hydrostatics and stability of floating bodies. Fluid flow, energy and continuity relationships. Viscosity. Force and momentum relationship. Dimensional analysis and similarity. Introduction to turbomachinery.

## **CIVIL 250 (10 Points)**

### **Civil Engineering Materials and Design**

Properties and manufacturing of concrete, steel and timber structural products. Design principles and examples for concrete, steel and timber members.

## **Part III**

## **CIVIL 300 (15 Points)**

### **Geotechnical Engineering**

Compaction, settlement and rate of consolidation. Stability analysis in geotechnical engineering, including slope stability, earth pressures on retaining structures and bearing capacity of shallow foundations.

*Prerequisite: CIVIL 200*

*Restriction: CIVIL 322*

## **CIVIL 301 (15 Points)**

### **Foundation Engineering**

Design of foundations, both shallow and pile, for buildings and other structures. Assessment of foundation ultimate capacity and working load settlement. Site investigation methods, with particular emphasis on the use of penetrometer tests to estimate soil parameter values. Current foundation construction methods. Design of

embedded retaining walls. Special aspects of house foundation design and construction. Observed foundation performance.

*Prerequisite: CIVIL 300, and STRCTENG 300 or 301 or 304*

*Restriction: CIVIL 721*

## **CIVIL 302 (15 Points)**

### **Hydrology and Open Channel Flow**

Engineering hydrology: Hydrologic processes, analysis of rainfall-runoff relationships, statistical analysis of hydrological data, groundwater flow. Open channel flow: energy and momentum, uniform flow and flow resistance, critical flow, specific energy and flow force, backwater analysis, channel transitions

*Prerequisite: CIVIL 202*

*Restriction: CIVIL 331, ENVENG 333*

## **CIVIL 303 (15 Points)**

### **Transport Operations and Pavements**

Traffic engineering, transportation planning and road pavement design. Topics include the main transport planning and traffic design techniques, criteria and fundamentals used in transportation engineering practice, traffic studies, public transport and active modes and transport modelling (micro and macro simulation). Additionally, pavement design, surfacings, traffic loading, mechanistic approaches and rehabilitation of road pavements are included.

*Prerequisite: CIVIL 203*

## **CIVIL 304 (15 Points)**

### **Climate Adaptation Design**

Fundamental understanding of the impact of climate change on horizontal infrastructure and the adaptation design and strategies to respond to these changes. Topic areas include the impact of climate on infrastructure, vulnerability studies and adaptation design and management techniques. Studies in knowledge areas of design, management and resilience of transport (roads, ports and

wharves), water provision, stormwater and wastewater systems.

*Prerequisite: CIVIL 203*

*Corequisite: CIVIL 303*

*Restriction: CIVIL 360, 759*

## **CIVIL 305 (15 Points)**

### **Construction Informatics**

The application of digital and automation technologies (such as building information modelling, virtual reality/augmented reality, internet of things, laser scanning, drones, artificial intelligence, big data, robotics) in civil engineering and management.

## **CIVIL 312 (15 Points)**

### **Structures and Design 2**

Structural analysis of indeterminate structures. Moment-area method for deformations. Loading actions as per NZS 1170 and load collation. Design of structural members in timber portal frames.

*Prerequisite: CIVIL 211*

## **CIVIL 313 (15 Points)**

### **Structures and Design 3**

Design of structures in reinforced concrete, prestressed concrete and structural steel. Computer analysis of structures; use of a commercial analysis program. Design project.

*Prerequisite: CIVIL 211*

## **CIVIL 314 (10 Points)**

### **Structural Dynamics**

Dynamics of single and multi-degree-of-freedom systems. Ground motion, response spectra, time-history and spectral modal analysis; introduction to seismic design.

## **CIVIL 322 (10 Points)**

### **Geomechanics 2**

Stability analysis in geotechnical engineering; slope stability, soil pressures on retaining structures, bearing capacity. Consolidation and settlement.

*Prerequisite: CIVIL 221*

## **CIVIL 324 (10 Points)**

### **Geomechanics 3**

Shear strength of soil – triaxial testing, measurement of pore water pressures, and interpretation of test data. Effective and total stress paths for drained and undrained loading in laboratory tests and field applications.

Consolidation. Application of elastic solutions in geomechanics. Geotechnical numerical modelling.

*Prerequisite: CIVIL 322 or equivalent*

*Restriction: CIVIL 420, 728*

## **CIVIL 331 (10 Points)**

### **Hydraulic Engineering**

Pipe flow – fluid resistance, friction factor, simple pipe flow and minor losses, steady-state pipe flow and pipe networks. Open channel flow – energy and momentum, uniform flow and flow resistance, critical flow, specific energy and flow force, backwater analysis, channel transitions.

*Prerequisite: CIVIL 230 or equivalent*

## **CIVIL 332 (10 Points)**

### **Fluid Mechanics 2**

Laminar and turbulent flow. Ideal fluid flows. Boundary layer theory and separation, drag and lift. River morphology and flows. River pollution. Unsteady flow in channels.

## **CIVIL 360 (10 Points)**

### **Transportation Engineering 1**

Highway alignment geometrics (horizontal, vertical and cross sectional design). Basis of the main pavement design techniques, pavement materials,

stabilisation, compaction and bituminous surfacings.

## **CIVIL 361 (10 Points)**

### **Transportation Engineering 2**

Planning for land transport facilities and urban development. Arrangement of street networks and environmental areas. Basic operational analyses at priority and signalised intersections for vehicles and pedestrians. Highway capacity analyses.

Parking design. Introduction to transportation planning modelling.

## **Part IV**

## **CIVIL 700 (15 Points)**

### **Geotechnical Analysis**

Shear strength of soil – triaxial testing, measurement of pore water pressures, and interpretation of test data for use in analysis. Introduction to numerical modelling in geotechnical engineering. The use of traditional methods versus numerical modelling in design.

*Prerequisite: CIVIL 300*

*Restriction: CIVIL 324*

## **CIVIL 705A (15 Points)**

## **CIVIL 705B (15 Points)**

### **Research Project**

*Restriction: CIVIL 408*

*To complete this course students must enrol in CIVIL 705 A and B*

## **CIVIL 710 (15 Points)**

### **Advanced Structural Dynamics**

Advanced topics in structural dynamics, such as wave guide representation, holistic consideration of structural behaviour including soil, main and secondary structures interaction, nonlinearities of soil-foundation-structure systems including uplift, pile-soil separation, plastic hinge or pounding. The core skills are taught and accompanied by an

individual project in which independent research is undertaken to solve a challenging structural dynamics problem.

Prerequisite: Departmental approval

### **CIVIL 713 (15 Points)**

#### **Structures and Design 4**

Continuation of the design and detailing of structures in structural steel, reinforced concrete, reinforced masonry, and timber including connections in steelwork, composite steel/concrete beams, masonry structures and retaining walls in reinforced masonry. Practical understanding and design of concrete ground floor slabs. Introduction to the NZ Standard for light timber frame construction. Introduction to fire engineering. Techniques in the checking of existing structures and lessons learnt from failures.

*Prerequisite: CIVIL 312 and 313 or equivalent*

*Restriction: CIVIL 411*

### **CIVIL 714 (15 Points)**

#### **Multistorey Building Design**

Techniques for the design of structures to resist seismic loading. Derivation of design actions, alternative structural systems for resisting these loads, design of structural components subject to cyclic inelastic action, detailing of members and joints to enhance earthquake resistance. Techniques of seismic isolation. Design project.

*Prerequisite: CIVIL 313 or equivalent*

### **CIVIL 715 (15 Points)**

#### **Advanced Structural Concrete**

Design and detailing of prestressed and precast reinforced concrete members subject to axial, flexure, shear, and torsion actions. Design of state-of-art low-damage concrete structural systems. Includes an independent concrete design project and an independent research project on past failures of concrete structures.

*Prerequisite: CIVIL 313 or equivalent*

### **CIVIL 718 (15 Points)**

#### **Light Gauge Steel**

Use of thin steel load bearing structural components in walls, floors and roofs. Behaviour of members and connections under the full range of structural actions. Theory and design application including the Direct Strength Method of design. Use of light gauge steel acting compositely with other materials such as concrete and structural foams.

*Prerequisite: CIVIL 313 or equivalent*

### **CIVIL 719 (15 Points)**

#### **Matrix Structural Analysis**

Direct stiffness method applied to linear, nonlinear and stability analyses. Introduction to variational principles and finite element method. Projects in practical modelling of major structures such as bridges and multi-storey buildings. Use of commercial software.

*Restriction: CIVIL 416*

### **CIVIL 721 (15 Points)**

#### **Foundation Engineering**

Foundation performance requirements. Foundation types. Foundation design loads. Limit state design. Design of shallow foundations. Design of deep foundation. Case histories illustrating construction, performance and failure of foundations. Design and performance of gravity retaining structures, embedded retaining walls and reinforced earth walls.

*Prerequisite: CIVIL 312 or equivalent*

*Restriction: CIVIL 323, 421*

### **CIVIL 722 (15 Points)**

#### **Slope Engineering**

*Slope failure mechanisms, geological controls and classification. Shear strength of rock and soil materials. Laboratory testing of earth materials for slope stability. Limit equilibrium techniques, including analytical, numerical and graphical*

methods. Effects of water and earthquake on slope stability. Slope monitoring, stabilisation and remediation. Landslide risk management.

*Prerequisite: CIVIL 322 or equivalent*

*Restriction: ENVENG 324, CIVIL 422*

### **CIVIL 726 (15 Points)**

#### **Engineering Geology**

Introduction to fundamentals in soil and rock mechanics and their application to engineering projects. Discussion of natural hazards and their implications on infrastructure design. Practical exercises in field mapping, core logging, aerial photograph interpretation, and basic laboratory tests.

*Restriction: CIVIL 404, EARTHSCI 372, GEOLOGY 372*

### **CIVIL 729 (15 Points)**

#### **Humanitarian Engineering**

Evaluate frameworks used in the humanitarian engineering field to assist with human crises, including shelter, standards, law, human rights, resilience, appropriate engineering. Rapid assessments, application of minimum international standards for engineering, engineered shelter solutions, water, sanitation and hygiene and the engineering management of humanitarian crises.

### **CIVIL 731 (15 Points)**

#### **Water Resources Modelling**

Risk and uncertainty in water resources systems; evaluation of alternatives in water resources; hydrologic modelling; hydraulic modelling; river basin modelling; water resources economics.

### **CIVIL 732 (15 Points)**

#### **Coastal Engineering Design**

Deriving design conditions, wave pressures and forces, design of structures, beaches and control structures, introduction to coastal modelling.

*Prerequisite: CIVIL 733*

### **CIVIL 733 (15 Points)**

#### **Coastal Engineering Dynamics**

Waves, wave theories, surf zone processes, sediment transport, dynamics of coastal systems.

### **CIVIL 734 (15 Points)**

#### **River Engineering**

Scales; flows; fluvial processes; mixing; ecohydraulics.

### **CIVIL 735 (15 Points)**

#### **Transport Modelling and Design**

The planning, modelling, design and operation of current and future transport systems. Topics include transport models and their applications, Intelligent Transport Systems and emerging technologies, transport planning process and travel demand modelling. Transport models are developed to plan, design and manage transport networks based on fundamental modelling concepts, New Zealand specifications and international best practices.

*Prerequisite: CIVIL 303*

*Restriction: CIVIL 758*

### **CIVIL 736 (15 Points)**

#### **Transport Safety and Mobility**

Develop a sound understanding of safety and mobility of transport systems. Transport safety topics include safe systems, crash reduction studies, road safety audits and at-grade intersection geometric design, economic appraisal methods and transport infrastructure funding. Planning for transport mobility and sustainable transport systems, public transport systems, active modes and travel behaviour.

*Prerequisite: CIVIL 203*

*Restriction: CIVIL 759*

### **CIVIL 741 (15 Points)**

#### **Ground Improvements and Geosynthetics Engineering**

Advanced ground improvement techniques including: densification, consolidation, preloading and surcharge, soil reinforcement, stabilisation and thermal ground improvement.

*Prerequisite: CIVIL 322 or equivalent*

*Restriction: CIVIL 403*

## **CIVIL 743 (15 Points)**

### **Special Topic:**

#### **Building Information Modelling**

Introduction to the main principles and tools of Building Information Modelling (BIM) in the Architecture-Engineering-Construction (AEC) industry. This course is suitable for different AEC professionals such as civil and structural engineers, architects, among others.

## **CIVIL 750 (15 Points)**

### **Timber Engineering**

The practical understanding of timber and its use in the construction industry. Design and detailing techniques for connections in timber structures, plywood structures, pole structures, timber floor systems, bridges, multi-storey buildings, formwork and falsework, arches and cable stayed systems.

*Prerequisite: CIVIL 312 or equivalent*

*Restriction: CIVIL 451*

## **CIVIL 756 (15 Points)**

### **Capstone Project**

Final year team exercise with students in multi-disciplinary civil and environmental roles integrating technical learning into realistic design outcomes. Comprehensive investigation of an open ended, complex, real or synthetic civil engineering problem with simulated professional design office constraints. Includes technical, economic and environmental impact components to complete a scheme assessment report.

*Prerequisites: 90 points from Part III courses listed in the BE(Hons) Schedule for Civil Engineering.*

## **CIVIL 758 (15 Points)**

### **Traffic Systems Design**

Traffic signal timing analysis. Gap acceptance parameters. Intersection analysis of performance (priority, roundabouts and signalised). Some human factors. Introduction to transportation planning modelling. Planning land transport in NZ under the Resource Management and other requirements. Computer modelling and simulation.

*Prerequisite: CIVIL 361*

*Restriction: CIVIL 403, 460, 660*

## **CIVIL 759 (15 Points)**

### **Highway and Transportation Design**

Economic and environmental assessments of transport projects. Land transport funding in NZ. Road safety engineering. Crash reduction and prevention methods. Pavement asset management. Pavement rehabilitation techniques. Heavy-duty pavements, highway drainage and chip seal design.

*Prerequisite: CIVIL 360*

*Restriction: CIVIL 461, 661*

## **CIVIL 782 (15 Points)**

### **Water Resources Engineering**

A selection from the following: reservoir design and optimisation, flood control and design of flood control structures, micro to large scale hydroelectric engineering, river engineering and sedimentation. A water resources engineering design project.

*Prerequisite: ENVENG 333 or equivalent*

*Restriction: CIVIL 480, 482*

## **CIVIL 790 (15 Points)**

### **Civil Engineering Administration**

The application of legal principles to problems in civil engineering and environmental engineering management. Examines the administration of national and international engineering contracts.

Discusses statutes affecting engineering business. Investigates the implications of resource management and natural resource allocation legislation on engineering projects. Analyses processes for resolving engineering disputes.

*Restriction: CIVIL 401, 490, ENGGEN 734*

## **CIVIL 791 (15 Points)**

### **Construction Management**

Understanding topics necessary for effective construction management. Using a generic construction project life cycle, essential aspects of construction projects including the tendering process, preparing tenders, tender evaluation, project planning, resource allocation, teamwork, site safety, and contract types are covered. Case studies are used to reinforce the application of theoretical ideas to the successful running of construction projects.

*Restriction: CIVIL 409*

## **Computer Systems Engineering**

### **Part II**

#### **COMPSYS 201 (15 Points)**

##### **Fundamentals of Computer Engineering**

Digital systems and binary coding; binary numbers; Boolean algebra and computer logic; combinational logic circuits; sequential logic circuits; hardware description language; digital design flow; register transfer level descriptions and design; data paths and control units; from circuits to microprocessors; basic computer organisation; introduction to modern microprocessors; timers and interfacing; C and assembly language for microprocessors; designing digital systems using microprocessors.

*Prerequisite: ELECTENG 101*

#### **COMPSYS 202 (15 Points)**

##### **Object Oriented Design and Programming**

A project-based course with extensive hands-on programming experience. Includes: an introduction to object oriented design including UML, sequence diagrams, use-case analysis; an introduction to object oriented programming in a modern high level language, algorithms, data abstraction and elementary data structures.

*Prerequisite: ENGGEN 131 or ENGSCI 131*

*Restriction: MECHENG 270*

#### **COMPSYS 209 (15 Points)**

##### **Computer Systems Design**

Project-based course introducing real-world design aspects of hardware and software components of computer systems using appropriate design methodology. Practical skills will be gained in computer aided design tools, printed circuit board design and construction.

*Prerequisite: COMPSYS 201, ELECTENG 291,*

*SOFTENG 250 or 281*

*Restriction: ELECTENG 209*

### **Part III**

#### **COMPSYS 301 (15 Points)**

##### **Design: Hardware Software Systems**

An appreciation of the engineering design process as applied to computer systems. Design skills are enhanced through engineering projects which typically include elements of: computer hardware design, computer software design, system design and control, sensing, actuation and interfacing.

*Prerequisite: COMPSYS 305, and COMPSYS 209 or ELECTENG 209, and COMPSYS 202 or SOFTENG 281*

#### **COMPSYS 302 (15 Points)**

##### **Design: Software Practice**

A project-based course to gain experience in software design emphasising problem solving

techniques and applications in computer systems engineering. The course includes practical, real-world project(s) involving a representative subset of the following topics: algorithm and data structure selection and implementation, parsing and translation, object-oriented and multi-threaded programming, scripting languages, peer-to-peer communication over internet.

*Prerequisite: COMPSYS 202 or SOFTENG 281*

### **COMPSYS 303 (15 Points)**

#### **Microcomputers and Embedded Systems**

Embedded applications. Microprocessors, microcontrollers, architecture, organisation, programming memories, I/O interfacing. Sensors, actuators, analog interfaces. Hardware/Software partitioning and interfacing. Concurrency. Implementing data transformations and reactivity. Case studies.

*Prerequisite: COMPSYS 201, and COMPSYS 202 or SOFTENG 251 or 281*

### **COMPSYS 304 (15 Points)**

#### **Computer Architecture**

Modern processor architectures. Principles of modern processor design; pipelining; memory hierarchies; I/O and network interfacing; compiler and OS support; embedded processors; performance; multiprocessing.

*Prerequisite: COMPSYS 201*

*Restriction: COMPSCI 313*

### **COMPSYS 305 (15 Points)**

#### **Digital Systems Design (previously Digital Systems Design 1)**

Digital Systems implementation technologies with emphasis on hardware description languages and design abstraction levels; structural, architectural and behavioral modelling; register-transfer level design; datapath and control units; functional and timing simulations; FPGA-based implementation design flow and case studies.

*Prerequisite: COMPSYS 201*

### **COMPSYS 306 (15 Points)**

#### **Artificial Intelligence and Machine Learning**

Fundamentals of artificial intelligence, including topics from artificial neural networks, fuzzy models, genetic algorithms. Using machine learning as an application of artificial intelligence to use data for training and inference, including topics from convolutional neural networks, deep learning, pattern classification and recognition.

*Prerequisite: COMPSYS 201, and COMPSYS 202 or SOFTENG 281*

## **Part IV**

### **COMPSYS 700A (15 Points)**

### **COMPSYS 700B (15 Points)**

#### **Research Project**

Students are required to submit a report on project work carried out on a Computer Systems Engineering topic assigned by the Head of Department. The work shall be supervised by a member of staff.

*Prerequisite: COMPSYS 301, and 45 points from COMPSCI 313, COMPSYS 302-305, ELECTENG 303, 331, 332*

*Restriction: COMPSYS 401*

*To complete this course students must enrol in COMPSYS 700 A and B*

### **COMPSYS 701 (15 Points)**

#### **Advanced Digital Systems Design**

Advanced concepts in digital design including: System-on-Chip (system level description, behavioural and register-transfer descriptions); advanced modelling techniques and design flows; design space exploration and optimisation; hardware-software partitioning and trade-offs; component reusability; reconfigurable systems; low-power systems; case studies (speech, image, video algorithms implementation, application

specific processor design); individual research projects to analyse the problem, model and implement the required hardware-software components.

*Prerequisite: COMPSYS 305*

## **COMPSYS 704 (15 Points)**

### **Advanced Embedded Systems**

Selected advanced topics from current research in embedded systems such as: embedded systems based on formal models of computation; centralised and distributed architectures for embedded systems; static and dynamic embedded systems; languages and frameworks for distributed embedded systems; actor and agent systems; verification. Includes a significant individual research project.

*Prerequisite: COMPSYS 723, and 202 or SOFTENG 281*

## **COMPSYS 705 (15 Points)**

### **Formal Methods for Safety Critical Software**

Formal methods for the validation/verification of safety critical software, including machine learning algorithms. Topics covered will include mathematical modelling for embedded, automation, and mechatronic systems; advanced techniques for validation and verification; techniques for formal specification; methods of verification such as Bisimulation and model checking; state space explosion problem and solutions such as BDDs, symbolic model checking, and modular verification; verification of HDL/C using model checking tools. Includes a significant individual research project.

*Prerequisite: COMPSYS 202 or ENGSCI 233 or MECHENG 270 or 313 or SOFTENG 211 or 281 or 282*

## **COMPSYS 723 (15 Points)**

### **Embedded Systems Design**

Concurrency and models of computation, task models and race conditions, real-time operating

systems based approach, synchronous approach, safe state machines, key properties: determinism and reactivity, SoPC and MPSoC, cyber-physical embedded systems, static analysis techniques, case studies in smart grid, automotive, medical devices and the like.

*Prerequisite: COMPSYS 303 or 304 or SOFTENG 370*

*Restriction: COMPSYS 402, 403, 727*

## **COMPSYS 725 (15 Points)**

### **Distributed Cyber-Physical Systems Design**

Network layers and protocols. Packet switching. Broadband network principles. Low versus high bandwidth services. Network interfaces and instrumentation. Wireless networks in embedded applications. Industrial networking.

*Prerequisite: COMPSYS 201, and COMPSYS 202 or SOFTENG 281*

*Restriction: COMPSYS 405*

## **COMPSYS 726 (15 Points)**

### **Robotics and Intelligent Systems**

Fundamentals of robotic and intelligent systems, including reactive and deliberative functionality, navigation techniques, planning and programming of robot actions, machine learning, artificial neural networks and may include topics in sensors and actuators, kinematic analysis, fuzzy systems, genetic algorithms. Core concepts are extended by an individual research project where a challenging robotics problem is analysed and a solution implemented and tested.

*Prerequisite: 15 points from COMPSYS 302, MECHENG 313, SOFTENG 306*

*Restriction: COMPSYS 406*

## **COMPSYS 732 (15 Points)**

### **Mobile Autonomous Robotics**

Techniques and principles for designing and developing mobile robots that interact autonomously with their environment. Topics include sensors and actuators, kinematic analysis,

computer vision, state estimation and planning. Includes significant hands-on experience through the design and development of a mobile robot.

*Prerequisite: 15 points from COMPSCI 230, 235, COMPSYS 302, ENGSCI 331, MECHENG 313, SOFTENG 306*

## **COMPSYS 770 (15 Points)**

### **Capstone Project**

Final year team exercise with students in multidisciplinary roles, with focus on computer systems engineering and integrating technical learning into realistic design outcomes. Comprehensive investigation of an open ended, complex, real or synthetic computer, electrical and software engineering problem with simulated professional design office constraints. Includes technical, economic and environmental impact components to complete a scheme assessment report.

*Prerequisite: Prerequisite: 75 points from Part III courses listed in the BE(Hons) Schedule for the Computer Systems Engineering specialisation*

## **Electrical and Electronic Engineering**

### **Part I**

#### **ELECTENG 101 (15 Points)**

##### **Electrical and Digital Systems**

An introduction to electrical, computer and electronic systems and technology. Digital circuits and analysis techniques, computer organisation. Analog circuits and analysis techniques. Inductive power transfer, power systems and electric machines. Communication systems.

*Restriction: ELECTENG 202, 204, 208, 210*

### **Part II**

#### **ELECTENG 202 (15 Points)**

##### **Circuits and Systems**

Aims to provide a good understanding of the way electrical circuits work. It covers DC and AC circuit theorems and analysis; transient analysis, including the Laplace transform; transfer functions; AC power calculations; and time and frequency representation of signals.

*Prerequisite: ELECTENG 101*

#### **ELECTENG 204 (15 Points)**

##### **Engineering Electromagnetics**

Electrostatics (Coulomb's and Gauss's Laws, scalar potential, energy, capacitance, dielectrics), magnetostatics (Biot-Savart and Ampere's Laws, moving conductors, magnetic forces/torques, ferromagnetic hysteresis, inductance, magnetic materials), electromagnetic induction (Faraday's and Lenz's Laws). Transmission lines subjected to pulse excitation, magnetic circuits and single-phase transformers.

Introduction to computational electromagnetics.

*Prerequisite: ELECTENG 101*

#### **ELECTENG 209 (15 Points)**

##### **Analogue and Digital Design**

Project-based course introducing the process of electrical engineering design. Students will research a diverse range of practical problems and develop solutions and prototypes, test and evaluate hardware and software solutions, and communicate the design and results.

*Prerequisite: COMPSYS 201, and ELECTENG 202 or 291*

#### **ELECTENG 210 (15 Points)**

##### **Electronics 1**

Semiconductor devices and applications, diodes, bipolar junction transistors and operational amplifiers. Elementary device physics. Linear and non-linear devices, terminal characteristics, small-signal modelling and analysis. Frequency-dependent behaviour of circuits and analysis methods. Linear and non-linear circuits such as amplifiers and switching circuits. Biasing, coupling

and bypass techniques. Operational amplifiers, frequency-dependence and characteristic limitations, frequency selective and non-linear switching circuits.

*Prerequisite: ELECTENG 101*

### **ELECTENG 291 (15 Points)**

#### **Fundamentals of Electrical Engineering**

AC and DC circuit analysis in the context of linear electrical and electronic systems. Time and frequency domain approaches to describing and analysing electrical networks and systems.

*Prerequisite: ELECTENG 101*

*Restriction: ELECTENG 202*

### **ELECTENG 292 (15 Points)**

#### **Electronics**

Electronic devices and circuits for solving engineering problems. Analysis of linear and nonlinear microelectronic circuits and their practical applications.

*Prerequisite: ELECTENG 202 or 291*

*Restriction: ELECTENG 210*

## **Part III**

### **ELECTENG 303 (15 Points)**

#### **Systems and Control**

Introduction to linear, time-invariant, continuous-time system theory from both a time-domain and frequency domain standpoint. This leads on to the fundamental body of knowledge underlying the control and enhancement of system behaviour, with application to the analysis and control of electrical systems.

*Prerequisite: ELECTENG 202*

### **ELECTENG 305 (15 Points)**

#### **Applied Electronics**

An advanced treatment of electronic circuits including a rigorous treatment of feedback, device

limitations, noise effects, stability, and design considerations. Emphasis on common practical circuits taken from analog and switching applications.

*Prerequisite: ELECTENG 202 or 291, and 210 or 292*

### **ELECTENG 307 (15 Points)**

#### **Fields and Waves**

Transmission lines subjected to AC excitation, the Smith chart, introduction to matching network design and introduction to antennas for radio systems. Maxwell's equations in differential and integral form, divergence and Stokes' theorems, skin effect and uniform plane waves (lossless/lossy media, reflection and transmission, polarisation). Case studies in computational electromagnetics.

*Prerequisite: ELECTENG 204*

### **ELECTENG 309 (15 Points)**

#### **Power Apparatus and Systems**

Introduces students to three-phase electric machines and power system components. Covers theory, modelling and practical aspects for synchronous machines, induction machines, transformer connections, transmission lines and substation components.

*Prerequisite: ELECTENG 204*

### **ELECTENG 310 (15 Points)**

#### **Electrical Engineering Design 1**

An appreciation of the design process as applied to various electrical and electronic engineering systems. Design skills are enhanced through a variety of engineering projects which typically introduce students to modelling, simulation and analogue and digital electronic hardware design.

*Prerequisite: COMPSYS 201, and COMPSYS 209 or ELECTENG 209, and ELECTENG 202 or 291, and COMPSYS 202 or SOFTENG 281*

### **ELECTENG 311 (15 Points)**

#### **Electrical Engineering Design 2**

The formal introduction to the design process is completed by one or more open-ended projects which typically include elements of design from concept to working prototype.

*Prerequisite: ELECTENG 310*

### **ELECTENG 331 (15 Points)**

#### **Signals and Systems**

Introduction to continuous-time and discrete-time signals and systems. Spectral analysis and representation of analog and digital signals, and linear, time-invariant systems. Conversion between analog and digital signals. Systems for manipulating and filtering signals in hardware and software.

*Prerequisite: ELECTENG 202 or 291*

*Restriction: ELECTENG 303*

### **ELECTENG 332 (15 Points)**

#### **Control Systems**

Introduction to modelling in the time-domain and frequency domain. The fundamental body of knowledge underlying the control and enhancement of system behaviour, with application to the analysis and control of systems.

*Prerequisite: ELECTENG 202 or 291*

*Restriction: ELECTENG 303*

## **Part IV**

### **ELECTENG 700A (15 Points)**

### **ELECTENG 700B (15 Points)**

#### **Research Project**

Students are required to submit a report on project work carried out on a topic assigned by the Head of Department. The work shall be supervised by a member of staff.

*Prerequisite: ELECTENG 310, 311, and 30 points from ELECTENG 303, 305, 309, 331, 332*

*Restriction: ELECTENG 401*

*To complete this course students must enrol in*

*ELECTENG 700 A and B*

### **ELECTENG 701 (15 Points)**

#### **Mobile Wireless Engineering**

Aspects of the design and planning of mobile radio systems. Radio propagation for mobile radio systems (multipath, narrowband and wideband channels, channel characterisation and measurements), propagation modelling (free-space, plane-earth, diffraction). Frequency reuse and interference, outage probabilities, system performance evaluation, space diversity, MIMO and millimetre-wave systems.

*Prerequisite: ELECTENG 307 or 721 or 737*

### **ELECTENG 703 (15 Points)**

#### **Advanced Power Systems**

Electricity markets: structure, pricing, optimisation, ancillary services; Power system protection practices; Distribution network development: Smart Grid, Demand Side participation; HVDC and FACT Devices Theory and Application; Renewable energy grid integration.

*Prerequisite: ELECTENG 731*

*Restriction: ELECTENG 738*

### **ELECTENG 704 (15 Points)**

#### **Advanced Control Systems**

Advanced theory of modern control systems with emphasis on optimisation techniques for both deterministic and stochastic processes. State-space modelling of dynamic systems and choice of suitable performance criteria. Adaptive, nonlinear and sliding mode control systems. Core concepts are extended by an individual research project in which a challenging control problem is analysed and solved.

*Prerequisite: ELECTENG 722*

### **ELECTENG 721 (15 Points)**

#### **Radio Engineering**

Matching networks, waveguides, transmitter/

receiver design, noise, non-linear behaviour, antennas, applications in computational electromagnetics. Fundamentals of radio propagation, tropospheric effects, diffraction, link budgets, point-to-point link design, multipath propagation, introduction to area coverage (mobile radio) systems. Introduction to radar systems, the radio spectrum and exposure standards.

*Prerequisite: ELECTENG 307*

*Restriction: ELECTENG 421, 737*

## **ELECTENG 722 (15 Points)**

### **Modern Control Systems**

State space analysis, relationship to transfer function methods, controllability and observability, multivariable plant. Computer simulation. Stability considerations. State variable feedback. Digital control system, design and realisation of digital controllers, adaptive controllers. Nonlinear systems, phase-plane and describing function techniques, Lyapunov's method of stability analysis, design of controllers for non-linear systems. Variable structure systems.

*Prerequisite: ELECTENG 303 or 331 or 332*

*Restriction: ELECTENG 422, MECHENG 720, 724*

## **ELECTENG 726 (15 Points)**

### **Digital Communications**

Advanced principles and techniques in digital transmission systems: base-band and pass-band digital systems. Geometric representation of signals: theory of orthonormal signals, correlation demodulators, optimal detector. Digital phase (PSK) and frequency (FSK) modulation. Digital communication systems with noise. Information theory, capacity theorem and applications. Signal and information coding: data compression, digital transmission, error detection and correction, block and convolutional codes. Noise, thermal noise, noise figure. Traffic theory. Digital networks and OSI model.

*Prerequisite: ELECTENG 303 or 331, and 732*

*Restriction: ELECTENG 426, 741*

## **ELECTENG 731 (15 Points)**

### **Power Systems**

Builds on the knowledge of three-phase power systems components to understand modelling, formulation and typical analysis carried out by electricity transmission, distribution and generation entities. Load flow, fault, stability and power quality. Supplemented by laboratories where students learn to use professional software to implement the theoretical aspects.

*Prerequisite: ELECTENG 309*

*Restriction: ELECTENG 411*

## **ELECTENG 732 (15 Points)**

### **Communication Systems**

Analog AM and FM modulation. Noise in AM and FM systems. AM modulators and demodulators. Coherent and non-coherent receivers. Superheterodyne receivers. Multiplexing: FDM, TDM, CDMA. Pulse modulation. Nyquist theorem; PCM modulation and multiplexing. Baseband digital transmission; optimal filtering; matched filter detection; probability of error. Intersymbol interference, waveform coding and data compression, base-band data transmission. Introduction to digital systems and modulations.

*Prerequisite: ELECTENG 303 or 331*

*Restriction: ELECTENG 412*

## **ELECTENG 733 (15 Points)**

### **Digital Signal Processing**

Analysis and manipulation of discrete-time signals and systems. Spectral representations and analysis using the z-transform, discrete Fourier transform and fast Fourier transform. Introduction to stochastic processes. Hardware systems for processing digital signals.

*Prerequisite: ELECTENG 303 or 331 or ENGSCI 311 or 313*

*Restriction: ELECTENG 413*

## **ELECTENG 734 (15 Points)**

### **Power Electronics**

Selected advanced concepts in power electronics are introduced through a practical and research based individual design project, utilising modern power converter topologies with supporting lectures that include: inductive power transfer and control, DC-DC converter design and control, high frequency magnetics design, semiconductor switches, practical design issues, controlled rectifiers and PWM converters with application to conventional and brushless DC motors.

*Prerequisite: ELECTENG 305, 310, 311*

*Restriction: ELECTENG 414*

## **ELECTENG 735 (15 Points)**

### **Green Energy Technologies**

Advanced green energy technologies with examples from current industry practice and cutting edge research developments. Topics include: renewable energy systems, distributed power generation, energy storage techniques, transportation electrification, power converters for renewable energy integration, soft-switched resonant converters, wireless power transfer, new semiconductor devices, motor drives, and LED lighting.

*Prerequisite: ELECTENG 734*

## **ELECTENG 736 (15 Points)**

### **Analog and Digital Filter Synthesis**

Filter concepts and network functions, a review of approximation techniques and frequency transformations, leading to a thorough treatment of passive, active and digital filter implementations.

*Prerequisite: ELECTENG 303 or 331*

*Restriction: ELECTENG 416*

## **ELECTENG 738 (15 Points)**

### **Selected Topics in Advanced Power Systems**

Electricity markets: structure, pricing, optimisation,

ancillary services; Power system protection practices; Distribution Network Development: Smart Grids, Demand Side Participation, Integration of DG/renewable sources and Electric Vehicles. Core concepts are extended by an individual research project, a self-guided protection laboratory and industry engagement in advanced power system practices.

*Prerequisite: ELECTENG 731*

*Restriction: ELECTENG 703*

## **ELECTENG 770 (15 Points)**

### **Capstone Project**

Final year team exercise with students in multidisciplinary roles, with focus on electrical and electronic engineering, integrating technical learning into realistic design outcomes. Comprehensive investigation of an open-ended, complex, real or synthetic computer, electrical and software engineering problem with simulated professional design office constraints. Includes technical, economic and environmental impact components to complete a scheme assessment report.

*Prerequisite: 75 points from Part III courses listed in the BE(Hons) Schedule for the Electrical and Electronic Engineering specialisation*

## **Engineering General**

### **Part I**

#### **ENGEN 115 (15 Points)**

##### **Principles of Engineering Design**

An introduction to the principles of design as a fundamental part of engineering practice and a foundation for subsequent design courses. Students are also introduced to essential drawing skills and CAD, and complete group-based design projects. Topics include systems life cycle, design, and introductions to professional issues such as health and safety, ethics, sustainability, cultural diversity, communication, leadership, and teamwork.

## **ENGGEN 121 (15 Points)**

### **Engineering Mechanics**

An introduction to planar mechanics including: free body diagrams, planar equilibrium of rigid bodies, friction, distributed forces, internal forces, shear force and bending moment diagrams, kinematics and kinetics of particles, work and energy, relative motion, kinematics and kinetics of rigid bodies.

*Restriction: CIVIL 210, MECHENG 222*

## **ENGGEN 131 (15 Points)**

### **Introduction to Engineering Computation and Software Development**

Introduction to problem solving in engineering through the use of the software package MATLAB, and the programming language C.

*Restriction: ENGSCI 233, 331*

## **ENGGEN 140 (15 Points)**

### **Energy and Society**

How will we power the modern world? An introduction to chemistry and biology and their application to solving problems in energy, its transformation and use. Treatment of associated risks and uncertainties applied to decision making in energy will develop understanding of perspective taking, the social licence to operate, and the role of professional engineering skills in the community and society.

## **Part II**

## **ENGGEN 204 (15 Points)**

### **Professional Skills and Communication**

A system-wide view of the role of the professional engineer in society and business. The skills of advocacy, and individual and group-based communication are put into practice. Scenarios representative of real-world issues are addressed through team-based projects and problem solving. The professional issues introduced in ENGGEN 115 (health and safety, ethics, sustainability, cultural

diversity, communication, leadership, and teamwork) are continued and developed.

*Prerequisite: ENGGEN 115, 199*

## **Part III**

## **ENGGEN 303 (15 Points)**

### **Managing Projects and Innovation**

Introduction to theory and practice of managing projects, innovation, product development and service delivery. Students work in interdisciplinary teams to complete a project based on a complex real-world systems scenario. Project management and innovation topics are integrated with design studies covered in previous courses, and extended to wider business issues of risk and opportunities, entrepreneurship, financial management, and regulatory issues.

*Prerequisite: ENGGEN 199, 204*

## **Part IV**

## **ENGGEN 403 (15 Points)**

### **Managing a Business**

An introduction to the commercial drivers and business practices which prepare students for successful roles in the commercial, government, and non-profit sectors after graduation. Students are presented with a systems thinking approach to managing large, complex, multidisciplinary challenges. Professional issues (such as health and safety, sustainability, resilience, ethics, leadership, and cultural diversity) from previous courses are expanded.

*Prerequisite: BUSINESS 101 and 102, or BUSINESS 111 and 112, or DESIGN 220 or 221 or 222, or ECON 151 and GLOBAL 101, or ENGGEN 303 or LAW 241 or MUS 186 or 365 or PROPERTY 231 or SCIGEN 201*

## **ENGGEN 701 (15 Points)**

### **Professional Project**

A comprehensive investigation, analysis and

reporting of a complex engineering design, development or professional engineering problem. Problem synthesis, solution specification, development and reporting as approved by the Head of Department of Mechanical Engineering.

*Prerequisite: Departmental approval required*

*Restriction: ENGGEN 401, 405, 410, 705*

## **ENGGEN 705 (15 Points)**

### **Engineering Product Development**

Advanced topics in the engineering design and development of new manufactured products, taking an integrated approach including technical, commercial, and user aspects. Theory is linked to practice through multidisciplinary teams engaging in projects and case studies.

*Prerequisite: B grade or higher in ENGGEN 303*

*Restriction: ENGGEN 404, 405, 410, 701, MGMT 305*

## **Engineering Science**

### **Part I**

#### **ENGSCI 111 (15 Points)**

##### **Mathematical Modelling 1**

Introduction to mathematical modelling. Differentiation and integration (polynomials, trigonometric, exponential, logarithmic, and rational functions). Integration by parts, substitution and partial fractions. Differential equations and their solutions (including Euler's method). Vector and matrix algebra, transformations, solving systems of linear equations. Modelling using probability.

*Restriction: ENGSCI 211, 213, 311, 313, 314, MATHS 150, 153*

### **Part II**

#### **ENGSCI 205 (15 Points)**

##### **Special Topic**

#### **ENGSCI 211 (15 Points)**

##### **Mathematical Modelling 2**

First and second order ordinary differential equations and solutions. Laplace transforms. Taylor series and series in general. Multivariable and vector calculus including divergence, gradient and curl. Further linear algebra. Eigenvalues and eigenvectors. Fourier series. Application of the techniques through appropriate modelling examples. Introductory data analysis and statistics.

*Prerequisite: ENGGEN 150, or ENGSCI 111,*

*or a B+ or higher in MATHS 108 or 110 or 150 or 153, or a B+ or higher in MATHS 120 and 130*

*Restriction: ENGSCI 213*

#### **ENGSCI 233 (15 Points)**

##### **Computational Techniques and Computer Systems**

Introduction to computer architecture and computational techniques. Data representation, memory, hardware, interfacing, and limitations. Numerical computation and algorithms, coding design and paradigms.

*Prerequisite: ELECTENG 101 and ENGGEN 131, and ENGGEN 150 or ENGSCI 111*

*Corequisite: ENGSCI 211 or 213*

#### **ENGSCI 255 (15 Points)**

##### **Modelling and Analytics in Operations Research**

Emphasises the relationship between business and industrial applications and their associated operations research models. Software packages will be used to solve practical problems. Topics such as: linear programming, transportation and assignment models, network algorithms, queues, inventory models, simulation, analytics and visualisation will be considered.

*Prerequisite: 15 points at Stage I in Statistics or Mathematics or Engineering*

*Restriction: STATS 255*

## **ENGSCI 263 (15 Points)**

### **Engineering Science Design I**

Introduction to concepts of model design for engineering problems, including model formulation, solution procedures, validation, and shortcomings, with examples from topics in computational mechanics, operations research and data science. Further development of problem-solving skills and group project work. The use of computational models to support design-focused decision making while considering ethical and societal factors.

*Prerequisite:* ENGGEN 115, and ENGGEN 150 or ENGSCI 111

*Corequisite:* ENGSCI 211 or 213

## **Part III**

### **ENGSCI 309 (15 Points)**

#### **Image and Digital Signal Processing**

Fundamentals of image processing and digital signal processing. One dimensional signals and digital filters. Digital filtering with FIR and IIR filters and the Digital Fourier Transform (DFT). Two-dimensional signals, systems and analysis methods. 2D images, spatial sampling, grey-scale quantification, point operations, spatial operations, high pass filtering, sharpening images, noisy images, nonlinear image processing.

*Prerequisite:* ENGSCI 211 or 213

### **ENGSCI 311 (15 Points)**

#### **Mathematical Modelling 3**

A selection from: ordinary differential equations, systems of equations, analytical and numerical methods, non-linear ODEs, partial differential equations, separation of variables, numerical methods for solving PDEs, models for optimisation, industrial statistics, data analysis, regression, experimental design reliability methods.

*Prerequisite:* ENGSCI 211

*Restriction:* ENGSCI 313, 314

### **ENGSCI 313 (15 Points)**

#### **Mathematical Modelling 3ECE**

Complex Analysis, including complex numbers, analytic functions, complex integration, Cauchy's theorem, Laurent series, residue theory; Laplace transforms; Modelling with partial differential equations, including electronic and electrical applications; Fourier Analysis, Fourier transform, Fast Fourier transform; Optimisation, including unconstrained and constrained models, linear programming and nonlinear optimisation.

*Prerequisite:* ENGSCI 211

*Restriction:* ENGSCI 311, 314

### **ENGSCI 314 (15 Points)**

#### **Mathematical Modelling 3ES**

Mathematical modelling using ordinary and partial differential equations. Topics include: probability, conditional probability, random variables as models of a population, common distribution models, the Poisson process, applications to reliability, exploratory data analysis, confidence intervals, tests of hypothesis, t-tests, sample tests and intervals, paired comparisons. Introduction to one-way ANOVA. Linear and polynomial regression, regression diagnostics.

*Prerequisite:* ENGSCI 211

*Restriction:* ENGSCI 311, 313, 321

### **ENGSCI 331 (15 Points)**

#### **Computational Techniques 2**

Methods for computing numerical solutions of mathematical models and data analytics problems with focus on translating algorithms to computer code. A selection of topics from numerical solution of linear and non-linear equations, eigen problems, ordinary and partial differential equations, databases, inverse problems and parameter estimation.

*Prerequisite:* ENGSCI 233

*Corequisite:* ENGSCI 311 or 313 or 314

## **ENGSCI 343 (15 Points)**

### **Mathematical and Computational Modelling in Mechanics**

Development of macroscopic models of physical systems using fundamental mathematical techniques and physical laws. Topics include vector and tensor calculus including indicial notation and integral theorems, conservation laws, control volumes and constitutive equations, continuum assumptions, isotropy and homogeneity. Possible applications include deformation, strain and stress, fluid flow, electromagnetism, reactive chemical transport, and kinetics.

*Prerequisite: BIOMENG 221 or MECHENG 242, and ENGSCI 211 or 213*

*Restriction: BIOMENG 321*

## **ENGSCI 344 (15 Points)**

### **Modelling and Simulation in Computational Mechanics**

Solution of real-world continuum mechanics problems, using computational tools commonly used in engineering practice. This will develop skills in: analysing complexity and selecting an appropriate model representation of the physical problem; choosing the correct computational tool with which to solve the model; designing and executing appropriate numerical experiments using the chosen tool; validating, interpreting and communicating the simulation results.

*Prerequisite: BIOMENG 321 or ENGSCI 343*

*Restriction: ENGSCI 744*

## **ENGSCI 355 (15 Points)**

### **Applied Modelling in Simulation and Optimisation**

Use of optimisation modelling languages and simulation software, with an emphasis on practical problem solving and laboratory-based learning.

*Prerequisite: ENGSCI 255 or STATS 255*

*Restriction: OPSRES 385*

## **ENGSCI 363 (15 Points)**

### **Engineering Science Design II**

Application of computational engineering methods combined with optimisation techniques to complex engineering design problems. Group-based integrated design, prototype and test projects that include consideration of societal, ethical and professional engineering factors.

*Prerequisite: BIOMENG 241 or ENGSCI 263*

## **ENGSCI 391 (15 Points)**

### **Optimisation in Operations Research**

Linear programming, the revised simplex method and its computational aspects, duality and the dual simplex method, sensitivity and post-optimal analysis. Network optimisation models and maximum flow algorithms. Transportation, assignment and transshipment models, and the network simplex method. Introduction to integer programming.

*Prerequisite: 15 points from ENGGEN 150, ENGSCI 111, MATHS 208, 250, 253, and 15 points from COMPSI 101, ENGGEN 131, MATHS 162, STATS 220*

*Restriction: ENGSCI 765*

## **Part IV**

### **ENGSCI 700A (15 Points)**

### **ENGSCI 700B (15 Points)**

#### **Research Project**

An investigation carried out under the supervision of a member of staff on a topic assigned by the Head of Department of Engineering Science. A written report on the work must be submitted.

*To complete this course students must enrol in ENGSCI 700 A and B*

## **ENGSCI 711 (15 Points)**

### **Advanced Mathematical Modelling**

A selection of modules on mathematical modelling methods in engineering, including theory of partial methods of characteristics, similarity solutions,

differential equations, integral transforms, asymptotic expressions, theory of waves, special functions, non-linear ordinary differential equations, calculus of variations, tensor analysis, complex variables, wavelet theory and other modules offered from year to year.

*Prerequisite: 15 points from ENGSCI 311, 313, 314*

### **ENGSCI 712 (15 Points)**

#### **Computational Algorithms for Signal Processing**

Advanced topics in mathematical modelling and computational techniques, including topics on singular value decomposition, Principle Component Analysis and Independent Component Analysis, eigen-problems, and signal processing (topics on neural network models such as the multi-layer perception and self organising map).

*Prerequisite: 15 points from ENGSCI 311, 313, 314*

### **ENGSCI 740 (15 Points)**

#### **Advanced Mechanics in Research and Technology**

Applications of continuum mechanics to problems in biomechanics, fluid mechanics and solid mechanics. Including topics such as large deformation elasticity theory applied to soft tissues, inviscid flow theory, compressible flows, viscous flows, meteorology, oceanography, coastal ocean modelling, mixing in rivers and estuaries. Fracture, composite materials and geomechanics.

*Prerequisite: BIOMENG 321 or ENGSCI 343*

### **ENGSCI 741 (15 Points)**

#### **Waves and Fracture**

Advanced topics in mechanics including: waves and wave motion with applications to acoustics, optics, fluid flow problems and shock discontinuities using numerical methods. Fracture: modes of, displacement discontinuity in linear elasticity, stress intensity factor, spectral solution methods, finite friction. Applications include: hydraulic fracturing, earthquakes, macroscale strength of

materials.

*Prerequisite: BIOMENG 321 or ENGSCI 343*

### **ENGSCI 753 (15 Points)**

#### **Computational Techniques in Mechanics and Bioengineering**

Theoretical and applied finite element and boundary element methods for static and time dependent problems of heat flow, bioelectricity, linear elasticity and non-linear mechanics.

*Prerequisite: ENGGEN 131 or equivalent, and 15 points from ENGSCI 311, 313, 314*

### **ENGSCI 755 (15 Points)**

#### **Decision Making in Engineering**

Introduction to techniques for decision making in engineering systems including decision heuristics, simple prioritisation, outranking approaches, analytic hierarchy process, application to group decision making.

*Prerequisite: Departmental approval*

### **ENGSCI 760 (15 Points)**

#### **Algorithms for Optimisation**

Meta-heuristics and local search techniques such as Genetic Algorithms, Simulated Annealing, Tabu Search and Ant Colony Optimisation for practical optimisation. Introduction to optimisation under uncertainty, including discrete event simulation, decision analysis, Markov chains and Markov decision processes and dynamic programming.

*Prerequisite: COMPSCI 101 or ENGGEN 131*

### **ENGSCI 761 (15 Points)**

#### **Integer and Multi-objective Optimisation**

Computational methods for solving optimisation problems. Algorithms for integer programming including branching, bounding, cutting and pricing strategies. Algorithms for linear and integer programmes with multiple objective functions.

*Prerequisite: ENGSCI 391 or 765*

## **ENGSCI 762 (15 Points)**

### **Scheduling and Optimisation in Decision Making**

A course of advanced topics arising in the practical application of optimisation models for machine and resource scheduling, routing applications, staff rostering and performance measurement.

*Prerequisite: ENGSCI 391 or 765*

## **ENGSCI 763 (15 Points)**

### **Advanced Simulation and Stochastic Optimisation**

Advanced simulation topics with an emphasis on optimisation under uncertainty. Uniform and non-uniform random variate generation, input distribution selection, output analysis, variance reduction. Simulation-based optimisation and stochastic programming. Two-stage and multi-stage programs with recourse. Modelling risk. Decomposition algorithms. Scenario construction and solution validation.

*Prerequisite: ENGSCI 391 or 765*

## **ENGSCI 768 (15 Points)**

### **Advanced Operations Research and Analytics**

Advanced Operations Research and Analytics topics including selected theory, algorithms and applications for non-linear programming, smooth and non-smooth optimisation, equilibrium programming and game theory.

*Prerequisite: ENGSCI 391 or 765*

## **Environmental Engineering**

### **Part II**

#### **ENVENG 200 (15 Points)**

##### **Fundamentals of Environmental Engineering**

Introduction to environmental engineering principles. Role of environmental engineers in the

twenty-first century. Environmental measurements, environmental standards and impact assessment. 105 Material mass balance. Drinking water, wastewater and stormwater treatment. Air quality parameters. Solid waste management. Sustainability Environmental Impact Assessment.

*Prerequisite: ENGGEN 140*

*Restriction: ENVENG 244*

#### **ENVENG 244 (15 Points)**

##### **Environmental Engineering 1**

Water quality, water and wastewater characteristics – physical, chemical and biological treatments (unit operations and processes). Solid waste characteristics and disposal, hazardous waste treatment. Stormwater management.

*Restriction: ENVENG 243*

### **Part III**

#### **ENVENG 300 (15 Points)**

##### **Natural and Built Environment Processes**

Chemical and Biological treatment processes. Surface water quality modelling. Soil chemistry. Contaminant fate and transport in soil and groundwater. Contaminated sites remediation.

*Prerequisite: ENGGEN 200*

*Restriction: ENVENG 341*

#### **ENVENG 333 (10 Points)**

##### **Engineering Hydrology**

Hydrologic processes, analysis of rainfall-runoff relationships. Statistical analysis of hydrological data. Groundwater movement.

#### **ENVENG 341 (15 Points)**

##### **Environmental Engineering 2**

Examines natural environmental processes and their relevance to engineering. Soil and water

chemistry, equilibrium and organic chemistry, microbiology, biochemistry and biological processes will be examined, focusing on the application of these in engineering design, practice and management.

### **ENVENG 342 (15 Points)**

#### **Environmental Engineering Design**

The applications of design practice in environmental engineering with a number of design projects. Elements of water and wastewater engineering. Landfill design and air pollution control.

*Restriction: ENVENG 405*

## **Part IV**

### **ENVENG 701 (15 Points)**

#### **Urban Stormwater Management**

Design and application of stormwater runoff quantity and quality control systems for urban development including: bioretention, living roofs, swales, permeable/porous pavement, detention ponds, and constructed wetlands. An independent project couples technical design, safety, maintenance, construction, hydrologic and water quality modelling, and stakeholder engagement in an application of "Low Impact Design" from the site to the catchment scale.

*Prerequisite: ENVENG 244, 333*

### **ENVENG 740 (15 Points)**

#### **Water and Wastewater Engineering**

Chemistry and microbiology of water and wastewater treatment, flow models and reactors. Unit operations and process analysis and design. Treatment plant design and operation. Nutrient removal processes. Effluent and residues disposal.

### **ENVENG 746 (15 Points)**

#### **Surface Water Quality Modelling**

Advanced specialist topics in modelling of lakes

and rivers. Specific topics covered include response to different loadings applied to surface water systems, and modelling of organic matter, dissolved oxygen consumption, eutrophication, and toxic substances. The core taught skills are extended by an individual project in which independent research is undertaken to solve a challenging surface water quality engineering problem.

*Prerequisite: ENVENG 341, 342*

### **ENVENG 747 (15 Points)**

#### **Soil-Contaminant Fate Processes and Modelling**

Focuses on modelling sorption, degradation kinetics, and leaching of chemicals in the soil environment. Topics include deriving sorption parameters, parent and metabolite fitting with statistical rigours, calculating degradation end-points, novel adsorbents for removing contaminants in soil and water. The core taught skills are extended by an individual project in which independent research is undertaken to solve an environmental issue.

*Prerequisite: ENVENG 341 or equivalent*

## **Mechanical Engineering**

### **Part II**

#### **MECHENG 201 (15 Points)**

##### **Introduction to Mechatronics**

Introduces mechatronics to mechanical and mechatronics engineers. Covers sensors and actuators, analogue and digital circuit elements for signal processing and programming.

*Prerequisite: ELECTENG 101, ENGGEN 131*

#### **MECHENG 211 (15 Points)**

##### **Thermofluids**

The fundamentals of fluid mechanics, thermodynamics and heat transfer with practical applications to engineering devices and systems.

## **MECHENG 222 (15 Points)**

### **Dynamics**

Kinematics of particles, rectilinear and curvilinear motion, kinematics of rigid bodies in the plane. Kinetics of particles, systems of particles and rigid bodies. Impulse and momentum, mechanism motion in the plane. Vibration of a particle.

*Prerequisite: ENGGEN 121 or 150*

## **MECHENG 235 (15 Points)**

### **Design and Manufacture 1**

The engineering design process as a teamwork and problem-solving activity involving analysis, synthesis, evaluation and critical thinking. Design methodology and communicating design intent through written and graphical means. Introduction to selected motive power sources, machine elements for mechanical power systems, and production and fabrication processes

*Prerequisite: ENGGEN 115*

## **MECHENG 236 (15 Points)**

### **Design and Manufacture 2**

Machine elements and their use in engineering design, including internal combustion engines, clutches, brakes, and basic hydraulic and pneumatics systems and components. Material-based production processes and fabrication methods. Design reliability and safety. Basic principles of "Design for X".

*Prerequisite: MECHENG 235*

## **MECHENG 242 (15 Points)**

### **Mechanics of Materials 1**

Principles of elastic material behaviour in the design of load carrying elements. Statically determinate stress systems; stress-strain relations. Bending of beams: stress-moment and moment-curvature relations; beam deflections; buckling of struts. Shear in joints, couplings, beams and circular shafts. General analysis of plane stress. Introduction to failure criteria by yield and fracture.

*Prerequisite: ENGGEN 121 or 150*

## **MECHENG 270 (15 Points)**

### **Software Design**

Fundamentals of software design and high-level programming making use of case studies and programming projects. Includes: requirements analysis, specification methods, software architecture, software development environments, software quality, modularity, maintenance, reusability and reliability; models of software development.

*Restriction: COMPSYS 202, SOFTENG 281*

## **Part III**

## **MECHENG 311 (15 Points)**

### **Thermal Engineering**

Second Law of Thermodynamics, entropy. Cycles and applications. Heat transfer, heat exchangers.

*Prerequisite: MECHENG 211*

## **MECHENG 312 (15 Points)**

### **Sensors and Actuators**

Mechatronics engineering and its elements, including sensors, actuators and computer interfacing. The design of mechatronic systems. Topics include interfacing, signal conditioning and processing, sensors, actuators, control technologies, software, systems modelling, simulation, analysis and design.

## **MECHENG 313 (15 Points)**

### **Design of Real-Time Software**

Introduces the principles of software design in a real-time environment. Main topics include computer/microcontroller architecture, programming in a real-time environment, software design and data acquisition systems.

*Prerequisite: MECHENG 270*

## **MECHENG 322 (15 Points)**

### **Control Systems**

An introduction to classical control of mechanical and mechatronic systems. Topics include: transfer functions, block diagrams, time response characteristics, stability, frequency response characteristics, and controller design (eg, pole placement, lead-lag compensation, PID). Applications in MATLAB/Simulink and with physical systems.

*Prerequisite: ENGSCI 211, MECHENG 222*

## **MECHENG 325 (15 Points)**

### **Dynamics of Fluids and Structures**

3D rigid body dynamics - inertia tensor, Euler's equations, gyroscopic motion. Vibration of single and two degree of freedom systems. Applications to vibration engineering. Introductory acoustics and spectral analysis. Mass, linear momentum, angular momentum and energy equations. Application to internal and external flows, boundary layers, pumps, turbines and lifting bodies. Experimental and numerical methods, dimensional analysis, similarity, and flow measurement.

*Prerequisite: MECHENG 211, 222*

## **MECHENG 334 (15 Points)**

### **Engineering Design 3M**

Good practice and standard methods in mechanical engineering design. Conceptual and detailed design in projects involving machine elements, engineering sciences and engineering mechanics. Some of the advanced computer-aided tools (eg, CAD, CAM, CAE) will be introduced and utilised in some projects.

*Prerequisite: Prerequisite: MECHENG 235, 236, 242*

## **MECHENG 340 (15 Points)**

### **Mechanics of Materials 2**

Complex material behaviour and structural analysis, extending capability from two to three dimensions. States of stress and strain at a point in

a general three-dimensional stress system. Generalised stress-strain relations for linearly elastic isotropic materials. Failure theories for ductile and brittle materials, elementary plasticity, and fatigue. Analytical techniques and numerical analysis of complex mechanical elements.

*Prerequisite: MECHENG 242*

## **MECHENG 352 (15 Points)**

### **Manufacturing Systems**

An introduction to the procedures and technological aspects of a typical manufacturing system; basic concepts and practice of plant and work design, automation, CAD/CAM, planning and simulation; selected IoT technologies; and project-based introduction to the tools and techniques applied by professional engineers in a modern manufacturing setting.

*Restriction: MECHENG 351*

## **MECHENG 370 (15 Points)**

### **Electronics and Signal Processing**

An introduction to the design, analysis and implementation of electronic circuits or systems for various applications such as signal generation and processing, interfacing, and high power electronics.

*Prerequisite: ELECTENG 101 or MECHENG 201*

## **MECHENG 371 (15 Points)**

### **Digital Circuit Design**

Fundamental concepts in the design of combinational and sequential logic circuits. Modern approach to design using CAD tools that exploit the advantage of automation. Students will be exposed to the use of FPGA to rapid prototype digital systems using schematic and hardware description language entries.

*Prerequisite: ELECTENG 101 or MECHENG 201*

## Part IV

### MECHENG 700A (15 Points)

### MECHENG 700B (15 Points)

#### Research Project

Supervised research on a topic in engineering culminating in an independent written project report that includes a literature review, a description of the research and its findings, and a statement of research contribution. Further supporting technical material will be provided as a compendium.

*Prerequisite:* 75 points from Part III courses in the BE(Hons) Schedule.

*Restriction:* MECHENG 407, 408, 461, 462, 762, 763

To complete this course students must enrol in MECHENG 700 A and B

### MECHENG 705 (15 Points)

#### Mechatronics Systems

Fundamentals of digital control and signal processing as applied to mechatronics systems. Modelling and analysis of mechatronics systems that includes transducers and applications. Issues related to mechatronics systems such as thermal management, signal detection, filtering and integrity, etc.

*Prerequisite:* MECHENG 312, 322

### MECHENG 706 (15 Points)

#### Mechatronics Design

A range of projects that demonstrate the application and integration of engineering knowledge to create practical intelligent devices, machines and systems. AI based control techniques will be introduced.

*Prerequisite:* MECHENG 312, 322

### MECHENG 709 (15 Points)

#### Industrial Automation

Automation technologies widely used in manufacturing and processing industries. Topics

include industrial robotics; programmable logic controllers (PLCs); pneumatics; machine vision systems; automated assembly; design for automation; and Industry 4.0 (such as machine-to-machine communications and data analysis). Students will participate in a number of hands-on labs throughout the course.

*Restriction:* MECHENG 710

### MECHENG 712 (15 Points)

#### Aerohydrodynamics

The study of fluid mechanics relevant to external flows, eg, wind turbines, yachts, aircraft or wind loadings on buildings, boundary layers, computational fluid dynamics.

*Prerequisite:* MECHENG 325

### MECHENG 713 (15 Points)

#### Energy Technology

Industrial thermodynamics and energy conversion/efficiency, power cycles, availability and irreversibility, simple combustion analysis, mass transfer, energy studies, boiling and condensation.

*Prerequisite:* MECHENG 311

### MECHENG 715 (15 Points)

#### Building Services

Principles and practice of heating, ventilation, air-conditioning and refrigeration (HVAC&R), psychrometry, heating/cooling loads, mass transfer and air quality, refrigeration/heat pump systems, cooling towers, pumps, fans, valves, pipes and ducts.

*Prerequisite:* MECHENG 325

### MECHENG 722 (15 Points)

#### Engineering Vibrations

Selected topics in vibration engineering: Multiple degree of freedom and continuous systems; Spectral analysis; analytical, approximate and numerical methods, including FEA; vibration instrumentation, measurement and testing; modal

analysis; vibration treatment.

*Prerequisite: MECHENG 325 or equivalent*

*Restriction: MECHENG 719*

## **MECHENG 724 (15 Points)**

### **Multivariable Control Systems**

Advanced control of mechanical and mechatronic systems. Topics include: state-space representations, linearisation, discretisation, stability, state feedback control design, optimal control, state estimation and Kalman filters. Applications in MATLAB/Simulink and with physical systems.

*Prerequisite: MECHENG 322*

*Restriction: ELECTENG 722, MECHENG 720*

## **MECHENG 726 (15 Points)**

### **Acoustics for Engineers**

Wave equations, sources, directionality; behaviour of sound waves. Principles of active control for sound. The ear and hearing system. Measurement of sound fields and acoustic properties of rooms. Philosophy of annoyance. Legal and Standards requirements. Sound fields in enclosures. Mass Law. General insulation equation. Materials as absorbers and reflectors, room acoustics, requirements in auditoria, sound system design principles and transducer performance. Electro-acoustics and audio signal processing.

*Prerequisite: MECHENG 325*

## **MECHENG 731 (15 Points)**

### **Engineering Design 4M**

A variety of engineering projects requiring the development and communication of design solutions to a professional standard, and using a wide range of advanced engineering methods.

*Prerequisite: MECHENG 334*

## **MECHENG 735 (15 Points)**

### **MEMS and Microsystems**

Introduction to working principles and fabrication of MEMS/microsystems such as microsensors, microactuators, microfluidics, etc. Exposure to engineering design principles including engineering mechanics, fluidics, materials, etc. at microscale. Exposure to microfabrication processes as part of a laboratory component.

*Prerequisite: MECHENG 325*

*Restriction: MECHENG 728*

## **MECHENG 736 (15 Points)**

### **Biomechatronic Systems**

Mechatronic principles and techniques for measuring, assisting, augmenting and mimicking biological systems. Topics include: brain machine interfaces, sensors and actuators, biomechanics and motion control, wearable and assistive devices, bioinstrumentation, soft robotic technologies, human factors, safety/ethical aspects, and biomechatronic design principles. Significant hands-on experience through the design, modelling and development of paradigmatic biomechatronic systems.

*Prerequisite: MECHENG 312*

*Restriction: MECHENG 730*

## **MECHENG 743 (15 Points)**

### **Composite Materials**

Applications and manufacturing of composite materials. Mechanics of composite lamina/laminate. Failure prediction, design and finite element analysis of composite laminates and structures. Analysis and design of sandwich structures.

*Prerequisite: MECHENG 340*

## **MECHENG 747 (15 Points)**

### **Manufacturing and Industrial Processes**

Theory of plasticity; material characterisation; process analyses; extrusion, wire drawing, forging, rolling; metal cutting: thin shear model and Merchant's diagram, tool wear and tool life; sheet forming; forming limit diagram; thermal analyses of industrial operations including polymer

processing; basic polymer science: thermosets and thermoplastics, profile extrusion, sheet extrusion; blown-film extrusion, filament extrusion, blow moulding.

*Prerequisite: MECHENG 340*

## **MECHENG 752 (15 Points)**

### **Technology Management**

An appreciation of the strategic systems and technology management aspects of manufacturing systems. Industry based projects that explore the design and optimisation of manufacturing operations form a major part of the course.

*Prerequisite: Grade of B or higher in ENGGEN 303*

## **Software engineering**

### **Part II**

#### **SOFTENG 206 (15 Points)**

##### **Software Engineering Design 1**

Project work. Skills and tools in systematic development of software, including testing, version control, build systems, working with others.

*Prerequisite: SOFTENG 251 or 281*

#### **SOFTENG 211 (15 Points)**

##### **Software Engineering Theory**

Sets. Formal languages, operations on languages. Deterministic and nondeterministic automata, designing automata, determinisation. Regular expressions. Logic. Induction. Recursion. Program correctness. Computability. Counting. Elements of graph algorithms.

*Prerequisite: ENGGEN 131 or COMPSCI 101*

#### **SOFTENG 250 (15 Points)**

##### **Introduction to Data Structures and Algorithms**

Introduction to the analytical and empirical behaviour of basic algorithms and data structures.

*Prerequisite: ENGGEN 131 or COMPSCI 101*

*Corequisite: ENGSCI 271*

#### **SOFTENG 251 (15 Points)**

##### **Object Oriented Software Construction**

An introduction to Object Oriented software development. Programming with classes; objects and polymorphism. Evolutionary and test-driven development. Analysis and design. Modelling with UML. Design patterns. Design for reuse, for testing, and for ease of change.

*Prerequisite: ENGGEN 131 or COMPSCI 101*

#### **SOFTENG 254 (15 Points)**

##### **Quality Assurance**

Software verification and validation. Static and dynamic QA activities as part of the software lifecycle. Unit, integration, system, and usability testing. Use of visual notations, automation, and tools to support development activities. Metrics to quantify strength of testing and complexity of programs.

*Prerequisite: SOFTENG 250, 251*

#### **SOFTENG 281 (15 Points)**

##### **Object-Oriented Programming**

Computer programming using objects as the mechanism for modularity, abstraction, and code reuse. Review of control structures for conditionals and iteration. Instance variables, methods, and encapsulation. Interfaces, inheritance, polymorphism, and abstract classes. Exception handling. Introduction to basic data structures and basic algorithms including sorting and searching.

*Prerequisite: COMPSCI 101 or ENGGEN 131*

*Restriction: COMPSYS 202, MECHENG 270, SOFTENG 250, 251*

#### **SOFTENG 282 (15 Points)**

##### **Software Engineering Theory**

Theoretical foundations of software engineering, including sets, formal languages, operations on languages, deterministic and nondeterministic

automata, designing automata, determinisation, regular expressions, logic, induction, recursion, program correctness, computability, counting, elements of graph algorithms

*Prerequisite: COMPSCI 101 or ENGGEN 131*

*Restriction: SOFTENG 211*

## **SOFTENG 283 (15 Points)**

### **Software Quality Assurance**

Software verification and validation. Static and dynamic quality assurance activities as part of the software lifecycle. Unit, integration, system, and usability testing. Metrics to quantify strength of testing and complexity of programs. Techniques for engineering of software systems including requirements, specification, validation, verification. Modelling paradigms including information, behaviour, domain, function and constraint models. Specification languages.

*Prerequisite: COMPSYS 202 or SOFTENG 251 or 281*

*Restriction: SOFTENG 254*

## **SOFTENG 284 (15 Points)**

### **Data Structures and Algorithms**

Data structures including linked-lists, stacks, queues, trees, hash tables; graph representations and algorithms, including minimum spanning trees, traversals, shortest paths; introduction to algorithmic design strategies; correctness and performance analysis.

*Prerequisite: COMPSYS 202 or SOFTENG 251 or 281*

*Restriction: SOFTENG 250*

## **Part III**

## **SOFTENG 306 (15 Points)**

### **Software Engineering Design 2**

Working in project teams to develop software to meet changing requirements for a large application. Project Planning. Requirements gathering. Estimating, costing and tracking. Acceptance and unit testing. Evolutionary design and development. Collaborative development tools.

*Prerequisite: SOFTENG 206, and 254 or 283, and 350*

## **SOFTENG 310 (15 Points)**

### **Software Evolution and Maintenance**

Design and maintenance of multi-version software, debugging techniques, design and documentation for software re-use, programme migration and transformation, refactoring, tools for software evolution and maintenance.

*Prerequisite: SOFTENG 254 or 283*

## **SOFTENG 325 (15 Points)**

### **Software Architecture**

Taxonomy of software architecture patterns, including client/server and multi-tier. Understanding quality attributes. Methodologies for design of software architectures. Technologies for architecture level development, including middleware.

*Prerequisite: COMPSYS 302 or SOFTENG 254 or 283*

## **SOFTENG 350 (15 Points)**

### **Human Computer Interaction**

Human behaviour and humans' expectations of computers. Computer interfaces and the interaction between humans and computers. The significance of the user interface, interface design and user centred design process in software development. Interface usability evaluation methodologies and practice. Includes an evaluation project, group design project, and implementation using current techniques and tools.

*Prerequisite: SOFTENG 206*

*Restriction: COMPSCI 345, 370*

## **SOFTENG 351 (15 Points)**

### **Fundamentals of Database Systems**

Relational model, Relational algebra, Relational calculus, SQL, SQL and programming languages, Entity-Relationship model, Normalisation, Query

processing, Query optimisation, Distributed databases, Transaction management, Concurrency control, Database recovery.

*Prerequisite: SOFTENG 251 or 281*

*Restriction: COMPSCI 351*

### **SOFTENG 364 (15 Points)**

#### **Networks and Security (previously Computer Networks)**

Physical networks, TCP/IP protocols, switching methods, network layering and components, network services. Information security, computer and network security threats, defence mechanisms and encryption.

*Prerequisite: COMPSYS 201, and SOFTENG 251 or 281*

### **SOFTENG 370 (15 Points)**

#### **Operating Systems**

History of operating systems. Multi-user systems. Scheduling. Concurrent processes, threads and synchronisation. Memory allocation and virtual memory. Managing files, disks and other peripherals. Security, protection and archiving. Engineering distributed systems; location, migration and replication transparency. Real-time programming and embedded systems.

*Prerequisite: COMPSYS 201, and SOFTENG 251 or 281*

*Restriction: COMPSCI 340*

## **Part IV**

### **SOFTENG 700A (15 Points)**

### **SOFTENG 700B (15 Points)**

#### **Research Project**

Students are required to submit a report on project work carried out on a Software Engineering topic assigned by the Head of Department.

*Prerequisite: SOFTENG 306*

*To complete this course students must enrol in*

*SOFTENG 700 A and B*

### **SOFTENG 701 (15 Points)**

#### **Advanced Software Engineering Development Methods**

Advanced studies in methods and techniques for developing complex software systems including topics in software engineering environments, advanced software design, tool construction and software architectures. The core taught skills are extended by individual projects in which independent research is undertaken to address challenging software system problems.

*Prerequisite: COMPSYS 302 or SOFTENG 306*

### **SOFTENG 702 (15 Points)**

#### **Advanced Human Computer Interaction**

Advanced topics in human computer interaction and human aspects of computer systems relevant to commercial solution development and computer science research. Sample topics: advanced evaluation methods; support of pen and touch-based interaction; trends with domain specific user interface design, such as interfaces for enterprise systems.

*Prerequisite: COMPSCI 345 or SOFTENG 350*

*Restriction: COMPSCI 705*

### **SOFTENG 750 (15 Points)**

#### **Software Development Methodologies**

Software lifecycle; software process models; examples of software processes; software process improvement; project management; tool support for software development; issues in software engineering.

*Prerequisite: SOFTENG 306*

*Restriction: COMPSCI 732*

### **SOFTENG 751 (15 Points)**

#### **High Performance Computing**

Advanced parallel and high performance

computing concepts and techniques such as parallel system architecture; parallelisation concepts, algorithms and methodology; parallel programming paradigms and technologies. Core concepts and skills are deepened by a hands-on research project in which a challenging parallel computing problem is analysed and solved.

*Prerequisite: COMPSYS 302 or SOFTENG 306*

### **SOFTENG 752 (15 Points)**

#### **Formal Specification and Design**

Formal specification, design, and (automatic) analysis of software systems. Quality assurance through precise description and rigorous verification on the design. Introduction to the Z, OCL, and CSP notations. Comparison of approaches, emphasising on their practical application.

*Prerequisite: SOFTENG 306*

### **SOFTENG 753 (15 Points)**

#### **Bayesian Machine Learning**

Examines classic and state of the art algorithms in the field of machine learning. Topics will include: Bayesian classification, regression and state estimation; clustering and mixture models; kernel-based methods; sequential models; graphical models; neural networks and deep architectures.

*Prerequisite: ENGSCI 211 or 213, and SOFTENG 251 or 281*

### **SOFTENG 754 (15 Points)**

#### **Advanced Software Requirements Engineering**

*(previously Software Requirements Engineering)*

Advanced software engineering concepts focusing on techniques for requirements analysis and requirements engineering (RE) of software systems. Topics will include: requirements elicitation, analysis, specification, validation, verification, user experience design, test-driven development, and continuous integration.

*Prerequisite: COMPSYS 302 or SOFTENG 251 or 281*

### **SOFTENG 761 (15 Points)**

#### **Advanced Agile and Lean Software Development**

*(previously Agile and Lean Software Development)*

Advanced software engineering concepts focussing on Agile and Lean software development; including hands-on iterative and incremental software development, self-organising teamwork, project management, and an individual research component to explore challenging issues in this discipline.

*Prerequisite: SOFTENG 306 or equivalent*

### **SOFTENG 762 (15 Points)**

#### **Robotics Process Automation**

Covers the fundamentals of Robotic Process Automation (RPA) systems. Students explore what RPA is and where it is useful, how RPA fits into current information technology setups, extracting and manipulating data from both external and internal sources, generating reports and statistics, and orchestrating multi-robot installations.

*Prerequisite: SOFTENG 306*

### **SOFTENG 770 (15 Points)**

#### **Capstone Project**

Final year team exercise with students in multidisciplinary roles, with focus on software engineering, integrating technical learning into realistic design outcomes. Comprehensive investigation of an open ended, complex, real or synthetic computer, electrical and software engineering problem with simulated professional design office constraints. Includes technical, economic and environmental impact components to complete a scheme assessment report.

*Prerequisite: 75 points from Part III courses*

*listed in the BE(Hons) Schedule for the Software Engineering specialisation*

# Structural engineering

## Part II

### STRCTENG 200 (15 Points)

#### Introductory Structural Mechanics

Introduction to structural analysis for civil engineers. Equilibrium, internal actions and deformations, structural forms, structural systems, analysis of determinate systems, plane section properties, elasticity, engineering beam theory, failure theories. Prepares students to embark on further studies in structural design.

*Prerequisite: ENGGEN 121*

*Restriction: CIVIL 210*

### STRCTENG 201 (15 Points)

#### Civil Engineering Materials and Design

Properties and manufacturing of civil engineering material including concrete, steel, timber structural products and roading material. Design principles and examples for concrete, steel and timber members.

*Restriction: CIVIL 250*

## Part III

### STRCTENG 300 (15 Points)

#### Design Loads and Dynamic Response of Structures

Determination of design loads according to AS/NZS1170 and the response of structures under dynamic loadings.

*Prerequisite: CIVIL 210 or STRCTENG 200*

*Restriction: CIVIL 314*

### STRCTENG 301 (15 Points)

#### Timber Structures Design

Structural analytical techniques including computer based approaches to simple indeterminate structures. Design procedures for members and structural systems of timber and engineered wood products. Design project.

*Prerequisite: CIVIL 210 or STRCTENG 200*

*Restriction: CIVIL 312*

### STRCTENG 302 (15 Points)

#### Steel Structures Design

Mechanical properties of steel and contextualizes the application of steel and steel/concrete into buildings and bridges. Comprehensive introduction to design of structural steel members and connections and their use in structures. Application to vertical load carrying systems and steel building behaviour in earthquake and fire.

*Prerequisite: CIVIL 210 or STRCTENG 200*

*Restriction: CIVIL 313*

### STRCTENG 303 (15 Points)

#### Concrete Structures Design

Design of reinforced concrete members including beams, columns, walls, foundations. Introduction to prestressed and precast concrete design and applications. Use of the NZ Concrete Structures Standard, NZS 3101.

*Prerequisite: CIVIL 210 or STRCTENG 200*

*Restriction: CIVIL 313*

### STRCTENG 304 (15 Points)

#### Structural Design for Civil Engineers

Structural loading for gravity and wind in accordance with the loading code AS/NZS1170. Design principles and examples for concrete and timber members and design for timber framed buildings using NZS3604. Introduction to seismic building behaviour at a conceptual level.

*Prerequisite: CIVIL 210 or STRCTENG 200*

*Restriction: CIVIL 312, 313*

## Part IV

### STRCTENG 710 (15 Points)

#### Low Rise Structures Design

Structural systems for low-rise buildings, including

seismic design and analysis techniques. Design and detailing of low-rise structures in structural steel, reinforced concrete, reinforced masonry, and timber. Strut and tie design for reinforced concrete. Introduction to fire engineering. Techniques in the checking of existing structures and lessons learnt from failures.

*Prerequisite: STRCTENG 302, and CIVIL 313 or STRCTENG 303*

*Restriction: CIVIL 713*

### **STRCTENG 711 (15 Points)**

#### **Multistorey Structures Design**

Techniques for the design of multistorey structures to resist seismic loading. Derivation of design actions, alternative structural systems for resisting these loads, design of structural components subject to cyclic inelastic action, detailing of members and joints to enhance earthquake resistance. Techniques of seismic isolation.

*Prerequisite: STRCTENG 302, and CIVIL 313 or STRCTENG 303*

*Restriction: CIVIL 714*





# APPENDIX - 2019 Calendar Regulations

Students enrolled in the BE(Hons) prior to 2020 will complete their degree under the 2019 Calendar Regulations. Visit <https://cdn.auckland.ac.nz/assets/calendar/docs/2019-CalendarBook1.pdf> for more details.

## Civil Engineering

| Part II      |              | Part III                     |              | Part IV                     |              |
|--------------|--------------|------------------------------|--------------|-----------------------------|--------------|
| 120 points   |              | 120 points                   |              | 120 points                  |              |
| Semester One | Semester Two | Semester One                 | Semester Two | Semester One                | Semester Two |
| CIVIL 201    | CIVIL 211    | CIVIL 322                    | CIVIL 361    | CIVIL 705A                  | CIVIL 705B   |
| CIVIL 210    | CIVIL 221    | CIVIL 331                    | ENGSCI 311   | CIVIL 790                   | ENGGEN 403   |
| CIVIL 220    | CIVIL 250    | CIVIL 360                    | ENVENG 333   | Elective                    | CIVIL 756    |
| CIVIL 230    | ENGGEN 204   | ENGGEN 303                   | Elective     | Elective                    | Elective     |
| ENGSCI 211   | ENVENG 244   | Elective                     | Elective     | Part IV Elective A Options: |              |
|              |              | Part III Elective A Options: |              | Semester One                | Semester Two |
|              |              | Semester Two                 | Semester Two | CIVIL 713                   | CIVIL 714    |
|              |              | CIVIL 312                    | CIVIL 313    | CIVIL 715                   | CIVIL 725    |
|              |              | ENVENG 341                   | ENVENG 342   | CIVIL 718                   | CIVIL 726    |
|              |              |                              |              | CIVIL 719                   | CIVIL 734    |
|              |              |                              |              | CIVIL 721                   | CIVIL 741    |
|              |              |                              |              | CIVIL 722                   | CIVIL 743    |
|              |              |                              |              | CIVIL 731                   | CIVIL 750    |
|              |              |                              |              | CIVIL 733                   | CIVIL 759    |
|              |              |                              |              | CIVIL 758                   | CIVIL 758    |
|              |              |                              |              | CIVIL 791                   | CIVIL 782    |
|              |              |                              |              | ENVENG 740                  | ENVENG 701   |
|              |              |                              |              | ENVENG 746                  | ENVENG 702   |
|              |              |                              |              | ENVENG 747                  | ENVENG 707   |
|              |              |                              |              | Part IV Elective B Options: |              |
|              |              |                              |              |                             | Semester Two |
|              |              |                              |              |                             | CIVIL 710    |
|              |              |                              |              |                             | ENGGEN 701   |

This schedule is designed as a reference for students who have entered the BEHONS programme prior to 2020. Please use this appendix in conjunction with course planning information which can be found at [https://uoa.custhelp.com/app/answers/detail/a\\_id/16182/kw/engineering%20software/p/212](https://uoa.custhelp.com/app/answers/detail/a_id/16182/kw/engineering%20software/p/212)

### Please note:

- Students are also required to complete ENGGEN 299 Workshop Practice in Part II and ENGGEN 499 Practical Work before and during Part IV.
- For further information on elective courses or for detailed information on all courses, visit <https://courses.foe.auckland.ac.nz/course>, or see the back of this handbook.

# Computer Systems Engineering

| Part II      |              | Part III     |   | Part IV      |   |  |
|--------------|--------------|--------------|---|--------------|---|--|
| 120 points   |              | 120 points   |   | 120 points   |   |  |
| Semester One | Semester Two | Semester One | Semester Two  | Semester One | Semester Two  |  |
| COMPSYS 201  | COMPSYS 202  | COMPSYS 302  | COMPSYS 301   | COMPSYS 700A | COMPSYS 700B  |  |
| ELECTENG 202 | ELECTENG 204 | COMPSYS 305  | ELECTENG 303  | Elective     | ENGGEN 403  |  |
| ELECTENG 210 | ELECTENG 209 | ENGGEN 303   | Elective  | Elective     | Elective  |  |
| ENGSCI 211   | ENGGEN 204   | ENGSCI 313   | Elective  | Elective     | Elective  |  |
|              |              |              | Part III Elective Options:                                |              | Part IV Elective A Options:   |  |
|              |              |              | Semester Two<br>COMPSYS 303<br>COMPSYS 304<br>SOFTENG 325 |              | Semester One<br>COMPSYS 701<br>COMPSYS 723<br>COMPSYS 726<br>COMPSYS 722<br>COMPSYS 726<br>ELECTENG 722<br>ELECTENG 732<br>ELECTENG 733<br>ELECTENG 734<br>SOFTENG 701<br>SOFTENG 751 |  |
|              |              |              | Or other approved course                                  |              | Semester Two<br>COMPSYS 704<br>COMPSYS 705<br>COMPSYS 725<br>ELECTENG 704<br>ELECTENG 706<br>ELECTENG 726<br>SOFTENG 761  |  |
|              |              |              | Part IV Elective B Options:                               |              |   |  |
|              |              |              | Semester Two<br>ENGGEN 701                                |              |   |  |

This schedule is designed as a reference for students who have entered the BEHONS programme prior to 2020. Please use this appendix in conjunction with course planning information which can be found at [https://uoa.custhelp.com/app/answers/detail/a\\_id/16182/kw/engineering%20software/p/212](https://uoa.custhelp.com/app/answers/detail/a_id/16182/kw/engineering%20software/p/212)

### Please note:

- Students are also required to complete ENGGEN 299 Workshop Practice in Part II and ENGGEN 499 Practical Work before and during Part IV.
- All courses in table above are 15 points in value.
- For further information on elective courses or for detailed information on all courses, visit <https://courses.foe.auckland.ac.nz/course>, or see the back of this handbook.

# Electrical and Electronic Engineering

| Part II      |              | Part III   |   | Part IV  |  |
|--------------|--------------|--|---|--|--|
| 120 points   |              | 120 points   |   | 120 points   |  |
| Semester One | Semester Two | Semester One   | Semester Two  | Semester One   | Semester Two   |
| COMPSYS 201  | COMPSYS 202  | ELECTENG 310   | ELECTENG 303  | ELECTENG 700A  | ELECTENG 700B  |
| ELECTENG 202 | ELECTENG 204 | ENGGEN 303   | ELECTENG 305  | Elective   | ENGGEN 403   |
| ELECTENG 210 | ELECTENG 209 | ENGSCI 313   | ELECTENG 311  | Elective   | Elective   |
| ENGSCI 211   | ENGGEN 204   | Elective   | Elective  | Elective   | Elective   |
|              |              | Part III Elective Options:                                 |   | Part IV Elective A Options:  |  |
|              |              | Semester Two<br>COMPSYS 302<br>COMPSYS 305<br>ELECTENG 307 | Semester Two<br>COMPSYS 303<br>COMPSYS 304<br>ELECTENG 309<br>SOFTENG 325 | Semester One<br>COMPSYS 723<br>COMPSYS 726<br>ELECTENG 721<br>ELECTENG 722<br>ELECTENG 731<br>ELECTENG 732<br>ELECTENG 733<br>ELECTENG 734 | Semester Two<br>COMPSYS 704<br>COMPSYS 725<br>ELECTENG 703<br>ELECTENG 704<br>ELECTENG 706<br>ELECTENG 726<br>ELECTENG 735<br>ELECTENG 736<br>ELECTENG 738 |
|              |              | Or other approved course                                   |   | Or other approved course   |  |
|              |              |  |   | Part IV Elective B Options:  |  |
|              |              |  |   | Semester Two<br>ENGGEN 701   |  |

This schedule is designed as a reference for students who have entered the BEHONS programme prior to 2020. Please use this appendix in conjunction with course planning information which can be found at [https://uoa.custhelp.com/app/answers/detail/a\\_id/16182/kw/engineering%20software/p/212](https://uoa.custhelp.com/app/answers/detail/a_id/16182/kw/engineering%20software/p/212)

**Please note:**

- Students are also required to complete ENGGEN 299 Workshop Practice in Part II and ENGGEN 499 Practical Work before and during Part IV
- All courses in table above are 15 points in value
- For further information on elective courses or for detailed information on all courses, visit <https://courses.foe.auckland.ac.nz/course>, or see the back of this handbook

# Software Engineering

| Part II      |              | Part III                 |                            | Part IV                         |                           |  |
|--------------|--------------|--------------------------|----------------------------|---------------------------------|---------------------------|--|
| 120 points   |              | 120 points               |                            | 120 points                      |                           |  |
| Semester One | Semester Two | Semester One             | Semester Two               | Semester One                    | Semester Two              |  |
| COMPSYS 201  | ENGGEN 204   | ENGGEN 303               | SOFTENG 306                | SOFTENG 700A                    | SOFTENG 700B              |  |
| ENGSCI 211   | SOFTENG 206  | SOFTENG 350              | SOFTENG 325                | Elective                        | ENGGEN 403                |  |
| SOFTENG 250  | SOFTENG 211  | SOFTENG 351              | Elective                   | Elective                        | Elective                  |  |
| SOFTENG 251  | SOFTENG 254  | SOFTENG 370              | Elective                   | Elective                        | Elective                  |  |
|              |              |                          | Part III Elective Options: |                                 | Part IV Elective Options: |  |
|              |              | Semester Two             | Semester Two               | Semester One                    | Semester Two              |  |
|              |              | COMPSCI 373              | COMPSCI 367                | COMPSYS 723                     | COMPSYS 705               |  |
|              |              | COMPSYS 305              | COMPSYS 303                | COMPSYS 726                     | SOFTENG 702               |  |
|              |              |                          | COMPSYS 304                | ENGSCI 760                      | SOFTENG 752               |  |
|              |              |                          | SOFTENG 364                | SOFTENG 701                     | SOFTENG 761               |  |
|              |              | Or other approved course |                            | SOFTENG 750                     | SOFTENG 762               |  |
|              |              |                          |                            | SOFTENG 751                     |                           |  |
|              |              |                          |                            | SOFTENG 754                     |                           |  |
|              |              |                          |                            | Or an approved 700 level course |                           |  |

This schedule is designed as a reference for students who have entered the BEHONS programme prior to 2020. Please use this appendix in conjunction with course planning information which can be found at [https://uoa.custhelp.com/app/answers/detail/a\\_id/16182/kw/engineering%20software/p/212](https://uoa.custhelp.com/app/answers/detail/a_id/16182/kw/engineering%20software/p/212)

► **Please note:**

- Students are also required to complete ENGGEN 299 Workshop Practice in Part II and ENGGEN 499 Practical Work before and during Part IV
- All courses in table above are 15 points in value
- For further information on elective courses or for detailed information on all courses, visit <https://courses.foe.auckland.ac.nz/course>, or see the back of this handbook.

# Find out more

## Need help and advice?

Visit or get in contact with us at the Engineering Student's Centre:

Faculty of Engineering Building

Level 4, 20 Symonds Street

Open: Monday to Friday 8.30am-4.30pm (except public holidays)

Email: [foe-enquiries@auckland.ac.nz](mailto:foe-enquiries@auckland.ac.nz)

Phone: 0800 61 62 63

+64 9 923 1969 (overseas)

[www.engineering.auckland.ac.nz](http://www.engineering.auckland.ac.nz)

Find answers to your questions at

[www.askauckland.ac.nz](http://www.askauckland.ac.nz)

Find more information about undergraduate study in the Faculty of Engineering at:

<https://www.auckland.ac.nz/en/study/study-options/find-a-study-option/bachelor-of-engineering-honours-behens.html>

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### TIHUA

Follow us on Twitter

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### PAEĀHUA

Check us out on Instagram

[www.instagram.com/uoaengineering](http://www.instagram.com/uoaengineering)



## Resources for students

### The Faculty of Engineering

[www.engineering.auckland.ac.nz](http://www.engineering.auckland.ac.nz)

### Canvas

<https://canvas.auckland.ac.nz>

### Current students

<https://www.auckland.ac.nz/en/engineering/current-students/undergraduate.html>

### How to enrol in courses

[www.auckland.ac.nz/enrolment](http://www.auckland.ac.nz/enrolment)

### IT Help

[www.engineering.auckland.ac.nz/engineering-IT](http://www.engineering.auckland.ac.nz/engineering-IT)

### Key dates

[www.auckland.ac.nz/dates](http://www.auckland.ac.nz/dates)

### MyAucklandUni

[www.myaucklanduni.ac.nz](http://www.myaucklanduni.ac.nz)

### Student Services Online

[www.student.auckland.ac.nz](http://www.student.auckland.ac.nz)

### Support for Engineering students

[foe-engagement@auckland.ac.nz](mailto:foe-engagement@auckland.ac.nz)

### Unleash space

[www.unleashspace.ac.nz](http://www.unleashspace.ac.nz)

## Useful web addresses

### Auckland University Student's Association

[www.ausa.org.nz](http://www.ausa.org.nz)

### Career Development and Employment Services

[www.cdes.auckland.ac.nz](http://www.cdes.auckland.ac.nz)

### Clubs, societies and associations

<https://www.auckland.ac.nz/en/on-campus/life-on-campus/clubs-societies.html>

### Entry requirements

[www.auckland.ac.nz/entry-requirements](http://www.auckland.ac.nz/entry-requirements)

### Exams

[www.auckland.ac.nz/exams](http://www.auckland.ac.nz/exams)

### Finances, scholarships and fees

[www.auckland.ac.nz/fees](http://www.auckland.ac.nz/fees)

[www.auckland.ac.nz/scholarships](http://www.auckland.ac.nz/scholarships)

### How to apply for admission

[www.auckland.ac.nz/apply](http://www.auckland.ac.nz/apply)

### International Office

Phone: +64 9 373 7513

Email: [int-questions@auckland.ac.nz](mailto:int-questions@auckland.ac.nz)

### International students

[www.international.auckland.ac.nz](http://www.international.auckland.ac.nz)

### IT essentials

[www.auckland.ac.nz/it-essentials](http://www.auckland.ac.nz/it-essentials)

### Libraries and Learning Services

[www.library.auckland.ac.nz](http://www.library.auckland.ac.nz)

### Maori and Pacific students

<https://www.auckland.ac.nz/en/engineering/study-with-us/maori-and-pacific-at-the-faculty.html>

### Overseas exchanges

[www.auckland.ac.nz/360](http://www.auckland.ac.nz/360)

### Security

Phone: 373 7599 ext 85000

(or ext 85000 directly from a University telephone)

### Student life

[www.auckland.ac.nz/en/on-campus.html](http://www.auckland.ac.nz/en/on-campus.html)

### Studylink

[www.studylink.govt.nz](http://www.studylink.govt.nz)

### Support services

[www.auckland.ac.nz/studentsupport](http://www.auckland.ac.nz/studentsupport)

### The University of Auckland

[www.auckland.ac.nz](http://www.auckland.ac.nz)

### The University of Auckland Calendar

[www.calendar.auckland.ac.nz](http://www.calendar.auckland.ac.nz)



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THE UNIVERSITY OF  
**AUCKLAND**  
Te Whare Wānanga o Tāmaki Makaurau  
NEW ZEALAND

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Engineering Student Centre  
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or 923 1969 (within Auckland)  
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### Email

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### Web

[www.engineering.auckland.ac.nz](http://www.engineering.auckland.ac.nz)  
[facebook.com/uoengineering](https://facebook.com/uoengineering)  
[twitter.com/uoengineering](https://twitter.com/uoengineering)

### Postal

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Auckland 1142  
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