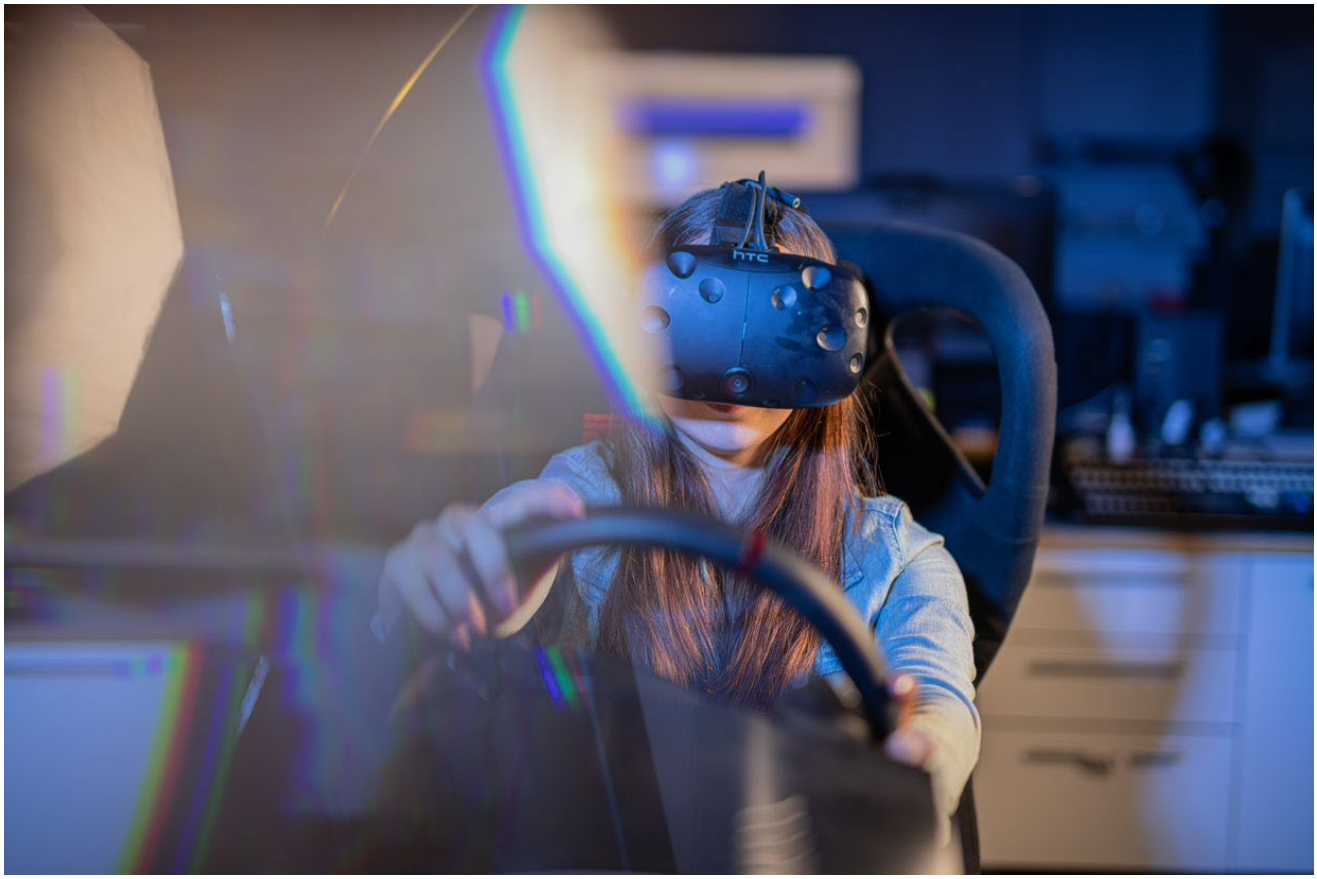
2025

Undergraduate courses

Engineering and Computer Science



School of Engineering and Computer Science
Te Kura Mātai Pūkaha, Pūrorohiko

www.wgtn.ac.nz/ecs

Updated August 2024

VICTORIA UNIVERSITY OF WELLINGTON
TE HERENGA WAKA

CONTENTS

CONTENTS **2**

BACHELOR OF ENGINEERING WITH HONOURS (BEHONS) **3**

DEGREE REQUIREMENTS 3
WORK EXPERIENCE 3

BACHELOR OF SCIENCE (BSC) **4**

BSC REGULATIONS 4

MAJOR REQUIREMENTS **5**

BACHELOR OF ENGINEERING WITH HONOUS (BE(HONS)) 5
BACHELOR OF SCIENCE (BSC) 6

PLANNING YOUR PROGRAMME **7**

PLEASE NOTE **7**

CANCELLATION OF COURSES 7
TIMETABLE CHANGES 7

100-LEVEL COURSES **8**

200-LEVEL COURSES **13**

300-LEVEL COURSES **17**

400-LEVEL COURSES **24**

CONTACT INFORMATION **31**

SCHOOL OF ENGINEERING AND COMPUTER SCIENCE 31

STUDENT SUPPORT **32**

TĪTOKO—CENTRE FOR STUDENT SUCCESS 32
ĀWHINA | MĀORI STUDENT SUPPORT 32
PASIFIKA STUDENT SUCCESS 32

BACHELOR OF ENGINEERING WITH HONOURS (BEHons)

The School of Engineering and Computer Science offers a four-year Bachelor of Engineering (BE(Hons)) with three majors: *Electrical and Electronic Engineering* (formerly Electronic and Computer Systems Engineering), *Cybersecurity Engineering* and *Software Engineering*. When taking the BE(Hons) degree, you will be enrolled under one of these majors.

DEGREE REQUIREMENTS

The BE(Hons) degree consists of several components which you will need to complete:

- **Part 1.** This consists of six or seven 100-level courses which provide the necessary foundations for the BE(Hons). You will need to ensure you take the right courses for your chosen major as set out on the following pages. If you are unsure about which major you like, leave your options open by taking all the courses required for any major (see page 6). **To successfully complete Part 1 of the BE(Hons), you will need to pass all Part 1 courses required by your major and achieve at least a B average in those courses.** (Students who achieve a lower average will be able to transfer their courses to a BSc.)
- **Part 2 Professional Practice.** This consists of a set of courses required for all majors (ENGR 201, 301, 302, 401 and 489) which develop a professional approach to engineering. Note that you must have successfully completed Part 1 (with at least a B average) in order to enrol in ENGR 301, 302, 401, and 489.
- **Part 2 Courses.** Part 2 of the BE(Hons) is made up of several core Engineering courses along with courses specific to your major, across second, third and fourth year. You may begin to take your Part 2 courses prior to completing Part 1, if you have passed any prerequisites.
- **Work Experience.** This consists of 800 hours of approved work experience in an engineering environment to help you prepare to apply for and work in appropriate employment. This will normally occur in the summers following your second and third years of study. Full details of the BE(Hons) work experience programme are on the school website (https://ecs.wgtn.ac.nz/Main/WorkExperience/WebHome)
- **Electives.** The degree requires a total of 480 points, including 120 400-level points of BE(Hons) courses. You will need to choose some elective courses to complete your degree; these may include courses from outside the BE(Hons) schedule.

If you achieve good grades during your BE(Hons) degree, and particularly in your third and fourth- year courses, you will be awarded the degree with First-Class Honours, Second-Class Honours (first division), or Second-Class Honours (second division).

WORK EXPERIENCE

Work experience is a key part of the Bachelor of Engineering with Honours degree.
The goals of work experience are:

- To increase an understanding of engineering terms and concepts introduced during the degree courses.
- To provide an actual experience of different work roles that you are likely to encounter once working as a professional engineer.

Reporting
Students must write a report for each work experience they undertake as well as managing the documentation needed to record their work experience. Templates and other guidance are provided. The report encourages students to reflect on the work experience by describing, interpreting, and evaluating the experience, to develop a deeper understanding of their skills, how they dealt with situations and what they learnt.

BACHELOR OF SCIENCE (BSc)

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

The School of Engineering and Computer Science currently offers 4 majors in the BSc:

- Artificial Intelligence
- Computer Graphics and Games
- Computer Science
- Electronic and Computer Systems

BSC REGULATIONS

The BSc regulations are very flexible, to allow students to take a wide range of courses, including taking some from outside the Bachelor Science. You need to construct your course choices carefully and this document contains example programmes to help you do that. These regulations apply to all new, returning or transferring students taking up a BSc degree.

Complete at least **360 points**, of which:

- At least 210 points must be from courses above 100-level, including
  - at least 120 points from courses listed for the BSc Schedule.
- At least 75 points must be from courses numbered 300-399; and
- At least 15 points must be from ENGR 121-123, 142, MATH, PHYS, QUAN, STAT.

What does 360 points mean in terms of courses?
Almost all the courses in the school are worth 15 points, so 360 points usually mean eight courses a year for three years (8×3×15=360) for a full-time student. You should aim to take four courses in each of Trimesters 1 and 2. Note that some other Schools offer courses worth 20 points.

How can I take extra non-science points?
Up to 30 non-science points taken to meet the requirements of a science major may be counted as if they were science points, and up to 60 non-science points may be counted as science if taken to meet the requirements of a major from outside Science. The total number of such points must not exceed 60.

What is a minor? A minor is a way of getting acknowledgement for completing a decent chunk of a second major without the constraint of having to meet all the requirements of that second major. A minor generally consists of 60 points above 100-level specified in the major requirements of the subject area, of which at least 15 points must be at 300-level.

MAJOR REQUIREMENTS

BACHELOR OF ENGINEERING WITH HONOUS (BE(Hons))

Overall Degree Requirements:

1st year:	COMP 102 or 112, ENGR 101, 110
2nd year:	ENGR 201
3rd year:	ENGR 301, 302
4th year:	ENGR 401, 489

Cybersecurity Engineering (CYBR)

1st year:	COMP 103, CYBR 171, (ENGR 121, 123) or (MATH 151, 161; one of MATH177, QUAN 102 or STAT 193)
2nd year:	COMP 261, CYBR 271, NWEN 241, 243, SWEN 221; SWEN 225 or one of MATH 200-299
3rd year:	CYBR 371, 372, 373; one of (MATH 324, NWEN 301, 302, 303, 304, SWEN 324, 326)
4th year:	CYBR 471, 472, 473; one further 400-level course from (AIML, CYBR, COMP, NWEN, SWEN)

Software Engineering (SWEN)

1st year:	COMP 103, CYBR 171, (ENGR 121, 123) or (MATH 161; one of MATH 177, QUAN 102 or STAT 193); one of (CGRA 151, ENGR 141, 142, PHYS 100-199)
2nd year:	COMP 261, CYBR 271, NWEN 241, 243, SWEN 221, 225
3rd year:	SWEN 301; SWEN 303 or 325; SWEN 324 or SWEN 326; at least one further course from AIML/CGRA/COMP/CYBR/NWEN/SWEN 301-379
4th year:	At least two courses from NWEN/SWEN 401-479; at least two further courses from AIML/CGRA/COMP/CYBR/NWEN/SWEN 401-479

Electrical and Electronic Engineering (EEEN)

1st year:	COMP 103; (ENGR 121, 122) or (MATH 142, 151); (ENGR 141, 142) or (PHYS 142, 145)
2nd year:	EEEN 201, 202, 203, 204, 220, ENGR 222, NWEN 241
3rd year:	EEEN 301, 313, 315, 320
4th year:	EEEN 401; at least three courses from EEEN 402-439, AIML 425, 429, RESE 411, 412

BACHELOR OF SCIENCE (BSc)

Artificial Intelligence (AIML)

1st year:	AIML 131, COMP (102 or 112), 103, (ENGR 121, 123) or (MATH 161; one of MATH 177 or QUAN 102 or STAT 193)
2nd year:	AIML 231, 232; one of (COMP 261, NWEN 241, SWEN 221), (MATH 177 or STAT 292), one of (DATA 201, DATA 202, ENGR 222)
3rd year:	AIML 335 or 339, 30 further points from (AIML 331-335); 15 further points from (AIML 331-338, COMP 361, SWEN 303, 304, DATA 301, 303, 304)

Computer Graphics and Games (CGRG)*

1st year:	CGRA 151, COMP (102 or 112), 103, (DSDN 102 or 132); (ENGR 121 or MATH 151)
2nd year:	CGRA 252, NWEN 241, (COMP 261 or SWEN 221), (CGRA 259 or ANFX 201 or MATH 245), (ENGR 123 or MATH 161 or 251)
3rd year:	CGRA 359; 30 further points from (CGRA 300-399, SWEN 303)

** Formerly Computer Graphics (CGRA).*

Computer Science (COMP)

1st year:	COMP (102 or 112), 103; (ENGR 121, 123) or (MATH 161; one of MATH 177 or QUAN 102 or STAT 193)
2nd year:	COMP 261; 45 further 200-level points from (AIML, CGRA, COMP, CYBR, NWEN, SWEN)
3rd year:	30 300-level points from (COMP, NWEN, SWEN); 30 further 300-level points from (AIML, CGRA, COMP, CYBR, NWEN, SWEN)

Electronic and Computer Systems (ELCO)

1st year:	COMP 102 or 112; (ENGR 121, 122) or (MATH 142, 151); (ENGR 141, 142) or (PHYS 142, 145)
2nd year:	EEEN 202, 203, 204; 15 further points from (AIML 231, EEEN 201-299, ENGR 201, NWEN 241)
3rd year:	60 points from (EEEN 301-399, RESE 321, 322)

PLANNING YOUR PROGRAMME

Enquiries: Please contact the member of the academic staff in charge of the course, the relevant level coordinator, or the Tītoko—Centre for Student Success office in Cotton 144, or phone (04) 463 5101.

COURSE INFORMATION INDEX

Course code ↓	CRN ↓	Title ↓	Points ↓	Trimester ↓
MATH 151	**CRN 17161**	**ALGEBRA**	**15 PTS**	**T1**

CRN: Course reference number

Prerequisites: Courses you must have passed before taking this course.
Restrictions: You can't enrol in this course if you have passed any of the restricted courses.

Use this template to plan your programme. Start by adding in the core papers for your degree.

Year 1:							120 points
Year 2:							120 points
Year 3:							120 points
Year 4:							120 points

PLEASE NOTE

CANCELLATION OF COURSES

The courses offered by the University and listed in this prospectus may be cancelled by the University as a result of insufficient resources or student demand, or if other unforeseen circumstances arise.

TIMETABLE CHANGES

Check the timetable online for confirmation of course times.
www.wgtn.ac.nz/students/study/timetable

100-LEVEL COURSES

AIML 131	CRN 35047	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	15 PTS	T2
Restrictions:	COMP 307, COMP 309			
Enter the dynamic world of Artificial Intelligence with AIML 131. Delve deep into Large Language Models, such as ChatGPT, addressing challenges like bias and hallucinations. Witness the power of text-to-image generation through tools like Midjourney. Grasp the foundational principles of Machine Learning and get acquainted with Explainable AI. Discover how AI is making waves in Aotearoa, touching on ethics and real-world applications. No programming experience? No worries! AIML 131 is designed for everyone. You will gain a good understanding of AI principles and its transformative impact so that you can use AI to improve lives, whatever your area of work.				

CGRA 151	CRN 28221	INTRODUCTION TO COMPUTER GRAPHICS AND GAMES	15 PTS	T2
Prerequisites:	COMP 102 or 112 or DSDN 142			
Introduces necessary background, fundamental concepts, and basic algorithms of Computer Graphics, including human visual perception, representation of colour and images, representation of 2D and 3D spaces, manipulation, movement and drawing of 2D and 3D objects. Students will use an appropriate modern programming language to investigate many of the ideas presented in the lectured material.				

COMP 102	CRN 943 CRN 28225	INTRODUCTION TO COMPUTER PROGRAM DESIGN	15 PTS	T1 T3
Restrictions:	COMP 112			
Today, most problems are solved using computers. An understanding of programming is needed to harness the full potential of computers. This course serves as an introduction to the foundational principles of programming utilising the high-level object-oriented programming language Java. You will progressively enhance your programming abilities through the creation of computer programs tailored for various applications. This course establishes the fundamental groundwork for all subsequent computer science and software engineering courses, fostering the development of programming skills applicable to a wide range of academic disciplines.				

COMP 103	CRN 945 CRN 7223	INTRODUCTION TO DATA STRUCTURES AND ALGORITHMS	15 PTS	T2 T3
Prerequisites:	COMP 102 or 112			
This course focuses on the techniques for designing, building, and analysing computer programs that deal with large collections of data. The course addresses techniques for programming with collections of data, and the data structures and algorithms needed to implement these collections. The course expands programming skills and provides an understanding of the principles of data abstraction, algorithm design, and the analysis of algorithms fundamental to computer science.				

COMP 112	CRN 26034	INTRODUCTION TO COMPUTER SCIENCE	15 PTS	T1
Prerequisites:	14 NCEA Level 3 Achievement Standard credits in Digital Technology including 6 credits in Computer Programming, or COMP 132, or equivalent programming experience			
Restrictions:	COMP 102			
This course introduces a range of important concepts and topics across Computer Science, Software Engineering and Network Engineering. Students will also gain a solid foundation of programming skills in object-oriented programming. The course is an entry point to the BE(Hons) and BSc in Computer Science for students who already have basic programming skills.				
NOT OFFERED IN 2025				

COMP 132	CRN 30095	PROGRAMMING FOR THE NATURAL AND SOCIAL SCIENCES	15 PTS	T2
This course addresses the fundamental programming skills required to process, transform, analyse, and present data. The course will explore a range of kinds of data, kinds of analysis and kinds of visualisation that can be performed on the data and give students expertise in a variety of programming techniques and tools to accomplish this analysis and visualisation. The practical assignments will enable students to develop programming skills that they will be able to apply in many different fields of study. The course does not assume any background in programming.				

CYBR 171	CRN 30039	CYBERSECURITY FUNDAMENTALS	15 PTS	T1
Hacker—hero or villain? Explore the world of cyber criminals, state-sponsored hackers, and commercial and government defenders. Engage directly with cybersecurity professionals as you explore diverse career paths — from incident response to digital forensics. This foundational course introduces you to social engineering, security and privacy concerns, physical security, common threats, attacks, and the techniques, frameworks, and tools used to defend and protect against them. You will leave the course equipped with essential skills to be a proactive guardian of your security without needing to be a programmer.				

ENGR 101	CRN 15243	ENGINEERING TECHNOLOGY	15 PTS	T1
Prerequisites:	Enrolment in the BE(Hons)			
This course provides a general introduction to the fundamental technical concepts needed to understand the design and engineering of electronic, mechatronic, networked and software systems. Experience is gained in basic engineering practice, with assembly and testing of basic hardware, software and networked systems, and construction of a personal computer.				

ENGR 110	CRN 26051	ENGINEERING DESIGN	15 PTS	T2
Prerequisites:	COMP 102 or 112, ENGR 101			
Restrictions:	ENGR 111			
This course addresses the engineering design process through a collection of engineering projects that require a range of technologies and design techniques. Sustainability will be an important component of the course, with some of the projects addressing technology and design for sustainable engineering.				

ENGR 121	CRN 26052 CRN 31158	ENGINEERING MATHEMATICS FOUNDATIONS	15 PTS	T1 T2
Prerequisites:	(16 Achievement Standard credits NCEA Level 3 in Mathematics) or (12 Achievement Standard credits NCEA Level 3 Mathematics excluding the statistics standards 91580, 91581, 91582, 91583, 91584) or MATH 132			
Restrictions:	Any pair (MATH 141/QUAN 111, MATH 151/161/177)			
An introduction to the range of mathematical techniques employed by engineers, including functions, calculus, linear algebra, vector geometry, set theory, logic, and probability. This course emphasises engineering applications and modelling.				

ENGR 122	CRN 26053	ENGINEERING MATHEMATICS WITH CALCULUS	15 PTS	T2
Prerequisites:	ENGR 121 or MATH 141			
Restrictions:	The pair MATH 142 and MATH 151			
Further mathematical techniques employed by electrical and electronic engineers, with a focus on methods of calculus, differential equations, and linear algebra. There is an emphasis on engineering applications and use of software.				

ENGR 123	CRN 27044 CRN 31159	ENGINEERING MATHEMATICS WITH LOGIC AND STATISTICS	15 PTS	T2 T3
Prerequisites:	ENGR 121			
Restrictions:	The pair MATH 161 and (MATH 177 or QUAN 102 or STAT 193)			
Mathematical techniques employed by cybersecurity and software engineers, including combinatorics, logic, probability distributions, model fitting and estimation. The course emphasises engineering applications.				

ENGR 141	CRN 30094	ENGINEERING SCIENCE	15 PTS	T1
Prerequisites:	(16 Achievement Standard credits NCEA Level 3 in Mathematics) or (12 Achievement Standard credits NCEA Level 3 Mathematics excluding the statistics standards 91580, 91581, 91582, 91583, 91584) or MATH 132			
Restrictions:	PHYS 101, PHYS 114, PHYS 115			
ENGR 141 deals with scientific topics relevant to Engineering. Topics will include forms and use of energy, Newton's laws of motion, gravity, waves, thermodynamics and required math concepts (limits, derivatives, functions). Students will obtain an appreciation for quantitative scientific reasoning and the role of fundamental physical laws in governing human energy use.				

ENGR 142	CRN 27045	ENGINEERING PHYSICS FOR ELECTRONICS AND COMPUTER SYSTEMS	15 PTS	T2
Prerequisites:	Either ENGR 141 and (ENGR 121 or MATH 141) or approved levels of achievement in NCEA Level 3 Physics and Calculus or equivalent			
Restrictions:	PHYS 115, 142			
Physics theory and practice relevant to electronics and computer systems engineering. Topics covered will include electrostatics (charge, force, field, potential), magnetic field and force, DC and AC circuits, electromagnetic induction, and other selected topics. Lectures, assignments, and laboratory work will all focus on the application of physics to engineering situations.				

MATH 132	CRN 17150 CRN 17286	INTRODUCTION TO MATHEMATICAL THINKING	15 PTS	T1 T3
Restrictions:	ENGR 121-123, MATH 100-199, QUAN 111			
This course provides an introduction to, or review of, fundamental skills and ideas in mathematics. The course is designed for students who require some mathematics in their degree, but who may not have a lot of mathematical experience. Topics include elementary arithmetic, algebra, coordinate geometry, and functions. There is an emphasis on mathematical ideas and how they have evolved: the goal is not only to apply mathematical tools correctly, but to understand them.				

MATH 141	CRN 17151	CALCULUS 1A	15 PTS	T1
Prerequisites:	12 AS credits NCEA Level 3 Mathematics (or equivalent) or MATH 132			
Restrictions:	ENGR 122, MATH 142, QUAN 111			
Determining the rate of change of a function as its dependent variable changes is a key question in many sciences. It is also the basis for differential calculus, which is the first part of mathematical analysis. This course provides a thorough development of differential calculus. It builds on the ideas of functions and limits to define derivatives and derives rules for computing them. These rules are demonstrated in scientific applications.				

MATH 142	CRN 17160	CALCULUS 1B	15 PTS	T2
Prerequisites:	MATH 141 or QUAN 111 or PHYS 101 or approved level of achievement in NCEA Level 3 Calculus or an equivalent background in Mathematics			
Integration looks at summing continuous variables, providing a way to define and compute areas and volumes, which are essential for many applications. This course develops integral calculus, including the view of integration as anti-differentiation, leading to the Fundamental Theorem of Calculus. Sequences and series are introduced, and functions are approximated using their Taylor polynomials. Techniques of integration are developed, including substitution and integration by parts. Differential equations are introduced, many of which arise from physical systems, and the course also introduces basic methods for solving them.				

MATH 151	CRN 17161	ALGEBRA	15 PTS	T2
Prerequisites:	12 AS credits NCEA Level 3 Mathematics (or equivalent) or MATH 132			
Linear algebra is central to mathematics, and essential in science and engineering. This course introduces linear algebra, motivated by some of these applications, and maintaining a practical approach using fundamental mathematical objects such as matrices and vectors. Methods to solve systems of linear equations using matrices are introduced, as are eigenvectors, which can be used to characterise matrices amongst many other applications. The concept of an algebraic structure is introduced, as are complex numbers, which allow the solution of many equations that did not previously have solutions.				

MATH 161	CRN 17162	DISCRETE MATHEMATICS AND LOGIC	15 PTS	T1
Prerequisites:	12 AS credits NCEA level 3 Mathematics (or equivalent) or MATH 132			
Logic underlies all of mathematics. This course introduces the basic notions of logic and discusses what makes some arguments good or valid, and others invalid. This leads to a definition of a mathematical proof, whereby the truth of mathematical statements is guaranteed. Other topics include sets, relations, functions, elementary counting principles, and an introduction to number theory. The second half of the course introduces the fundamental concepts of graph theory, which is the study of networks, which have applications from computing to disease transmission.				

MATH 177	CRN 19803	PROBABILITY AND DECISION MODELLING	15 PTS	T2
Prerequisites:	Approved level of achievement in NCEA Level 3 Calculus or one of (ENGR 122, 123, MATH 141, QUAN 111) or equivalent background in mathematics.			
Heads or tails? That's fair, right? Is the coin fair though - and how could you check? How might you choose in a more complicated situation? This course gives you an introduction to probability models in Statistics and their use in good decision making. Concepts you will study include probability, random variables and their distributions, decision theory, model estimation using sampled data, and tests for checking fitted models. Bad decisions follow from badly fitting models. This course is needed for a mathematical pathway in Statistics, and for Actuarial Science. To make good decisions using probability, choose this course!				

PHYS 101	CRN 35064	INTRODUCTION TO PHYSICS	15 PTS	T1
Prerequisites:	16 Achievement Standard credits NCEA Level 3 in Mathematics) or (12 Achievement Standard credits NCEA Level 3 Mathematics excluding the statistics standards 91580, 91581, 91582, 91583, 91584) or MATH 132			
Restrictions:	PHYS 114, PHYS 115, ENGR 141			
PHYS 101 is designed for students who want a university level introduction to physics. It will serve students majoring in physics without requiring prior knowledge in physics. The course will also serve any (science or otherwise) student, interested in general ideas of physics as a way of understanding the (physical) world around us. The course introduces basic concepts as well as worked examples. Exercises and assignments will reinforce key concepts. Topics covered are mechanics (energy, Newton's laws, gravity), waves, thermodynamics and required math concepts (limits, derivatives, functions).				

PHYS 142	CRN 35065	CALCULUS-BASED PHYSICS	15 PTS	T2
Prerequisites:	PHYS 101 or ((MATH 141 or approved level of achievement in NCEA Level 3 Calculus1) and (PHYS 131 or physics standard AS 91524 "mechanical systems" with excellence))			
Restrictions:	PHYS 114, PHYS 115, ENGR 142			
PHYS 142 covers topics in electrostatics and will also cover mechanics (circular and harmonic motion) and required math concepts (differential equations and integration).				

PHYS 145	CRN 35066	PRACTICAL SKILLS FOR SCIENTISTS: APPLICATIONS IN PHYSICS	15 PTS	T1
Prerequisites:	16 Achievement Standard credits NCEA Level 3 in Mathematics) or (12 Achievement Standard credits NCEA Level 3 Mathematics excluding the statistics standards 91580, 91581, 91582, 91583, 91584) or MATH 132			
Restrictions:	PHYS 114, PHYS 115			
PHYS 145 is designed to teach basic computing, data analysis, physics, and mathematics transferrable skills and their applications to practical physics problems. It will serve students majoring in physics and is also open to any (science or otherwise) student, interested in a hands-on experience of physics. The course will introduce skills required for experimental physics in laboratory environments and use them to explore physics phenomena in optics, mechanics, modern physics and thermodynamics.				

STAT 193	(SEE STREAMS)	STATISTICS IN PRACTICE	15 PTS	T1 T2 T3
Restrictions:	MATH 277, QUAN 102			
Streams:	Stream A (CRN 1791), Stream B (CRN 11333)			T1
	Stream A (CRN 4442), Stream B (CRN 6164)			T2
	Steam A (CRN 17069)			T3
An applied statistics course for students who will be advancing in other disciplines as well as those majoring in Statistics. It is particularly suitable for students majoring in Biological Science subjects, Geography, Health, Linguistics, Psychology, social sciences such as Education, and if you are a BCom student. This course assumes no previous knowledge of statistics, but mathematics to Year 12 is preferred. Topics we will cover include data display and inference, estimation, confidence intervals and hypothesis testing, comparison of means, linear regression and correlation, and analysis of variance.				

200-LEVEL COURSES

AIML 231	CRN 35049	TECHNIQUES IN MACHINE LEARNING	15 PTS	T1
Prerequisites:	one of (AIML 131, MATH 177, QUAN 102, STAT 193) or 60 200-level points; one of (COMP 103, 132)			
Restrictions:	COMP 307, 309, DATA 302			
This course introduces core concepts and techniques in machine learning, as well as commonly used software libraries for implementing machine learning pipelines. It includes an overview of the machine learning field, including supervised and unsupervised learning; fundamental machine learning techniques including neural networks; tools to understand data such as exploratory data analysis, pre-processing, and visualisation; and the design machine learning pipelines. This course balances theoretical concepts of machine learning and the use of programming libraries for hands-on practice.				

AIML 232	CRN 35050	TECHNIQUES IN ARTIFICIAL INTELLIGENCE	15 PTS	T2
Prerequisites:	AIML 131, COMP 103, one of (ENGR 123, MATH 177, STAT 193, QUAN 102, EEEN 220)			
Restrictions:	COMP 307			
This course introduces various concepts and techniques of broad applicability to artificial intelligence and machine learning. It includes an introduction to common machine learning paradigms such as neural networks and evolutionary learning; gradient-based and gradient-free optimisation techniques; dimensionality reduction; reasoning under uncertainty including Bayesian networks; and an introduction to AI planning. The course covers how these concepts can be used to solve important AI/ML tasks such as classification, regression, clustering, and sequential decision making.				

CGRA 252	CRN 35033	GAME ENGINE PROGRAMMING	15 PTS	T2
Prerequisites:	CGRA 151, COMP 103			
This course introduces students to a range of and graphics engines and teaches students how to use the variety of tools in these engines to build games and graphics output. Students will evaluate the engines as implementations of graphics pipelines and game development systems. Students will learn how to program extensions to games and graphics engines and how to use graphics APIs such as OpenGL in their programming.				

CGRA 259	CRN 35034	GAME PROTOTYPING – PROGRAMMING	15 PTS	T1
Prerequisites:	CGRA 151, COMP 103			
Restrictions:	GAME 203 taken concurrently			
This course uses game jams and hackathons as a learning environment where students work with commercial developers to learn how to develop new and innovative game prototypes. Students from the Graphics and Games major will be collaborating with students from the School of Design Innovation.				

COMP 261	CRN 18314	ALGORITHMS AND DATA STRUCTURES	15 PTS	T1
Prerequisites:	COMP 103, ENGR 123 or MATH 161			
Restrictions:	INFO 205			
This course covers a range of algorithms and data structures building on the fundamental structures and algorithms from COMP 103. The major areas covered are graph algorithms, graphics algorithms and advanced data structures. This course takes a practical approach focusing on the implementation of a wide variety of algorithms.				

CYBR 271	CRN 30040	CODE SECURITY	15 PTS	T2
Prerequisites:	CYBR 171, NWEN 241			
This course covers measures taken to protect software code and applications from unauthorized access, modification, or exploitation. It involves identifying and addressing potential security vulnerabilities in the source code, design, and architecture of software applications.				

EEEN 201	CRN 33053	MECHATRONIC DESIGN AND PROTOTYPING	15 PTS	T2
Prerequisites:	COMP 102 or 112; ENGR 101, 110; ENGR 121 or MATH 141 or equivalent			
Restrictions:	ECEN 201			
This course will equip students with a basic understanding of mechanical theory and the skills of electronic and mechanical design and construction so that they can successfully design and complete a moderately complex project. A presentation of this project work forms an integral part of the course.				

EEEN 202	CRN 33054	DIGITAL ELECTRONICS AND MICROPROCESSORS	15 PTS	T1
Prerequisites:	one of (COMP 102, 112, ENGR 101, 121, MATH 161)			
Restrictions:	ECEN 202			
An introduction to the design and construction of digital electronic instruments. Following a review of binary arithmetic and Boolean algebra, the course will focus on the design of digital circuits using both combinatorial and sequential logic. Further work will study microprocessor architectures, programming and interfacing and the conversions of digital and analogue signals.				

EEEN 203	CRN 33055	CIRCUIT ANALYSIS	15 PTS	T1
Prerequisites:	(ENGR 122 or MATH 142); (ENGR 142 or PHYS 142 or 115)			
Restrictions:	ECEN 203			
This course covers the analysis of analogue electrical and electronic circuits. Topics covered include basic circuit theorems, operational amplifier circuits, the use of phasors for AC circuit analysis and the Laplace transform for switched systems. The use of computational and measurement tools for circuit characterisation is also covered.				

EEEN 204	CRN 33056	ELECTRONIC DEVICES	15 PTS	T2
Prerequisites:	(ENGR 122 or MATH 142); (ENGR 142 or PHYS 142 or 115)			
Restrictions:	ECEN 204			
This course introduces fundamental electronic devices and their circuit applications. Topics include semiconductor fundamentals, diodes, transistors and operational amplifiers and the operation and application of special function diodes such as light emitting diodes and solar cells. Prototyping and testing of practical circuits using these electronic devices will be addressed in the laboratory sessions.				

EEEN 220	CRN 33057	SIGNALS, SYSTEMS AND STATISTICS 1	15 PTS	T2
Prerequisites:	(ENGR 121,122) or (MATH 142, 151)			
Restrictions:	ECEN 220			
The course introduces analysis techniques for signals and linear time-invariant systems as well as fundamentals of engineering statistics. The first part of the course focuses on continuous time signals and systems and Fourier transform techniques, with applications to circuit analysis and communication systems. The second part of the course introduces probability mass and density functions, random variables, and functions of random variables.				

ENGR 201	CRN 29036	ENGINEERING IN CONTEXT	15 PTS	T2
Prerequisites:	ENGR 101, 110 and 45 further points from Part 1 of the BE(Hons) schedule			
This course addresses the research, analysis, critical and creative thinking skills embodied in written and oral communication which professional engineers are expected to display in the workplace. While addressing these aspects, the course at the same time develops the personal and interpersonal skills required to work effectively as part of a team in an engineering context.				

ENGR 222	CRN 33042	COMPUTATIONAL ALGEBRA AND CALCULUS	15 PTS	T1
Prerequisites:	(ENGR 121, 122) or (MATH 142, 151)			
This course covers fundamental concepts in linear algebra and multivariable calculus, with an emphasis on their applications to physical and engineering problems. Topics covered include linear transformations, matrix decomposition including the singular value decomposition, Taylor series, calculus of vector-valued functions, multivariate functions, and vector fields. Mathematical software will be used extensively.				

MATH 244	CRN 18324	ORDINARY DIFFERENTIAL EQUATIONS	15 PTS	T1
Prerequisites:	(MATH 142, 151) or (ENGR 121,122)			
Ordinary Differential Equations (ODEs) have motivated a lot of mathematics, both for themselves and for their applications, particularly in the wider sciences. This course introduces ODEs, covering their classification, and various solution methods for both linear and nonlinear equations. Systems of ODEs are introduced, together with the linear algebra needed to solve them. The course also presents the Laplace transform and its use in solving ODEs.				

MATH 245	CRN 30099	COMPUTATIONAL MATHEMATICS	15 PTS	T2
Prerequisites:	ENGR 122 or ENGR 123 or (MATH151 and (141 or 142))			
Combining mathematics with computational techniques allows us to study a wide variety of applications in science, for example, solving physics problems by approximating integrals and derivatives, and compressing digital images using singular-value decomposition. This course develops mathematical, numerical, and computational techniques for practical problems that utilise optimisation, simulation, interpolation, and approximation. Some previous experience in programming is highly desirable.				

MATH 251	CRN 18325	LINEAR ALGEBRA	15 PTS	T2
Prerequisites:	MATH 151 or B+ or better in ENGR 122			
Linear algebra is a fundamental part of mathematics. This is a second course in linear algebra, focusing on more abstract representations and giving an axiomatic treatment of vector spaces. The course introduces the underlying concepts of linear algebra, including linear transformations, subspaces, isomorphisms, dimensions, eigenvectors, inner products, and diagonalisation. Applications are used to motivate and demonstrate these concepts.				

MATH 261	CRN 18326	GROUPS AND GRAPHS	15 PTS	T1
Prerequisites:	MATH161 or B+ or better in ENGR123			
This course explores two fundamental mathematical structures: groups and graphs. Both have wide applications in mathematics, as well as in fields such as computer science, cryptography, physics, and chemistry. The course starts with basic group theory and explores permutations, matrices, and symmetries. The graph section uses an algorithmic lens to investigate graph complexity, study network flows, construct shortest paths, and find matchings in graphs.				

NWEN 241	CRN 18315	SYSTEMS PROGRAMMING	15 PTS	T1
Prerequisites:	COMP 103			
This course considers the issues raised when programming at a low-level, for example in embedded systems, OS system level, or network protocol stacks. It includes an introduction to C language programming and motivating examples related to a wide variety of applications of system programming.				

NWEN 243	CRN 19863	CLOUDS AND NETWORKING	15 PTS	T2
Prerequisites:	COMP 103			
The course provides a broad introduction to computer networks and a basic understanding of network application programming, with an emphasis on the working principles and application of computer networks. It covers a range of introductory topics including the essentials of data communication, computer network concepts, protocols, network applications and cloud computing. The course features an interactive laboratory component with projects starting from basic networking technologies leading into cloud application development.				

STAT 292	CRN 18331	APPLIED STATISTICS	15 PTS	T1
Prerequisites:	STAT 193 or one of (ENGR 123, QUAN 102) or a comparable background in Statistics			
Modern science is heavily data-driven, and statistical methods are instrumental in producing evidence-based conclusions. This course covers applied statistical methods that are widely used across the biological, social, and physical sciences. You will examine chi-square tests, t-tests, analysis of variance and non-parametric tests as a means to assess the evidence for differences between groups; and you will fit linear regression, logistic regression, and loglinear models to explore relationships between variables. Relevant examples are used throughout to illustrate the statistical methods considered. The statistical computing package R is used and demonstrated, although no previous programming experience is required.				

SWEN 221	CRN 18318	SOFTWARE DEVELOPMENT	15 PTS	T1
Prerequisites:	COMP 103			
This course develops a deeper understanding of object-oriented programming and associated practices. The focus is on programming techniques at the micro scale. Topics include inheritance, polymorphism, genericity, error handling, testing, and debugging. A sequence of short assignments will develop the key ideas and practices; rigour in testing will be developed through (automated) assessment of programme correctness.				

SWEN 225	CRN 30043	SOFTWARE DESIGN	15 PTS	T2
Prerequisites:	SWEN 221	Restrictions:	SWEN 222	
This course develops a strong understanding of object-oriented design. Students will study modelling and programming techniques that support the analysis, design and development of large and maintainable programs. Students will work together in groups on an engineering problem and use a variety of best practices and notations. Students will use specialized tools to apply these techniques in practical work.				

300-LEVEL COURSES

AIML 320	CRN 37006	AI COMPUTER VISION & IMAGE PROCESSING	15 PTS	T1
Prerequisites:	AIML 232; one of (COMP 261, NWEN 241, SWEN 221, at least a B in both DATA 201, 202)			
Computer vision and image processing has a wide range of real-world applications, such as automated vehicles and face recognition. This course addresses key AI techniques, tasks, and applications in this area. The course covers a range of topics, starting from the basics of image pre-processing and data augmentation to recent deep learning techniques, addressing tasks such as edge detection, image segmentation, and image classification. Various applications of relevant techniques will also be introduced.				

AIML 331	CRN 37006	AI COMPUTER VISION & IMAGE PROCESSING	15 PTS	T1
Prerequisites:	one of (AIML 231, 232, 320, COMP 307, COMP 309); one of (COMP 261, NWEN 241, SWEN 221, at least a B in both DATA 201, 202)			
Computer vision and image processing has a wide range of real-world applications, such as automated vehicles and face recognition. This course addresses key AI techniques, tasks, and applications in this area. The course covers a range of topics, starting from the basics of image pre-processing and data augmentation to recent deep learning techniques, addressing tasks such as edge detection, image segmentation, and image classification. Various applications of relevant techniques will also be introduced.				

AIML 332	CRN 37008	AI NATURAL LANGUAGE PROCESSING	15 PTS	T2
Prerequisites:	one of (AIML 231, 232, 320, COMP 307, COMP 309); one of (COMP 261, NWEN 241, SWEN 221, at least a B in both DATA 201, 202)			
This course introduces the basic concepts, applications, and algorithms for natural language processing, with a particular focus on processing and analysing large natural language data sets. The course will cover topics such as text representation, text classification, text clustering, text generation, sentiment analysis, machine translation, and information extraction. It will explain traditional natural language processing techniques and algorithms and will also explore more recent deep learning-based methods.				

AIML 333	CRN 37009	ACTING, PLANNING, AND SCHEDULING	15 PTS	T1
Prerequisites:	one of (AIML 231, 232, 320, COMP 307, COMP 309); one of (COMP 261, NWEN 241, SWEN 221)			
This course introduces key concepts, techniques and algorithms for AI systems that perform actions. It starts with reactive systems that respond intelligently to observations, expands to AI systems that use their knowledge about the world to plan or schedule actions into the future, and finally considers AI systems that improve their behaviour while interacting with the world. The course considers a range of real-world application domains such as controlling devices, robotics, games, and logistics.				

AIML 335	CRN 37010	MACHINE LEARNING	15 PTS	T2
Prerequisites:	one of (AIML 231, 232, 320, COMP 307, COMP 309); one of (COMP 261, NWEN 241, SWEN 221); one of (MATH 177, STAT 292)			
This course teaches fundamental concepts and mathematical techniques that underlie much of machine learning (ML). Topics include an introduction to learning theory, optimisation for ML, unsupervised learning, learning with latent variables, generative models, kernels, aspects of information theory, deep learning, continual/online learning, transfer learning, and anomaly detection. The course will also explore the connections between ML and cognitive science.				
NOT OFFERED IN 2025				

AIML 338	CRN 37005 CRN 37029 CRN 37030	DIRECTED INDIVIDUAL STUDY	15 PTS	T1 T2 T3
A supervised programme of study approved by the Head of School.				

AIML 339	CRN 37011	ARTIFICIAL INTELLIGENCE PROJECT	15 PTS	T2
Prerequisites:	one of (AIML 231, 232, 320, COMP 307, COMP 309); one of AIML 331-335			
A capstone project to construct a solution to an AI task. The project may be an individual or a group project.				

CGRA 350	CRN 28400	REAL-TIME 3D COMPUTER GRAPHICS	15 PTS	T2
Prerequisites:	CGRA 252 (or 251), NWEN 241			
This course addresses graphics programming for real-time 3D graphics. It covers graphics APIs, in particular OpenGL, and the graphics processing pipeline (including geometry processing, viewing, projection, transformation, illumination, texture mapping). It also addresses display hardware and graphics cards.				

CGRA 352	CRN 30096	IMAGE-BASED GRAPHICS	15 PTS	T1
Prerequisites:	CGRA 252 (or 251); NWEN 241; ENGR 121 or MATH 151			
Image-based graphics brings together the power visual media content to produce vivid, compelling, and meaningful computer graphics. This course studies ways of manipulating and combining images and videos, including image filtering, image manipulation, and video processing.				

CGRA 354	CRN 36029	COMPUTER GRAPHICS PROGRAMMING	15 PTS	T1
Prerequisites:	CGRA 252, NWEN 241; ENGR 121 or MATH 151			
Restrictions:	CGRA 251			
This course addresses algorithms, mathematical knowledge, and programming tools for 3D Computer Graphics, including offline rendering. It covers programming with Modern low-level graphics APIs, shader programming and the graphics processing pipeline (including geometry processing, viewing, projection, transformation, illumination, texture mapping and shading algorithms).				

CGRA 359	CRN 36030	GAMES AND GRAPHICS PROJECT	15 PTS	T2
Prerequisites:	CGRA 252, 15 300-level CGRA pts			
Restrictions:	COMP 313; GAME 390 taken concurrently			
This course is a capstone for the Computer Graphics and Games major in which students learn to work in a multidisciplinary team to develop a game or graphics system up to release quality. The course will be taught in conjunction with GAME 390, and most teams will have students from both courses. The course brings together practical development and theoretical analysis to ensure students know both how to make games and how to assess them.				

COMP 312	CRN 30098	MACHINE LEARNING TOOLS AND TECHNIQUES	15 PTS	T2
Prerequisites:	COMP 261 or (DATA 201 and DATA 202) or NWEN 241 or SWEN 221			
Restrictions:	AIML 421, AIML 231, AIML 131			
This course explores a range of machine learning tools and techniques for analysing data and automatically generating applications. The course will address tools for classification, regression, clustering and text mining, and techniques for preprocessing data and analysing the results of machine learning tools. Students will gain practical experience in applying a range of tools to a range of different data sets from different domains.				
NOT OFFERED IN 2025				

COMP 361	CRN 26060	DESIGN AND ANALYSIS OF ALGORITHMS	15 PTS	T1
Prerequisites:	COMP 261			
This course examines techniques for developing correct and efficient algorithms for some important classes of problems in Computer Science. It explores methods for designing algorithms, including greedy algorithms, divide and conquer, dynamic programming and graph algorithms. It covers techniques for demonstrating the correctness of algorithms and for analysing their efficiency.				
NOT OFFERED IN 2025				

CYBR 371	CRN 32072	SYSTEM AND NETWORK SECURITY	15 PTS	T1
Prerequisites:	CYBR 171, NWEN 243			
This course covers system and network security, emphasizing secure design, access control, and TCP/IP protocol security. Students will gain practical skills in Linux ACLs, shell scripting, and the deployment of defence mechanisms, preparing them for modern cybersecurity challenges.				

CYBR 372	CRN 32078	APPLIED CRYPTOGRAPHY	15 PTS	T1
Prerequisites:	CYBR 171; COMP 261 or SWEN 221			
This course covers key cryptography concepts and services, encryption, hash functions, digital signatures, public key certificates, cryptographic protocols, and applications like SSL/TLS and blockchain.				

CYBR 373	CRN 32079	GOVERNANCE, RISK AND COMPLIANCE	15 PTS	T1
Prerequisites:	CYBR 171, 60 200-level pts from (AIML, COMP, CYBR, SWEN)			
This course offers a detailed exploration of risk management in cybersecurity, covering concepts from basic principles to advanced applications. It includes practical exercises on security controls, incident response, and policy development, alongside in-depth discussions on security governance, ethics, legal environments, and cloud security. We also cover cultural considerations, as well as Māori Data Sovereignty principles.				

EEEN 301	CRN 34002	COMPUTER ARCHITECTURE AND EMBEDDED SYSTEMS	15 PTS	T1
Prerequisites:	EEEN 202 (or ECEN 202), NWEN 241			
Restrictions:	ECEN 301, NWEN 342			
The course develops an understanding of the structure of computers, how they execute programs and how they interface to the real world. The course first covers ARM assembly language programming, data representation, computer arithmetic, microprocessor architecture at the hardware level and a comparison with GPU, DSP and FPGA architectures. The course then explores the design flow and application of embedded computers in real-world engineering problems. Practical experience is gained using microprocessors, techniques to interface them with the physical world, development tool chains, debugging and embedded Linux operating systems.				

EEEN 310	CRN 34001	COMMUNICATION ENGINEERING	15 PTS	T1
Prerequisites:	EEEN 220 (or ECEN 220)	Restrictions:	ECEN 310	
The course provides students with an introduction to the physical layer of communication systems. It begins with basics of analog communications (AM, FM). Digital communications topics include intersymbol interference and Nyquist pulse shaping for bandlimited channels, matched filter receivers for additive noise channels and their error rate performance. Also covered are fundamentals of wireless fading channels and diversity receivers, followed by a brief overview of equalisation and OFDM.				
NOT OFFERED IN 2025				

EEEN 313	CRN 33058	POWER ELECTRONICS AND ELECTRICAL MACHINES	15 PTS	T2
Prerequisites:	EEEN 203 (or ECEN 203), EEEN 204 (or ECEN 204)			
This course covers the theory, design and application of electrical machines, power electronic circuits, electric drives, and the transformation and control of electrical energy. The course introduces the fundamentals of electromagnetics and electrical machines, as well as power electronics and discusses the design issues related to electrical drives and small-scale power generation. Practical work will involve the design, development, and implementation of solutions to drive motors, convert renewable power, and switch mode power amplifiers.				

EEEN 315	CRN 34004	CONTROL AND INSTRUMENTATION	15 PTS	T1
Prerequisites:	EEEN 203 (or ECEN 203)	Restrictions:	ECEN 315	
The course shows how models can be used to analyse, describe, and predict the behaviour of mechanical and electrical systems. The use of feedback to alter the properties of these systems to meet desired specifications is presented. A variety of methods are developed for designing control systems, including the use of a PID controller.				

EEEN 320	CRN 34005	SIGNALS, SYSTEMS AND STATISTICS 2	15 PTS	T2
Prerequisites:	EEEN 220 (or ECEN 220)	Restrictions:	ECEN 321	
The course introduces analysis techniques for discrete-time signals and linear time-invariant systems as well as topics in engineering statistics. The first part of the course focuses on discrete-time signals and systems and discrete Fourier transform techniques, with applications to circuit analysis and communication systems. The second part of the course covers topics in engineering statistics, including confidence intervals, statistical tests, and regression, as applied to engineering problems.				

EEEN 325	CRN 34006	ROBOTIC ENGINEERING	15 PTS	T2
Prerequisites:	EEEN 201	Restrictions:	ECEN 301	
This course presents the principles of robotic and mechatronic design, construction and control. It covers both the theoretical and practical aspects of integrating mechanical, electronic and software components.				

ENGR 301	CRN 17178	ENGINEERING PROJECT MANAGEMENT 1	15 PTS	T1
Prerequisites:	Satisfactory completion of Part 1 of the BE(Hons), ENGR 201 and 60 200-level pts from (CYBR, COMP, ECEN, EEEN, NWEN, RESE, SWEN)			
The course takes a practice-based approach to teaching engineering project management, including aspects of project life cycle, requirements analysis, principles of design, project tasks and deliverables, contracts, cost estimation, project scheduling, risk management, quality assurance, managing project resources, testing and delivery, interpersonal communication, teamwork, and project leadership. Students will work on a technical group project which will provide opportunities to practice the project management techniques learned in class.				

ENGR 302	CRN 17179	ENGINEERING PROJECT MANAGEMENT 2	15 PTS	T2
Prerequisites:	ENGR 301			
The course uses a large collaborative group project to teach engineering project management. Through the project, the students will experience the full lifecycle of a project, from requirements analysis through design and implementation to closing the project.				

MATH 324	CRN 15668	CODING AND CRYPTOGRAPHY	15 PTS	T2
Prerequisites:	MATH 251			
Encoding messages so that they can be transmitted robustly and efficiently, while being safe from eavesdroppers, is an important part of modern communication. This course starts with modern coding theory, introducing linear codes, coding bounds, perfect codes, and cyclic codes to develop codes that can deal with communication over a noisy channel. Moving on to cryptography, the course covers topics such as classical ciphers, one-way pads, Shannon's Theorem, public key cryptography, one-way functions, the RSA cryptosystem, key distribution, and digital signatures.				

NWEN 301	CRN 17180	OPERATING SYSTEMS DESIGN	15 PTS	T2
Prerequisites:	NWEN 241			
This course addresses the design and implementation of operating systems and examines fundamental concepts such as resource management, concurrency, protection, and security. Examples drawn from a range of modern operating systems illustrate these concepts and project work provides practical experience in the design and implementation of operating systems.				
NOT OFFERED IN 2025				

NWEN 302	CRN 17181	COMPUTER NETWORK DESIGN	15 PTS	T2
Prerequisites:	NWEN 241, 243; ENGR 123 or (MATH 161, one of MATH 177, QUAN 102 or STAT 193)			
This course addresses the principles, architectures and protocols that have shaped the development of the Internet and modern networked applications. It examines network design principles, underlying protocols, technologies, and architectures of the TCP/IP protocol stack. Topics include the design of transport protocols, routing protocols, logical link control, medium access control and physical media.				
NOT OFFERED IN 2025				

NWEN 303	CRN 17182	CONCURRENT PROGRAMMING	15 PTS	T1
Prerequisites:	ENGR 123 or MATH 161; SWEN 221; 15 points from (COMP 261, CYBR 271, NWEN 241, 243)			
This course examines a range of techniques for programming multi-threaded and distributed applications. Topics include synchronisation mechanisms used for programs that communicate via shared memory and message passing techniques for programs that communicate across a network. Practical work involves implementing programs using these techniques in a modern concurrent language, such as Java.				
NOT OFFERED IN 2025				

NWEN 304	CRN 19864	ADVANCED NETWORK APPLICATIONS	15 PTS	T2
Prerequisites:	ENGR 123 or MATH 161, NWEN 243; COMP 261 or NWEN 241 or SWEN 221			
This course introduces technologies, algorithms, and systems for developing secure, scalable and reliable web server applications. Specific emphasis will be placed on application development middleware, computer security, network protocols and distributed systems. Particularly a variety of topics ranging from fundamental to advanced technologies for developing RESTful web applications, including MVC, distributed authentication and authorization, secure data communication, web caching and content replication, will be covered in lectures.				
NOT OFFERED IN 2025				

RESE 321	CRN 34007	RENEWABLE ENERGY GENERATION ENGINEERING		15 PTS	T1
Prerequisites:	EEEN 203, 204	Restrictions:	RESE 211		
This course introduces a range of different energy generation systems, and especially those that utilise renewable resources: wind energy (pumping and power), geothermal, hydro (at different scales), solar photovoltaic, solar thermal, and bioenergy. For each technology, the theoretical underpinning is examined – for example, optical physics to harness solar radiation in concentrating solar systems – and the engineering approaches to identify and design efficiency improvements for such systems are established.					

RESE 322	CRN 34008	RENEWABLE ENERGY STORAGE ENGINEERING	15 PTS	T2
Prerequisites:	EEEN 203, 204			
This course provides insights into technologies that convert renewable energy generation into useful fuels or power in the economy and society. It will include bioenergy conversion processes, such as gasification, pyrolysis and torrefaction; chemical storage (solid-state and liquid batteries); thermal storage; and pumped and mechanical storage. It examines the underlying physics and chemistry for each technology platform, with related practical experiments in the laboratory. The engineering approaches to identify and design efficiency improvements for such systems are established.				
NOT OFFERED IN 2025				

SWEN 301	CRN 17183	SCALABLE SOFTWARE DEVELOPMENT	15 PTS	T2
Prerequisites:	SWEN 225			
This course introduces the processes, practices, and tools required to engineer medium to large software systems, and to address challenges arising from the emerging complexity of such systems. Topics include software craft, architecture, design, implementation, testing, maintenance, quality assurance, configuration management, build automation and principled use of components and libraries, and open-source development. Practical work will use integrated development environments, automation, and domain specific languages.				

SWEN 303	CRN 17185	USER EXPERIENCE ENGINEERING		15 PTS	T1
Prerequisites:	COMP 261 or SWEN 221	Restrictions:	INFO 307		
This course addresses the engineering of user experiences (UX). It presents principles and guidelines for design and covers a range of design and engineering processes. It presents techniques for user testing of applications, digital systems, and physical devices.					

SWEN 304	CRN 17186	DATABASE SYSTEM ENGINEERING	15 PTS	T1
Prerequisites:	COMP 261 or SWEN 221; ENGR 123 or MATH 161			
Restrictions:	COMP 302, INFO 310			
The course addresses fundamental principles underlying databases and database management systems. It covers the structure and principles of the relational data model, including SQL, and the principled design of the relational database schema. It also addresses issues in database transaction procession, concurrency control, recovery, and the complexity of query processing.				

SWEN 326	CRN 30042	SAFETY-CRITICAL SYSTEMS	15 PTS	T1
Prerequisites:	(NWEN 241 or SWEN 225), 15 further 200-level AIML, CGRA, COMP, CYBR, EEEN, NWEN, SWEN pts			
This course addresses the concepts, techniques and tools required for developing computer systems that are applicable where safety and reliability is paramount. Topics include: the concepts and principles underlying safety-critical systems & standards (e.g. DO178C and IEC61508); techniques for design validation (e.g. model checking); and implementation techniques for ensuring software correctness (e.g. coding guidelines, testing, static analysis, etc). Practical work will involve the design, implementation, and analysis of simple safety critical applications (e.g. for industrial, embedded and healthcare systems).				

400-LEVEL COURSES

AIML 425	CRN 33067	NEURAL NETWORKS AND DEEP LEARNING	15 PTS	T2
Prerequisites:	one of (AIML320, AIML 331-335, AIML 420, COMP 307, DATA 305)			
Restrictions:	the pair (COMP 421 and 422)			
This course addresses the fundamentals of neural network based deep learning. It covers the commonly used deep learning architectures such as fully connected networks, resnets, variational autoencoders, and generative adversarial networks. It discusses functional blocks such as convolutional nets, recurrent neural nets such as LSTMs, and the common objective functions and regularization procedures. Examples will discuss applications such as object classification, classification of sequential text, and the generation of realistic human faces.				

AIML 426	CRN 33068	EVOLUTIONARY COMPUTATION AND LEARNING	15 PTS	T2
Prerequisites:	one of (AIML320, AIML 331-335, AIML 420, COMP 307, DATA 305)			
This course addresses evolutionary approaches in machine learning and optimisation. The course will cover both evolutionary algorithms and swarm intelligence as well as some other population-based techniques for problem solving. It will include a range of real-world application domains such as classification, regression, clustering, and optimisation.				

AIML 427	CRN 33069	BIG DATA	15 PTS	T1
Prerequisites:	one of (AIML 231, 232, AIML 320, AIML 331-335, AIML 420, AIML 421, COMP 307, COMP 309, DATA 301, 303, 305, STAT 393, 394); one of (ENGR 123, MATH 177, STAT 193, QUAN 102) or approved background in statistics			
Restrictions:	COMP 424, COMP 473 (2016-2018)			
Big Data refers to the large and often complex datasets generated in the modern world: data sources such as commercial customer records, internet transactions, environmental monitoring. This course provides an introduction to the theory and practice of working with Big Data. Students enrolling in this course should be familiar with the basics of machine learning, data mining, statistical modelling and with programming.				

AIML 428	CRN 33070	TEXT MINING AND NATURAL LANGUAGE PROCESSING		15 PTS	T1
Prerequisites:	one of (AIML 331-335, COMP 307, DATA 305)		Co-requisites:	AIML 320 or AIML 420	
Restrictions:	COMP 423				
This course focuses on text mining and natural language processing. It covers a variety of topics including text representation, document classification and clustering, opinion mining, information retrieval, recommender systems, query expansion, and information extraction.					

AIML 429	CRN 33071	PROBABILISTIC MACHINE LEARNING	15 PTS	T1
Prerequisites:	one of (AIML320, AIML 331-335, AIML 420, COMP 307, DATA 305); one of (MATH 177, STAT 292, 293) or approved background in Maths or Statistics			
This course teaches the ideas, algorithms, and techniques of probabilistic machine learning. Topics include Bayesian inference, discriminative and generative classifiers, the EM algorithm, Gaussian processes, Markov Chain Monte Carlo, hidden Markov models, belief nets and other graphical models, and causal modelling.				
NOT OFFERED IN 2025				

AIML 430	CRN 33072	APPLICATIONS AND IMPLICATIONS OF ARTIFICIAL INTELLIGENCE	15 PTS	T2
Prerequisites:	60 300-level pts			
AIML 430 explores AI's diverse applications in today's world and what the future might hold. We go beyond just understanding AI solutions, diving into how AI techniques can have real-world consequences and ramifications. Develop your ability to critically analyse AI literature and communicate your own opinions. Learn how varied perspectives shape AI views, emphasising the vital role of ethics. We welcome students from all backgrounds, fostering a deep and balanced understanding of AI's potential and challenges.				

AIML 431	CRN 33073	CURRENT TOPICS IN ARTIFICIAL INTELLIGENCE	15 PTS	T2
Prerequisites:	one of (AIML320, AIML 331-335, AIML 420, COMP 307, DATA 305)			
This course addresses several current topics in artificial intelligence. Possible topics include Reinforcement Learning, AI for robotics, AI in games, Intelligent image analysis, AI and optimisation, AI Planning.				

CGRA 408	CRN 28327	COMPUTER GRAPHICS RENDERING	15 PTS	T1
Prerequisites:	CGRA 350 or 352 or (CGRA 251 and 30 300-level CGRA/COMP/SWEN/NWEN points) or at least B- in CGRA 401 and 402			
This course will introduce a physically based photo-realistic rendering pipeline including radiometry, reflectance models, lighting, scene acceleration structures, ray tracing, path tracing and other global illumination algorithms.				
NOT OFFERED IN 2025				

CGRA 409	CRN 28328	GEOMETRY PROCESSING ALGORITHMS	15 PTS	T1
Prerequisites:	CGRA 350 or COMP 308 or at least B- in CGRA 401 and 402 (or COMP 471 and 472 in 2014-15)			
Restrictions:	COMP 409			
This course introduces the algorithmic and mathematical foundations of three-dimensional modelling. Topics include representations such as polygons, splines, implicit surfaces, point models, particle systems and volumetric models; concepts such as parameterisation, curvature, and discrete differential geometry; algorithmic approaches such as gradient domain processing, spectral processing and example-based deformation. It does not address content creation.				
NOT OFFERED IN 2025				

CGRA 463	CRN 28330 CRN 31190	COMPUTER GRAPHICS PRACTICUM	30 PTS	T2 T3
Prerequisites:	Permission of Head of School			
The practicum is an opportunity for students to engage with a supervised computer graphics project in the context of an external company or organisation.				

CGRA 489	CRN 28333	RESEARCH PROJECT	30 PTS	T1
A research project on a topic in computer graphics approved by the Head of School.				

COMP 489	CRN 1027	RESEARCH PROJECT	30 PTS	T1
A research project on a topic approved by the Head of School.				

CYBR 471	CRN 32239	OFFENSIVE AND DEFENSIVE SECURITY	15 PTS	T2
Prerequisites:	CYBR 371; 45 further 300-level pts from (AIML, CYBR, SWEN)			
This course provides an in-depth journey into cybersecurity attacks and defences. It begins with the basics of reconnaissance, scanning, and exploitation, moving into advanced topics such as exploitation tools, post-exploitation techniques, and threat intelligence. The curriculum includes practical log analysis, vulnerability management, incident investigation, and the recovery process.				

CYBR 472	CRN 32240	CYBERCRIME INVESTIGATIONS	15 PTS	T1
Prerequisites:	60 300-level pts from (AIML, COMP, CYBR, SWEN)			
This course offers an in-depth look at digital forensics, emphasizing its role in civil and criminal investigations including the legal context. Students will learn to analyse computer systems, mobile devices, and cloud environments, while understanding the legal and ethical aspects of forensic investigations. The program combines guest lectures from industry experts and practical exercises, preparing students to tackle real-world forensic challenges effectively.				

CYBR 473	CRN 32241	MALWARE ANALYSIS	15 PTS	T1
Prerequisites:	60 300-level pts from (AIML, COMP, CYBR, SWEN)			
This course introduces techniques and tools for analysing and detecting malicious software (malware). It covers in-depth analysis techniques for identifying, dissecting, and neutralising malware threats, including viruses, worms, trojans, and ransomware. The course emphasises practical skills in developing and implementing defensive strategies to protect systems against malware attacks.				

EEEN 401	CRN 34003	APPLIED ELECTROMAGNETICS AND COMPLIANCE	15 PTS	T2
Prerequisites:	EEEN 313, one of (ENGR 222, MATH 244)			
This course will address the engineering applications of electromagnetism, including propagation of signals, low EM emissions circuit board design, radio waves and antennas, grounding, high voltage insulators, and electrical safety design and testing. An important focus of the course is to become familiar with the international framework of product compliance and sustainability.				

EEEN 402	CRN 34014	PROGRAMMABLE DIGITAL LOGIC	15 PTS	T2
Prerequisites:	EEEN 301 (or ECEN 301)			
Restrictions:	ECEN 302			
The course develops an understanding of the structure of Field Programmable Gate Arrays, how to program them and how to interface them to the real world. The topics covered are VHDL programming, logic design, state machine design, I/O, design tools, simulation, timing analysis, debugging, IP block design methodology, softcore microprocessors, and system on a chip implementation. Practical experience is gained through the use of professional design tools and hardware to interface FPGAs with the physical world.				

EEEN 411	CRN 34022	CODING AND CRYPTOGRAPHY FOR COMMUNICATIONS	15 PTS	T2
Prerequisites:	EEEN 310 (or ECEN 310)			
Restrictions:	MATH 324			
The course covers key topics in modern coding theory (finite vector spaces, linear codes, coding bounds, perfect codes, cyclic codes) as applied to wireless communication systems. Further topics include cryptography (classical ciphers, the one-time pad, Shannon's Theorem, linear shift registers, public key cryptography, one-way functions, the RSA cryptosystem, key distribution, and digital signatures).				

EEEN 415	CRN 34029	ADVANCED CONTROL SYSTEMS ENGINEERING	15 PTS	T1
Prerequisites:	EEEN 315 (or ECEN 315)			
Restrictions:	ECEN 415			
This course extends previous control studies to cover the use of modern control techniques in shaping the behaviour of complex systems having multiple inputs and outputs, in both discrete and continuous time. Optimal control (LQR) and estimation (the Kalman filter) are introduced. The course concentrates on linear and linearised systems, but some introductory nonlinear material is presented, including applications to robot control.				

EEEN 425	CRN 34032	ADVANCED ROBOTIC ENGINEERING	15 PTS	T2
Prerequisites:	EEEN 325 (or ECEN 301)			
Restrictions:	ECEN 425			
This course presents advanced principles of robotic and mechatronic design, prototyping, construction and control. It covers both the theoretical and practical aspects of integrating the mechanical, electronic and software components and applies relevant machine learning concepts.				

EEEN 427	CRN 34034	SPECIAL TOPIC: ADVANCED MECHATRONIC DESIGN	15 PTS	T1
Prerequisites:	EEEN 325 (or ECEN 301)			
The course will cover a number of topics in design, simulation, construction and testing of advanced mechatronic systems, addressing both theoretical and practical design aspects.				
NOT OFFERED IN 2025				

ELCO 489	CRN 23071	RESEARCH PROJECT	15 PTS	T1
A research project on a topic approved by the Head of School.				

ENGR 401	CRN 18690	PROFESSIONAL PRACTICE	15 PTS	T1
Prerequisites:	ENGR 201, 301, 302; 45 further 300-level pts from the BE(Hons) Schedule			
This course will prepare student's expectations for many of the events and situations they are likely to meet in the professional working world. This includes codes of conduct, as determined by professional bodies and company practices; ethical behaviour, as found in the workplace and dictated by company practices; critical thinking and people issues, as relevant in the workplace and in company practice.				

ENGR 440	CRN 26008 CRN 27189	DIRECTED INDIVIDUAL STUDY	15 PTS	T1 T2
Prerequisites:	60 300-level points from CGRA, COMP, CYBR, ECEN, EEEN, NWEN, RESE, SWEN. Permission of Head of School			
A supervised programme of study approved by the Head of School.				

ENGR 441	CRN 26239 CRN 26009	DIRECTED INDIVIDUAL STUDY	15 PTS	T1 T2
Prerequisites:	60 300-level points from CGRA, COMP, CYBR, ECEN, EEEN, NWEN, RESE, SWEN. Permission of Head of School			
A supervised programme of study approved by the Head of School.				

ENGR 489	CRN 18688	ENGINEERING PROJECT	30 PTS	T1
Prerequisites:	ENGR 201, 301, 302; 45 further 300-level pts from the BE(Hons) schedule			
Students will work on an individual project of a complex nature in order to develop a solution to an engineering problem. In addition to the technical engineering development work, the project may require consideration of issues such as customer specifications, cost analysis, IP and product testing and delivery. Students will be required to give an oral and a poster presentation as well as a final report on their project				

RESE 411	CRN 31173	POWER SYSTEMS ANALYSIS		15 PTS	T1
Prerequisites:	EEEN 313	Co-requisites:	RESE 413		
This course introduces the electricity industry and its components along with techniques for modern electric power system modelling and analysis. Topics include transmission line models, transformers and per unit systems, generator models, network matrices, power flow analysis and computation, real and reactive power control, voltage control, and protection. The course incorporates lab and simulation-based exercises, an industrial tour, and an industrial project.					

RESE 412	CRN 31165	ADVANCED DEVELOPMENT OF RE SYSTEMS		15 PTS	T2
Prerequisites:	EEEN 313, 315		Co-requisites:	One of RESE 421, 431	
This course presents techniques used to design advanced, integrated renewable energy solutions for given situations. The hardware and control enabling renewable energy systems to interact with a wider grid are presented along with topologies such as nano- and micro-grids. To supplement the technical content, this course presents the concepts of systems engineering, which introduces systems thinking principles.					

RESE 413	CRN 35092	POWER ELECTRONICS AND ELECTRICAL MACHINES	15 PTS	T2
Prerequisites:	EEEN 203, EEEN 204			
Restrictions:	EEEN 313, EEEN 405, ECEN 405			
This course covers the theory, design and application of electrical machines, power electronic circuits, electric drives, and the transformation and control of electrical energy. The course introduces the fundamentals of power electronics and electrical machines and discusses the design issues related to electrical drives and small-scale power generation. Practical work will involve the design, development, and implementation of solutions to drive motors, convert renewable power, and switch mode power amplifiers.				

SWEN 422	CRN 18662	HUMAN COMPUTER INTERACTION	15 PTS	T1
Prerequisites:	one of (COMP 313, SWEN 303, 325)			
This course covers principles of human-computer interaction that underlie good design of software user interfaces. Advanced topics are introduced with a focus on current research areas.				

SWEN 426	CRN 18666	ADVANCED SOFTWARE IMPLEMENTATION AND DEVELOPMENT	15 PTS	T2
Prerequisites:	ENGR 301, 15 further 300-level AIML, COMP, CYBR, NWEN or SWEN pts			
Restrictions:	SWEN 438 in 2020, 2021, 2023			
This course covers issues relating to the successful implementation of a software design, including processes, metrics, the choice of implementation tools and platforms, coding styles, code reviews, and testing. The course looks closely at maintenance and operation, and the issue of quality throughout the entire DevOps life cycle. Issues such as software quality assurance, configuration management and software process improvement are raised.				

SWEN 431	CRN 18669	ADVANCED PROGRAMMING LANGUAGES	15 PTS	T1
Prerequisites:	30 300-level COMP or SWEN points			
Restrictions:	COMP 432			
This course applies a range of advanced contemporary programming languages in current use, covering practical programming skills in the languages as well as their niches and design paradigms. The course will cover languages of present industrial interest, along with design trends of future languages.				

SWEN 432	CRN 18670	ADVANCED DATABASE DESIGN AND IMPLEMENTATION	15 PTS	T2
Prerequisites:	SWEN 304, 15 further 300-level COMP, NWEN or SWEN pts			
Restrictions:	COMP 442, INFO 311			
This course explores a selection of the following topics: XML Databases, Cloud Databases, Data Warehouse and Object-Relational Databases. It examines features of these advanced database systems and analyses the new applications they facilitate.				

SWEN 435	CRN 35116	DATABASE SYSTEM ENGINEERING	15 PTS	T1
Prerequisites:	60 300-level pts of COMP, NWEN, SWEN			
Restrictions:	SWEN 304, SWEN 439 in 2021-2022			
The course addresses fundamental principles underlying databases and database management systems. It covers the structure and principles of the relational data model, including SQL, and the principled design of the relational database schema. It also addresses issues in database transaction procession, concurrency control, recovery, and the complexity of query processing.				

SWEN 438	CRN 18597	SPECIAL TOPIC: AUTOMATED PROGRAM ANALYSIS	15 PTS	T2
Prerequisites:	COMP 261, 30 300-level points from COMP, CYBR, NWEN, SWEN			
The course will look at different techniques that can be used to automatically discover bugs and vulnerabilities in software. The course covers both static and dynamic techniques and discusses the pros and cons of various approaches. Students will develop their own program analyses and learn how to use existing state-of-the-art tools.				

CONTACT INFORMATION

SCHOOL OF ENGINEERING AND COMPUTER SCIENCE

Te Kura Mātai Pūkaha, Pūrorohiko

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STUDENT SUPPORT

TĪTOKO—CENTRE FOR STUDENT SUCCESS

The Student Success team offers a range of services that cover all student-related matters from applications and enrolment to graduation. Our aim is to create a client-focused, friendly environment where all who visit our area not only feel welcome, but also receive support and advice of high quality.

Address	CO144, Level 1, Cotton Building
Phone	0800 04 04 04
Email	info@vuw.ac.nz
Hours	9.00am - 4.00pm Monday, Wednesday, Thursday, Friday 9.30am - 4.00pm Tuesday

Email
We encourage you to use email for enquiries. You can contact our team at info@vuw.ac.nz.
Please include your full name and ID number in the subject line of your email.

In-person appointments
If you are coming to the office, you will need to make an appointment in advance.

ĀWHINA | MĀORI STUDENT SUPPORT

Āwhina is the on-campus whānau for Māori students to work together to share knowledge, achieve academic success, and build strong communities and leaders.

At Āwhina, our kaupapa (goal) is to help students successfully transition from secondary education or work into tertiary education, and to provide academic support for Māori students enrolled at the University. Our experienced staff offer one-to-one advising and mentoring sessions, tutorials, study wānanga, and a range of workshops to help you achieve your study goals. Our culturally inclusive environment includes whānau rooms with computer facilities, study areas, kitchen facilities, and space to meet with peers or tuākana (older students).

Email: awhina@vuw.ac.nz Website: www.wgtn.ac.nz/awhina

PASIFIKA STUDENT SUCCESS

The Pasifika Student Success team is the University ‘āiga (family) who journey with all Pasifika students at the University. The team fosters learning and teaching communities in an environment that celebrates Pasifika cultures, is welcoming and safe, and is focused on academic excellence, personal growth, and wellbeing.

The Pasifika Student Success team can help you navigate your transition into tertiary study, with study spaces, support staff and mentoring programmes. The team engage with Pasifika students on campus and via various online platforms, such as Zoom, email, phone, and social media.

Email: pasifika@vuw.ac.nz Website: www.wgtn.ac.nz/pasifika