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WELCOME TO ENGINEERING AND COMPUTER SCIENCE

The School of Engineering and Computer Science is a leading research department in New Zealand that stands proudly on the world stage with its distinguished faculty and research output. We back up our research with access to sophisticated, cutting-edge equipment. Our researchers have access to the high-speed network connectivity of other research institutions and resource providers in New Zealand, including access to HPC resources hosted at New Zealand eScience Infrastructure (NeSI) https://www.nesi.org.nz/. We also have research networks across the world, provided via our National Research and Education Network (NREN) operator, Research and Education Advanced Networking New Zealand (REANNZ) https://reannz.co.nz/.

We encourage anyone interested in graduate study to contact a relevant staff member directly by email (firstname.lastname@ecs.vuw.ac.nz). We are open to receiving your proposals for PhD and Master's projects, and provided we have the appropriate resources and supervisory experience available, we will consider these most positively.

We look forward to hearing from you.

Stuart Marshall
Head of School

IMPORTANT DATES 2018

University re-opens for Trimester 3 and Summer School	8 January
Wellington Anniversary (observed)	22 January
Trimester 3 and Summer School examinations	19–24 February
Enrolment closes for 2018	20 February
Trimester 1 begins	5 March
Easter break	29 March–4 April
Mid-trimester break	23–29 April
Anzac Day	25 April
Graduation	15–17 May
Queen's Birthday	4 June
Examinations	15 June–4 July
Mid-year break	5–15 July
Trimester 2 begins	16 July
Mid-trimester break	27 August–9 September
Labour Day	22 October
Examinations	26 October–17 November
Trimester 3 begins	19 November
Graduation	12–14 December
Christmas break	24 December–6 January 2019

TIMETABLE

The timetable is online at www.victoria.ac.nz/timetables.

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

Location	Room 358, Cotton Building, Kelburn Campus
Office Hours	Monday–Friday, 8.30am–5.00pm
Telephone	463 5341 from New Zealand
	+64-4-463 5341 from Overseas
Email	office@ecs.vuw.ac.nz
Website	http://ecs.victoria.ac.nz

STAFF CONTACTS

DEANS AND HEAD OF SCHOOL

Staff		Room	Contact
Prof Dale Carnegie	*Dean*	AM224	463 7485
Dr Stuart Marshall	*Head of School*	CO342	463 6730
Dr Gideon Gouws	*Deputy Head of School*	AM225	463 5952
A/Prof Peter Andreae	*Associate Dean (Students)*	CO336	463 5834
Prof Mengjie Zhang	*Associate Dean (Research)*	CO355	463 5654

GRADUATE STUDIES COORDINATORS

Staff		Room	Contact
Prof Winston Seah	*Postgraduate Coordinator (Admission)*	AM403	463 5233 x8493
Diana Siwiak	*Graduate and Equity Coordinator*	CO354	463 6240
Dr Bing Xue	*International Student Adviser for Postgraduate Coursework (CGRA/COMP/NWEN/SWEN)*	CO352	463 5542
Dr Robin Dystra	*International Student Advisor for Postgraduate Coursework (ECEN/ELCO)*	AM415	463 5233 x7013
A/Prof Kris Bubendorfer	*International Student Admissions* (MEP/MSwDev)	EA110	463 6484

PROGRAMME DIRECTORS

Staff		Room	Contact
Professor Alan Brent	*Renewable Energy Systems*	AM413	463 5960
Prof Neil Dodgson	*Computer Graphics and Computer Science*	CO329	463 6922
A/Prof Ian Welch	*Cybersecurity*	AM403	463 5664
Dr Pawel Dmochowski	*Electronic and Computer Systems Engineering*	AM419	463 5948
Dr Alex Potanin	*Software Engineering*	CO231	463 5833
A/Prof Kris Bubendorfer	*Master of Software Development and Master of Engineering Practice*	EA110	463 6484

ACADEMIC STAFF

Staff	Research Interests	Room	Contact
A/Prof Peter Andreae	*Artificial Intelligence*	CO336	463 5834
Dr Craig Anslow	*Empirical Software Engineering, Human Computer Interaction, Information Visualization, Visual Analytics*	EA103	463 6449
Dr Dionysis Athanasopoulos	*Service-Oriented Computing*	EA111	463 5233 x8024
Prof Alan Brent	*Renewable Energy Systems*	AM413	463 5960
A/Prof Will Browne	*Evolutionary Computation, Cognitive Robotics*	AM418	463 5233 x8489
A/Prof Kris Bubendorfer	*Clouds, Services, eScience, Security and Distributed Computing*	EA110	463 6484
Prof Dale Carnegie	*Mechatronics, Digital Electronics, Embedded Controllers, Musical Mechatronics, Engineering Education*	AM224	463 7485
Dr Aaron Chen	*Distributed Computing, Evolutionary Computation, Machine Learning*	AM405	463 5114
Dr Pawel Dmochowski	*Wireless Communications, Signal Processing*	AM419	463 5948
Prof Neil Dodgson	*Computer Graphics, Imaging*	CO329	463 6922
Dr Robin Dykstra	*Development of Scientific, Industrial and Educational Instruments*	AM415	463 5233 x7013
A/Prof Marcus Frean	*Machine Learning, Theoretical Biology*	CO337	463 5672
Dr Qiang Fu	*Internet Protocols, Wireless and Mobile Systems, Network Measurement and Security*	AM414	463 5233 x8829
Dr Xiaoying Gao	*Artificial Intelligence*	CO339	463 5978
Dr Gideon Gouws	*Sensor Devices and Instrumentation*	AM225	463 5952
A/Prof Lindsay Groves	*Formal Software Development*	CO257	463 5656
Dr Christopher Hollitt	*Vision and Control for Robotics*	AM223	463 6965
Dr Michael Homer	*Programming Languages*	EA115	463 5233 x4034
Dr Ajay Kapur	*Robotic Music, Digital Luthier, Machine Learning for Audio, Musical Science*		
Prof Bastiaan Kleijn	*Signal Processing*	AM417	463 6613
A/Prof Thomas Kühne	*Programming Languages, Model-Driven Development, Multi-Level Modelling*	CO233	463 5443
Dr Zohar Levi	*Geometry processing*	CO338	463 5233 x7045
A/Prof John Lewis	*Computer Graphics, Machine Learning*		Adjunct
Dr Karsten Lundqvist	*eLearning*	EA116	463 5233 x8018
Dr Hui Ma	*Databases*	CO259	463 5657
Dr Stuart Marshall	*Mobile Devices, Information Visualisation*	CO342	463 6730
Dr Yi Mei	*Evolutionary Computation, Machine Learning, Scheduling and Operations Research*	CO353	463 5233 x8016
Dr Mark Moir	*Practical and Theoretical Aspects of Concurrent, Distributed and Real-time Systems*t		Adjunct
Dr Ciaran Moore	*Microfabrication, Optics, Plasmonics*	AM227	463 5233 x8931
Dr Bryan Ng	*Network Engineering, Stochastics*	AM410	463 9792

Staff	Research Interests	Room	Contact
Prof James Noble	*Object-Oriented Software Design*	CO234	463 6736
Dr David Pearce	*Compilers, Program Analysis*	CO231	463 5833
Dr Alex Potanin	*Secure Web Programming Languages, Type Systems, Software Engineering*	CO262	463 5302
Dr James Quilty	*Optical Engineering, Computational Science and Engineering*	AM226	463 5233 x4090
Dr Ramesh Rayudu	*Power System Engineering, Power Electronics, Renewable Energy Systems*	AM421	463 5223 x8068
Dr Taehyun Rhee	*Computer Graphics*	CO330	463 5233 x7088
Prof Winston Seah	*Network Engineering, Wireless Systems*	AM416	463 5233 x8493
Dr Marco Servetto	*Formal programming language design, 5302 Languages, Type Systems, Software Engineering*	CO258	463 5820
Dr Mansoor Shafi	*Wireless Communications Systems*		Adjunct
Dr David Streader	*Use of Formal Mathematical Techniques in Software Engineering*	CO260	463 5655
A/Prof Paul Teal	*Signal Processing and Communications*	AM420	463 5966
Dr Alvin Valera	*Internet of Things Applications*	AM401	463 5139
A/Prof Ian Welch	*Cybersecurity*	AM403	463 5664
Dr Bing Xue	*Evolutionary Computation, Feature Reduction, Classification*	CO352	463 5542
Dr Fanglue Zhang	*Computer Graphics, Image, Video Processing*	CO331	463 5233 x7527
Prof Mengjie Zhang	*Data Mining and Machine Learning, Genetic Programming, Evolutionary Computer Vision*	CO355	463 5654

GRADUATE ADMISSION AND ENROLMENT PROCEDURES

- International students must apply through Victoria International (Victoria's International Student Office): www.victoria.ac.nz/international.
- See more information in the International Students section below.
- New Zealand residents can apply online; information about the process is available at: www.victoria.ac.nz/study/apply-enrol/postgraduate-admissions.

THESIS STUDENTS: CONTACT US BEFOREHAND

For both international students and New Zealand residents, applicants for PhD thesis and Master thesis programmes are advised to discuss their proposed enrolment with a member of the Engineering and Computer Science staff, either in person or by email. Prof Winston Seah (winston.seah@ecs.vuw.ac.nz) is in charge of admissions for thesis students, and can provide advice if you do not know which staff member to approach.

Applicants with qualifications from universities other than Victoria University should bring/include a copy of their transcript and details of courses they have taken. International students for whom English is not their first language should also meet the University's postgraduate English language requirements – see page 6.

TIME OF APPLICATION

PhD

There are three deadlines per year for all PhD applications to be considered. The dates are 1 March, 1 July, and 1 November. Students may complete an application form and speak with prospective supervisors prior to the deadline, but their application must be submitted through the Faculty of Graduate Research (FGR) and decision on acceptance into the programme will be made after the deadline. This admission/scholarship application process applies to both domestic and international prospective PhD students. More information can be found on the FGR website: www.victoria.ac.nz/fgr

Note: Every effort will be made to ensure that enrolment in the PhD degree is flexible where there is a demonstrated need such as for those candidates who have funding or a scholarship from outside Victoria University that must be taken up within a particular timeframe. Please contact the postgraduate thesis coordinator at any time to discuss these issues and we will endeavour to manage your enrolment as quickly as we can.

Masters by Thesis Only

Applications for Master's by thesis only (ME or Part 2 of MSc) can be made at any time.

Postgraduate Programes with Coursework

Applications for postgraduate programmes with coursework (BSc(Hons), MSc with Part 1, MCompSci, postgraduate diplomas) can be made prior to each trimester using the same application process as for undergraduate programmes.

INTERNATIONAL STUDENTS

Victoria International is the University's office for international students, and applications for all graduate programmes must be made through Victoria International. The International office has a website at www.victoria.ac.nz/international that provides much information on application and immigration formalities, scholarships, New Zealand living costs, fees, academic programmes and the like. You can contact Victoria International online or email victoria-international@vuw.ac.nz.

In addition to the academic prerequisites for graduate programmes, International applicants must also meet the University's postgraduate English language requirements:

- IELTS overall band of 6.5 with no sub-score below 6.0; or
- TOEFL 90 IBT with a minimum of 20 in writing; or
- Pearson Test of English score of 65 with a Communicative score of not less than 58; or
- Two ratings of five and two ratings of four in Victoria University's English Proficiency Programme.

TUITION FEES

International students accepted for the PhD degree currently pay the same fees as domestic students. For other degrees and qualifications, International students from Australia also pay the same tuition fee as New Zealand students. International students from other countries pay the full international student fees for degrees and qualifications other than the PhD. Some thesis students may have their fees paid from a scholarship or from the research grants of their supervisors.

QUALIFICATIONS AVAILABLE

The School of Engineering and Computer Science offers a variety of graduate programmes. Except for the MSwDev, these programmes require an undergraduate qualification in a relevant Engineering discipline, Computer Science, Computer Graphics, Electronic and Computer Systems or an equivalent. They are suitable for new graduates seeking an advanced degree before entering the work force, professionals with an Engineering or Computer Science background seeking a more advanced professional qualification (possibly on a part-time basis), and graduates seeking research based qualifications in order to enter research or academia.

For students whose undergraduate degree is not in Engineering, Computer Science, or Computer Graphics, the MSwDev and the GradDipSc are graduate programmes that may be taken as preparation for postgraduate study in Engineering, Computer Science, or Computer Graphics, or as a qualification in their own right.

The School of Engineering and Computer Science offers the following postgraduate programmes:

- ***BSc(Hons)*** (Bachelor of Science with Honours) in Computer Science, Computer Graphics, or Electronic and Computer Systems. This degree is the traditional first graduate degree, and involves one-year of full-time (or two-years part-time) study combining course and project work.
- ***PGDipSc*** (Postgraduate Diploma in Science) in Computer Science, Computer Graphics or Electronic and Computer Systems. The diploma is a postgraduate qualification. As a research project is not compulsory, the PGDipSc will appeal to students wanting a postgraduate course-work qualification. The PGDipSc also provides an opportunity for those students who are not able to meet the entry requirements for the BSc(Hons) or MSc Part 1. The PGDipSc requires 120 points of postgraduate study and can be completed full-time in two trimesters or part-time up to four-years.
- ***PGCertSc*** (Postgraduate Certificate in Science) in Computer Science, Computer Graphics, or Electronic and Computer Systems. This certificate is a short postgraduate qualification that consists of 60 points of 400-level courses. The PGCertSc may include a project with permission.
- ***ME*** (Master of Engineering), this Master's degree involves a thesis in engineering and may be endorsed with a specific area (Electronic and Computer System Engineering, Cybersecurity Engineering, or Software Engineering). It consists of a 120 point Master's thesis, or a 90 point thesis plus 30 points of 400 or 500-level courses from the ME or BE(Hons) schedule.
- ***MEP*** (Master of Engineering Practice), this is a one-year, 180-point Master's programme which aims to help students advance their skills and improve their job prospects.
- ***MCompSc*** (Master of Computer Science), this Master's degree is a full-time 12-month programme comprising 120 points of course-work and one 60 point project.
- ***MSc*** (Master of Science) in Computer Science, Computer Graphics, or Electronic and Computer Systems. This Master's degree has two parts. Part 1 is one-year of full-time study consisting of course-work. Part 2 is a thesis, which typically requires 12 months of study. Students with an Honours degree (including a BE with Honours) or a PGDipSc take Part 2 only. Students with only a BSc or GDipSc need to take both parts 1 and 2.

- ***PhD*** (Doctor of Philosophy), the PhD is a research degree, involving a substantial thesis, and is open to students with a good four-year qualification or a master's degree in Engineering, Computer Science, or Computer Graphics.
- ***MSwDev*** (Master of Software Development), this is a one-year, 180 point Master's degree delivered through a combination of course-work and an in-work (industry placement) research and development project. It is a "conversion masters" designed for students with a good undergraduate qualification in a subject other than computer science or software engineering.

Figure 1 indicates how the various degree programmes relate to the undergraduate BSc and BE(Hons), and to each other. Candidates normally progress along the paths indicated by the solid arrows and can by permission progress along the paths indicated by dashed arrows. Previous professional experience can be taken into account.

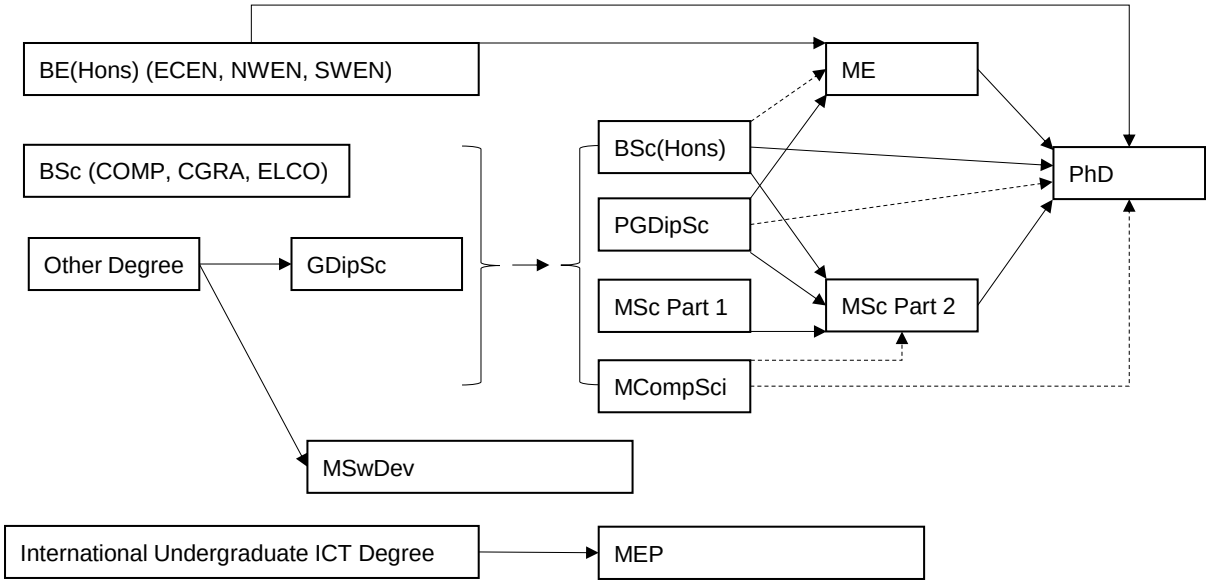

FIGURE 1: RELATIONSHIP BETWEEN DEGREE PROGRAMMES

The BSc(Hons), MCompSc, MSc Part 1 and PGDipSc consist of courses on advanced topics in engineering, computer science, and computer graphics. Students are able to study technology that is just finding its way into commercial implementations and concepts that will form the foundations for future technology and solutions. This combination of material prepares our students for a successful career in areas such as software design and development, network or systems planning and management, electronics and computer systems, or for study towards a further degree. An overview of individual graduate courses can be found starting on page 19. Entry to all these programmes assumes a BSc in Computer Science, Computer Graphics, Electronic and Computer Systems or equivalent. Page 17 describes programmes to enable graduates in other disciplines to obtain an equivalent background.

The MSc Part 2, ME and PhD are all research degrees featuring a substantial research project leading to a thesis. Thesis projects are supervised by academic staff and are normally related to staff research.

Each of these programmes is described briefly below, including an indication of whom the programme is designed for, the programme goals, the prerequisites for entry, and the requirements for completion of the programme. For the complete regulations regarding these programmes, we refer you to the appropriate pages of the Victoria University Calendar, available online at:

www.vuw.ac.nz/publications/calendar or www.victoria.ac.nz/home/study/calendar.aspx

BSc(Hons)

The BSc(Hons) degree is the traditional first step beyond a three-year undergraduate degree and is typically taken immediately following completion of a BSc. It comprises one academic year of full-time study. With permission, it can be undertaken part-time over two-years.

BSc(Hons) IN COMPUTER SCIENCE

The BSc(Hons) in Computer Science is designed both for students wishing to strengthen their studies in Computer Science before entering the workforce or as a first step for students intending to pursue a research degree (MSc or PhD).

ENTRY REQUIREMENTS

Entry to the degree requires a first degree and at least 60 points in 300-level courses in Computer Science. Applicants should have attained a good standard of performance in their final year of study (normally an average grade of B+ or higher in relevant 300-level courses), and should have completed any specific prerequisites for their proposed courses of study.

SUBJECT REQUIREMENTS

Candidates are required to complete 120 points at 400-level, which must include COMP489 (a 30-point research project), and a further 90 points from Computer Science (including COMP, NWEN, and SWEN) 400-level courses. Up to 60 points may be replaced by graduate courses from other disciplines. Whilst we encourage Honours students to enrich their education with advanced courses in other subjects, substitution of courses will only be permitted if the complete set of courses constitutes a coherent programme of study. Recent graduate students have taken courses in mathematics, philosophy (logic), linguistics, information systems, and physics (electronics).

BSc(Hons) IN COMPUTER GRAPHICS

The BSc(Hons) in Computer Graphics is designed as a first step for students intending to pursue a research degree (MSc or PhD in Computer Graphics) and also for students wishing to work in industry in related areas.

ENTRY REQUIREMENTS

Entry to this program requires students to have the equivalent of an undergraduate degree with a major in computer science including relevant computer graphics courses. For Victoria University graduates the requirements include (for students studying 300-level courses in 2017 or earlier) the completion of COMP308, and a further three 300-level courses (45 points) from COMP, MDDN, NWEN or SWEN, or (for students studying 300-level courses in 2018 or later) the completion of CGRA350 and 352, and a further two 300-level courses (30 points)

from CGRA, COMP, MDDN, NWEN, SWEN or MATH. It is normally expected that students have achieved a B+ or better average in their 300-level courses with an A- or better in their graphics courses.

SUBJECT REQUIREMENTS

Candidates are required to complete 120 points. These must include CGRA489 (a 30 point project); CGRA408, 409; and a further 30 points at 400-level in an approved combination from CGRA, COMP, MDDN and SWEN.

BSc(Hons) IN ELECTRONIC AND COMPUTER SYSTEMS

This programme is ideal for graduates with a BSc with a major in Electronic and Computer Systems, or in a related discipline that included significant electronics or signal processing studies.

ENTRY REQUIREMENTS

Entry to the degree requires a first degree and at least 60 points in approved 300-level or higher courses from BE(Hons) schedule or 300-level courses in COMP or PHYS. Applicants should have attained a good standard of performance in their final year of study (normally an average grade of B+ or higher in relevant 300-level courses), and should have completed any specific prerequisites for their proposed courses of study.

SUBJECT REQUIREMENTS

Candidates are required to complete 120 points. These must include ELCO489 (a 30 point research project); 60 points from ECEN401-440; and a further 30 points in an approved combination from 400-level courses in ECEN, COMP, NWEN and SWEN.

MCompSc (MASTER OF COMPUTER SCIENCE)

The Master of Computer Science degree is a graduate qualification designed for professionals seeking to advance their knowledge of Computer Science and to obtain a formal qualification that recognises their achievement. The degree will also be attractive to new graduates who wish to advance their knowledge of Computer Science before seeking employment.

ENTRY REQUIREMENTS

Entry to the MCompSc requires a degree with the equivalent of 60 points of 300-level courses in Computer Science, with an average grade of at least B+. International applicants are expected to have an average grade equivalent to at least a B+ at Victoria University. The Graduate Diploma in Science (Computer Science) is one way of satisfying this prerequisite for candidates who have a degree in a subject other than Computer Science. In exceptional cases, substantial professional experience combined with a degree containing less Computer Science may be acceptable. Applicants should have demonstrated the ability to study at an advanced level, through either their previous study or work experience.

Applicants who did not complete their previous study at Victoria University should pay particular attention to the prerequisite requirements of individual courses.

DEGREE REQUIREMENTS

The degree requires 180 points, which is equivalent to 12 months (three trimesters) of full-time study that can be spread over four-years part-time. There are 120 points of course-work in an approved combination from COMP, NWEN, SWEN401-479 (excluding the project courses) combined with 60 points of project work leading to a thesis.

This programme can be taken full-time or part-time. Full-time students can complete this qualification within 12 months.

ME (MASTER OF ENGINEERING)

The ME degree provides a clear route for continued study for graduates with a BE degree. The ME programme provides students with both a very attractive professional qualification in the engineering fields as well as opportunities to carry out a significant piece of research in engineering.

ENTRY REQUIREMENTS

Entry to this programme normally requires a BE degree with first or second class honours from Victoria University or equivalent. Those with a BSc(Hons) or a PGDipSc in Computer Science or Electronic and Computer Systems with good grades may also be accepted into the programme.

DEGREE REQUIREMENTS

The ME programme has two options:

- a 120 point Master's thesis (ENGR591); or
- a 90 point Master's thesis (ENGR592), and 30 points of approved 400-level or 500-level courses from the schedules to the BE or ME.

The degree may be awarded with distinction or merit, but a candidate must complete the work required for the degree within 12 months to be considered for such an award. For part-time students, the period may be extended pro-rata to a maximum of two-years.

MSc (MASTER OF SCIENCE)

MSc IN COMPUTER SCIENCE

The MSc is a postgraduate degree with a thesis as a major component. The degree is designed to provide an advanced level of professional competence with some research experience. Individuals seeking advanced expertise in one or more areas of Computer Science and research experience in a specialised area of Computer Science will find the MSc programme attractive.

This programme has two parts. Part 1 is similar to the BSc(Hons) degree without a research project. Part 2 is a substantial year-long research project leading to a thesis.

ENTRY REQUIREMENTS

Applicants seeking entry to Part 1 need to meet the entry requirements of the BSc(Hons) degree and satisfy the Graduate Coordinator of Computer Science that they have the prospect

of successfully completing the MSc thesis. Applicants who have already completed an Honours degree in Computer Science, or the equivalent, and have the prospect of successfully completing the MSc thesis, may gain direct entry to Part 2.

SUBJECT REQUIREMENTS

Candidates for Part 1 are required to complete 120 points of course-work. These points need to come from 400-level Computer Science, Cybersecurity Engineering, Network Engineering, and Software Engineering courses. Candidates may be given approval to substitute some courses from other disciplines provided the complete set of courses constitute a coherent programme of study.

Full-time candidates taking both Part 1 and Part 2 must complete the degree within two and a half-years, extended pro-rata up to five-years for part-time candidates. Full-time candidates for Part 2 only must complete the degree within 12 months, extended pro-rata up to two-years for part-time candidates.

MSc IN COMPUTER GRAPHICS

The MSc in Computer Graphics is a postgraduate degree with a research thesis as a major component. Graduates of the MSc in Computer Graphics will have a solid understanding of the mathematical and computer science principles that underlie computer graphics. They will be familiar with common languages and advanced libraries used in computer graphics, and will be able to use these to independently develop novel solutions to computer graphics problems. Graduates will also have experience working in teams to develop graphics software involving a variety of components.

This programme has two parts. Part 1 is similar to the BSc(Hons) degree without a research project. Part 2 is a substantial year-long research project leading to a thesis.

ENTRY REQUIREMENTS

Applicants seeking entry to Part 1 need to meet the entry requirements of the BSc(Hons) in Computer Graphics, which requires students to have the equivalent of an undergraduate degree with a major in computer science including relevant computer graphics courses. For Victoria University graduates, the requirements include (for students studying 300-level courses in 2017 or earlier) the completion of COMP308 and a further three approved 300-level courses (45 points) from COMP, MDDN, NWEN, or SWEN or (for students studying 300-level courses in 2018 or later) the completion of CGRA350 and 352, and a further two 300-level courses (30 points) from CGRA, COMP, MDDN, NWEN, SWEN or MATH. It is normally expected that students have achieved a B+ or better average in their 300-level courses with an A- or better in their graphics courses.

SUBJECT REQUIREMENTS

The Programme is divided into two parts:

- **Part 1**: candidates are required to complete 120 points. These must include CGRA408, 409; and a further 90 points at 400-level in an approved combination from CGRA, COMP, MDDN, and SWEN
- **Part 2**: candidates are required to complete a 120 point Computer Graphics Thesis (CGRA591).

MSc IN ELECTRONIC and COMPUTER SYSTEMS

The MSc in Electronic and Computer Systems deals with topics at the intersection of computer science and electronics. With embedded controllers existing in almost all of modern-day electronics, the distinction between software and hardware is becoming blurred. Victoria University has expertise in communications, electronic design, network and software design, artificial intelligence, renewable energy systems, mechatronics and robotics, and signal processing. This two-year programme offers students the opportunity to explore all of these topics in a manner which best suits their interests.

ENTRY REQUIREMENTS

Entry requirements are the same as BSc(Hons) in ELCO, which requires 60 points in approved 300-level or higher courses from the BE(Hons) schedule or 300-level courses in COMP or PHYS with at least a B+ average grade and satisfies the Graduate Coordinator that they have the prospect of successfully completing the MSc thesis.

SUBJECT REQUIREMENTS

The programme is divided into two parts. Part 1 consists of 120 points including ELCO580; 60 point from ECEN401-440; and further 30 points in an approved combination of 400-level courses from ECEN, COMP, NWEN, and SWEN.

Part 2 is a 120 point research thesis (ELCO591). Students who have entered the degree with a satisfactory academic background (typically a BSc(Hons) or equivalent degree) may enrol directly in Part 2. Full-time candidates for Part 2 only must complete the degree within 12 months, extended pro-rata up to two-years for part-time candidates.

MASTER OF ENGINEERING PRACTICE

The Master of Engineering Practice (MEP) is a unique and innovative programme for graduates seeking a professional postgraduate engineering qualification in the IT field.

ENTRY REQUIREMENTS

Applicants for the MEP will have:

- completed a Bachelor's degree in a relevant subject with good grades; and
- been accepted by the Head of School of Engineering and Computer Science as capable of proceeding with the proposed course of study.

International applicants must also meet the Victoria University's postgraduate English language requirements – see page 6.

SUBJECT REQUIREMENTS

Taught 180 points Master's degree – three trimesters of academic study. It is taught in three parts and it should be possible for students to complete the degree in 12 months.

Part 1 (one trimester of study) – 60 points

- ENGR501—Research and Communication Skills (15 points)
- ENGR502—Engineering Practice (15 points)
- Two 400-level courses from Electronics, Networking, Software or Computer Science (30 points)

Part 2 (one trimester of study) – 60 points

- ENGR589—Engineering project (30 points)
- Two courses from Electronics, Networking, Software or Computer Science (30 points)

Part 3 (one trimester of study) – 60 points

- ENGR589—Industry Research and Development Project (60 points)

Students may be placed in industries locally (including within Victoria University), or nationally – past industry placements include companies such as Google, Xero, Datacom, Weta Digital, Park Road Post, Solnet, Microsoft, IBM, Trade Me, Fujitsu, Magritek, Tekron, BRANZ, Callaghan Innovation, BECA, GNS, Fisher & Paykel, EDMI, Chorus, Transfield Services, 2 Degrees and others.

Students may be paid by companies in which they are placed.

* Entry to Part 3 requires good grades in Part 1 and Part 2 or special permission from the Head of School.

MASTER OF SOFTWARE DEVELOPMENT

Master of Software Development (MSwDev) is a graduate programme designed to equip students from a range of backgrounds with an industry focused qualification that prepares them to develop real-world software-based systems. It is an opportunity for those from non-ICT fields to convert into the software engineering field. In prior years, students have included: designers, micro-biologists, librarians, teachers, media and film, etc.

ENTRY REQUIREMENTS

Applicants for the MSwDev will have:

- a university New Zealand bachelor's degree in any discipline (except computer science, software engineering, or the equivalent), or equivalent qualification with at least a B average (or good grades as previous page)
- a basic level of competence in programming – this can be demonstrated by:
  - achieving a good grade in the four week MSwDev boot-camp: SWEN131 Programming for Software Development (optional: enrolment as a certificate of proficiency (COP)). This is held prior to the start of the MSwDev each year
  - attaining excellent grades in either COMP102 or a first-year computing course in your prior degree. This is assessed on a case-by-case basis
- satisfied an entry interview (held between the boot-camp and the start of the MSwDev).

International applicants must also meet Victoria University's postgraduate English language requirements – see page 6.

SUBJECT REQUIREMENTS

The programme is a one-year 180 point Master's degree delivered through a combination of course-work and an in-work (industry placement) research and development project. It is taught as a full-time intensive course and the individual courses do not follow the normal trimester calendar. The programme is normally completed in 12 months.

Part 1 (two trimesters of study)

- SWEN501—Professional Programming Skills
- SWEN502—Software Development Studio I
- SWEN503—Software Development Studio II
- SWEN505—Professional Seminar

Part 2

- SWEN585—Research and development project (60 points)

Entry into the research and development component requires good grades in the Part 1 courses or approval by the Head of School.

POSTGRADUATE DIPLOMA IN SCIENCE

The PGDipSc is a postgraduate science qualification offered in all subjects offered for the MSc. It will appeal to students wanting a postgraduate course-work only qualification since a research project is not compulsory. The PGDipSc may also provide an opportunity for postgraduate study for some students who are not able to meet the entry requirements for the BSc(Hons) or MSc Part 1. The PGDipSc requires 120 points of postgraduate study and can be completed full-time in two trimesters or part-time over four-years. Students who have successfully completed a PGDipSc may be accepted directly into a thesis program (MSc Part 2, ME or PhD).

ENTRY REQUIREMENTS

Entry to this qualification usually requires a degree in a relevant subject that satisfies the prerequisites for the required courses. In special cases, candidates without a relevant degree but have extensive practical, professional or scholarly experience may also be considered.

SUBJECT REQUIREMENTS

PGDipSc in Computer Science requires 120 points in approved courses from COMP, NWEN and SWEN401-489.

PGDipSc in Computer Graphics requires CGRA408, 409; a further 90 approved points from CGRA401-489, COMP401-479, MDDN401-479, SWEN401-479, including at least 30CGRA, COMP or SWEN points.

PGDipSc in Electronic and Computer Systems requires 90 points from an approved combination of ECEN401-440, ELCO489, 580; and 30 further approved 400-level points from the BE Schedule.

POSTGRADUATE CERTIFICATE IN SCIENCE

This PGCertSc provides an alternative path of postgraduate study in Science for students wanting a short course-work postgraduate qualification of fewer than 120 points. PGDipSc students who wish to exit the qualification early may be able to transfer to the certificate. A candidate in PGCertSc will normally be enrolled for at least one trimester and must complete the requirements within two-years. This program is also suitable for those who want to complete postgraduate study in a focused area within a short timeframe while in full-time work or managing other commitments. Entry to the PGCertSc is the same as for the PGDipSc.

SUBJECT REQUIREMENTS

PGCertSc in Computer Science requires 60 points in approved courses from COMP, NWEN and SWEN401-489.

PGCertSc in Computer Graphics requires CGRA408, 409, and 30 approved points from CGRA401-289, COMP401-479, and MDDN401-479.

PGCertSc in Electronic and Computer Systems requires 45 points from approved combination of ECEN401-440, ELCO489, 580; and 15 further approved 400-level points from the BE(Hons) schedule.

PhD

The PhD degree is an internationally recognised research qualification that usually involves three to four-years of original research work. A PhD is generally required by people seeking careers in a university or research laboratory such as one of the Crown Research Institutes. A number of private companies and government departments also carry out research and seek new employees with a PhD.

The PhD degree is designed to encourage original thought and teach disciplined research techniques. PhD candidates are frequently employed in the School as teaching assistants and gain valuable experience in teaching and communicating their knowledge. Thus, the skills acquired in pursuit of a PhD are often applicable in careers other than research.

Students interested in pursuing a PhD are encouraged to discuss their plans with the Thesis Coordinator, and with staff who may supervise their research.

ENTRY REQUIREMENTS

Applicants should normally have either an Honours or Master's degree in Engineering or Computer Science, or a closely related discipline, with at least second class (first division) honours. Applicants will also need to propose, in general terms, a research project (topic/area) that can be supervised by a member of Victoria University staff. Several months of preliminary work including background reading, discussions with prospective supervisors, and preparation of a research proposal might be required before a candidate is accepted.

SUBJECTS

The School currently provides PhD programmes in the following subjects:

- *Computer Science*: covering many areas in computer science including artificial intelligence, computer graphics, databases, data mining and knowledge discovery,

distributed systems, formal methods, human-computer interaction, information retrieval, and programming languages
- *Computer Graphics*
- *Electronic and Computer Systems*: covering all the science aspects of electronic and computer system engineering subjects
- *Engineering*: covering all areas of engineering at Victoria University, particularly electronic and computer system engineering cybersecurity engineering, software engineering, intelligent system engineering, and related interdisciplinary engineering programmes.
- *Renewable Energy Systems Engineering*

A PhD is expected to take three-years of full-time study. The initial enrolment for a PhD is provisional and is normally converted to full registration within one-year, after the successful presentation of a full research proposal.

All PhD students are expected to meet regularly with their supervisors to report and discuss their progress. Together with their supervisors, they must also submit six-monthly reports on their progress in May and November each year.

PhD students are also expected to participate in the research activities of the school, in particular attending research seminars in their discipline.

There are other requirements for PhD students, for example, to do with initial enrolment, re-enrolment, and thesis submission and examination. It is particularly important for new PhD students to submit the Confirmation of PhD Provisional Registration form within the first month of enrolment/provisional registration to the School, and arrange a meeting with the Postgraduate Coordinator to complete the registration process. Students should read the School thesis information website http://ecs.victoria.ac.nz/Main/ThesisInformation, where there are a lot of policies and guidelines as well as important links to the FGR.

Current postgraduate students who have questions about the PhD programme should talk to their current supervisor or the thesis coordinator.

CERTIFICATE OF PROFICIENCY

Students who do not want to complete a degree or diploma may take courses individually for a Certificate of Proficiency, as long as they have satisfied the prerequisites for the course(s) they wish to take. Such courses may (with certain restrictions) be credited later to a graduate qualification.

PREPARATORY PROGRAMME FOR GRADUATES OF OTHER DISCIPLINES

Graduates of disciplines other than Engineering and Computer Science wanting to take any of the above postgraduate programmes (except the MSwDev) will need the equivalent of 60 points of COMP, ELCO, ECEN, NWEN and/or SWEN courses at the level of the final year (300-level) of undergraduate study. For some students without this background, the appropriate way of achieving this will be the GDipSc containing appropriate COMP, ELCO, ECEN, NWEN and/or SWEN courses.

The GDipSc requires 120 points of 200 and 300-level science courses with at least 75 points at 300-level. Most students require a minimum of two-years of part-time study because of the prerequisites of the 300-level courses.

Students with no relevant background will need an additional year to take the appropriate 100-level courses before starting the GDipSc. For such students, the combination of transfer credit from their previous qualification and the additional courses taken to meet prerequisites may mean that they could complete a BSc with only a few more courses than are required for their GDipSc.

With an appropriate selection of courses, the GDipSc may be obtained with a specialisation. The School provides three specialisations to the GDipSc: Computer Graphics, Computer Science, Electronic, and Computer Systems. To obtain a specialisation, the candidate's courses must meet the 300-level requirements of the relevant BSc major.

Students considering the GDipSc are encouraged to also investigate the MSwDev, which will better meet some students' needs: http://www.wellingtonict.ac.nz/.

GRADUATE PROGRAMMES IN INFORMATION SYSTEMS

The School of Information Management (SIM) offers several qualifications that may appeal to students who are more interested in information systems rather than in computer science. Their graduate programmes are designed for people who wish to develop expertise in managing information and information technologies in a corporate environment.

The Master of Information Management (MIM) is a post-experience qualification and students need at least three-years of appropriate work experience. In contrast to the Computer Science graduate programmes described above, the MIM has a strong management orientation and is aimed at people who want to become effective managers or executives. SIM also offers a BCom(Hons) and an MCA in Information Systems.

For students without a degree in Information Systems, the transitional Graduate Diploma in Commerce in Information Systems may be of interest.

Contact the School of Information Management for more information about these programmes: www.victoria.ac.nz/sim/postgraduate.

PLANNING YOUR COURSES

The School offers a number of graduate level courses for the BSc(Hons), MSc, MCompSc, and other postgraduate qualifications. Many of these courses reflect the research interests of the staff and build on top of the third-year undergraduate courses. Candidates for these courses are assumed to have a general background in undergraduate computer science, computer graphics, electronic and computer system engineering, cybersecurity engineering, or software engineering in addition to any specific prerequisites indicated, and admission to the courses is not automatic, even if the specified prerequisites are met.

The offering of graduate courses is subject to availability of staff, and not all courses will be offered in any given year. The following list shows the courses that we are currently expecting to be able to offer in 2018. However, there may be late changes to this list; please check with the School.

Note that in special cases, students may be permitted to take one (or two in exceptional cases) "reading" course(s) from the courses that are not being offered in a given year, but we make no guarantee that such courses will be available. Students should consult http://ecs.vuw.ac.nz for details, including prerequisites and the timetable.

Admission to any graduate course requires the approval of the School. Students wishing to undertake graduate study should consult the School office prior to enrolment regarding the availability of the courses they wish to take and their eligibility to enrol in those courses.

CGRA/COMP/CYBR/NWEN/SWEN 400-LEVEL COURSES

CGRA402	CRN28326	**Special Topic: Project in Computer Graphics Programming**	15 Points	**Trimester 1**
Prerequisites:		Permission of Head of School		
Restrictions:		COMP472 in 2014-15		
Coordinator:		Prof Neil Dodgson		

This course will develop programming and collaboration skills in the context of computer graphics. Students will program each stage of a computer graphics pipeline and integrate the results into a complete graphics application.

CGRA408	CRN28327	**Computer Graphics Rendering**	15 Points	**Trimester 2**
Prerequisites:		COMP308 or at least B- in CGRA401 and 402 (or COMP471 and 472 in 2014-15)		
Restrictions:		COMP408		
Coordinator:		Dr Fanglue Zhang		

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.

CGRA409	CRN28328	**3D Modelling for Computer Graphics**	15 Points	**Trimester 2**
Prerequisites:		COMP308 or at least B- in CGRA401 and 402 (or COMP471 and 472 in 2014-15)		
Restrictions:		COMP409		
Coordinator:		Dr Zohar Levi		

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.

CGRA463	CRN28330	**Computer Graphics Practicum**	30 Points	**Trimester 2**
Prerequisites:		Permission of Head of School		
Coordinator:		Prof Neil Dodgson		

The practicum is an opportunity for students to engage with a supervised computer graphics project in the context of an external company or organisation.

CGRA489	CRN28333	**Computer Graphics Project**	30 Points	**Full-Year**
Prerequisite:		Approval of Head of School		
Coordinator:		Prof Neil Dodgson		

All candidates for BSc(Hons) in Computer Graphics are required to take CGRAR89, which is a research project conducted under the supervision of a staff member. The purpose of the BSc(Hons) research project is to provide students with an opportunity to study a particular problem within this area. It is also intended to provide training and experience in individual study and research, and communicating the results thereof. CGRAR89 is a two-trimester course. It can be done over any two consecutive trimesters.

COMP422	CRN2324	**Data Mining, Neural Networks and Genetic Programming**	15 Points	**Trimester 2**
Prerequisites:		COMP307, one further 300-level COMP, ECEN, NWEN or SWEN course		
Coordinator:		Dr Bing Xue		

This course is concerned with data mining concepts and techniques, especially neural networks and genetic programming. It mainly focuses on the following topics: data mining and knowledge discovery in databases; data mining techniques such as nearest neighbour, naive Bayes, support vector machines, neural networks, genetic algorithms and genetic (automatic) programming; image analysis operations such as feature extraction and image recognition; and performance evaluation of data mining / machine learning / Image recognition systems. The course considers applications ranging from general classification, clustering and optimisation tasks to engineering applications.

COMP423	CRN4962	**Intelligent Agents**	15 Points	**Trimester 1**
Prerequisites:		COMP307, one further 300-level COMP, ECEN, NWEN or SWEN course		
Coordinator:		Dr Xiaoying Gao		

This course examines construction of intelligent agents - software programs that can act for themselves in some part of the human world. This course focuses on agents for improving web search and includes topics such as agents for information extraction from the web, web page clustering and classification, automatic query expansion and web page ranking.

COMP440	CRN15202 CRN27190	**Directed Individual Study**	15 Points	**Trimester 1** **Trimester 2**
Prerequisite:		Approval of Head of School		

This course enables a student to study a topic that is not covered by other 400-level courses. It is conducted under the supervision of a staff member, and may involve attending a 300-level course, but undertaking additional 400-level assessment.

COMP441	CRN15203 CRN23169 CRN29145	**Directed Individual Study**	15 Points	**Trimester 1** **Trimester 2** **Trimester 3**
Prerequisite:		Approval of Head of School		

This course enables a student to study a topic that is not covered by other 400-level courses. It is conducted under the supervision of a staff member, and may involve attending a 300-level course, but undertaking additional 400-level assessment.

COMP473	CRN28126	**Special Topic: Introduction to Big Data Analysis**	15 Points	**Trimester 1**
Prerequisite:		STAT193 or ENGR123 equivalent preparation in statistics; 30 approved 200/300-level points		
Coordinator:		Prof Mengjie Zhang		

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 statistical modelling and with programming.

Note: Course is being jointly offered at several NZ universities and will use video conferencing for the lecture delivery. Victoria University lecturers will be delivering one segment of the course.

COMP489	CRN1027	**Research Project**	30 Points	**Full-Year**
Prerequisite:		A research project on a topic approved by the Head of School		

All candidates for BSc(Hons) in Computer Science are required to take COMP489, which is a research project conducted under the supervision of a staff member. The purpose of the BSc(Hons) research project is to provide students with an opportunity to study a particular problem within this area. It is also intended to provide training and experience in individual study and research, and communicating the results thereof. COMP489 is a two-trimester course. It can be done over any two consecutive trimesters, but the school does not guarantee availability of the course over trimester three.

CYBR471	**Offensive and Defensive Security**	15 Points
Prerequisites:	CYBR271, 371, 373	

This course focuses on offensive and defensive security techniques in the context of incident handling best practices and theories about attacker behaviour. The course will include lectures and demonstrations, but is designed around a virtual lab environment and scenarios that provide robust and realistic hands-on experiences in dealing with a range of offensive and defensive topic areas such as cybersecurity intelligence and investigation, incident response, and proactive cybersecurity.

This course is not offered in 2018. It will be from 2021 subject to regulatory approval.

CYBR472	**Digital Forensics**	15 Points
Prerequisites:	CYBR271, 371, 30 further 300-level points of (CYBR, NWEN, SWEN324, 326)	

This course addresses the collection and analysis of the digital footprint left by humans and computers in a way that is reproducible by third-parties and suitable for presentation to a non-specialist audience. Topics include the rules of evidence, preservation of data, file system forensics, network forensics, live forensics, anti-forensics as well as forensics for non-standard devices such as mobile/smart phones, cloud computing and vehicular systems. Practical work will include labs where evidence is collected using tools and presented as well as the use, development and enhancement of these tools.

Not offered in 2018. Offered from 2021 subject to regulatory approval.

CYBR473	**Malware and Reverse Engineering**	15 Points
Prerequisites:	CYBR271, 371, 30 further 300-level points of (CYBR, NWEN, SWEN 324, 326)	

This course addresses the problem of using reverse-engineering techniques and related techniques such as fuzzing to both analyse malicious code and identify vulnerabilities in software. Topics will include methodology and techniques as well as the anatomy, behaviour and propagation of malware. Practical work will involve malware analysis in a controlled environment as well as the analysis of real-world vulnerabilities and creation of exploits.

Not offered in 2018. Offered from 2021 subject to regulatory approval.

NWEN403	CRN 18605	**Advanced Network Engineering**	15 Points	**Trimester 1**
Prerequisites:		NWEN302, 30 further 300-level points from (COMP, ECEN, NWEN, SWEN)		
Restrictions:		COMP414, ECSE432		
Coordinator:		Qiang Fu		

This course extends the data communications and telecommunication taught in Computer Network Design, concentrating on new developments and network case studies. The course is designed for those aiming for careers that involve networking or network research and enhances the understanding of distributed systems through the applications of distributed systems in network management and Internet infrastructure.

NWEN404	CRN18605	**Mobile Computing**	15 Points	**Trimester 2**
Prerequisites:		NWEN302, 30 further 300-level points from (COMP, ECEN, NWEN, SWEN)		
Restriction:		COMP415 or ECSE433 (before 2008)		
Coordinator:		Prof Winston Seah		

The course introduces the fundamental topics of Mobile Computing. In particular, the course will emphasise the network and transport layers of wireless communication protocols and network infrastructure suitable for mobile personal systems (e.g., GSM, 3G, Mobile IP, etc.). Key issues of mobility and disconnected operation with respect to mobile computing systems, and quality of service issues in mobile personal systems will be covered and how applications handle node mobility and wireless communications will be explored.

NWEN405	CRN18606	**Security Engineering**	15 Points	**Trimester 2**
Prerequisites:		NWEN304, 30 further 300-level points from (COMP, ECEN, NWEN, SWEN)		
Restriction:		COMP418		
Coordinator:		A/Prof Ian Welch		

The Internet's role as a large, public, distributed system has raised security to an issue of critical importance. This course examines security mechanisms, security policies, security evaluation and risk management, security issues in networks and operating systems, and case studies that show how these security techniques can be used to solve real-world problems such as conducting trustworthy auctions and secret ballots.

NWEN406	CRN18592	**Distributed Computing in Grids and Clouds**	15 Points	**Trimester 1**
Prerequisites:		NWEN301; NWEN302 or 303		
Restriction:		COMP415 in 2009, ECSE433 in 2009		
Coordinator:		Dr Aaron Chen		

This course focuses on the design and use of distributed systems for high-end computing. In particular, we look at the aggregation of geographically distributed computing resources to form massive distributed computing platforms. These platforms can then be applied to solve large problems in science and industry – protein docking, seismology, medicine, astronomy, particle physics, climate prediction etc. Topics in this course typically include: e-Science, clusters, grids and clouds, service oriented architectures, workflow management, utility computing and grid economies.

NWEN438		**Full Stack App Development**	15 Points	
Prerequisite:		Permission of Head of School		

The course focuses on building scalable, secure and reliable web and mobile applications. This course will study techniques, tools and libraries used by industry for app development in conjunction with studies on the fundamental elements of the Internet, application layer protocols, security techniques, replication, app programming, mobile app programming and scripting.

Not offered in 2018.

SWEN421 CRN18661 **Formal Software Engineering** 15 Points **Trimester 1**
Prerequisites: SWEN324 (or 224), 30 300-level points from (COMP, SWEN)
Coordinator: Dr David Streader

This course addresses the use of mathematical logic in the specification and construction of software systems. It presents an introduction to the area of formal methods; the formal specification of software systems; the refinement of specifications to code; and their semantic foundations.

SWEN422 CRN18662 **Human Computer Interaction** 15 Points **Trimester 2**
Prerequisite: SWEN303
Restrictions: COMP453, ECSE434
Coordinator: Dr Stuart Marshall

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.

SWEN423 CRN18663 **Object Oriented Paradigms** 15 Points **Trimester 2**
Prerequisites: COMP304 or SWEN301;
15 further 300-level points from COMP, NWEN or SWEN
Restriction: COMP462
Coordinator: Prof James Noble

Object-orientation is the basis for many approaches to programming, systems, languages and applications. This course discusses the design principles of object-orientation and studies advanced topics in system design, programming language, and development process.

SWEN424 CRN18664 **Model-Driven Development** 15 Points **Trimester 1**
Prerequisite: 30 300-level points from (COMP, NWEN, SWEN)
Restriction: COMP471 in 2007-2009
Coordinator: A/Prof Thomas Kühne

An introduction to model-driven development - the modern approach to large-scale software system development. Along with an introduction to the core concepts of model-driven development, the course will address the foundations and principles for infrastructures supporting model-driven development. This includes an in-depth discussion of 'meta-modelling' and a critique of existing modelling techniques. Students will get hands-on experience with using a meta-case tool.

SWEN430 CRN18668 **Compiler Engineering** 15 Points **Trimester 2**
Prerequisites: COMP261, SWEN324 (or 224); 30 further 300-level points from (COMP, NWEN303, SWEN)
Coordinator: A/Prof Lindsay Groves

The course looks at a range of issues relating to the design and implementation of modern compilers. In particular, the course will focus on techniques and algorithms for code generation, code optimisation, and type checking. During the course projects, students will be working on a fully-fledged Java compiler to extend it in various ways. Students should expect to learn a great deal about how compilers work and, in particular, about the Java compiler and Java Bytecode instruction set.

SWEN432	CRN18670	**Advanced Database Design and Implementation**	15 Points	**Trimester 1**
Prerequisites:		SWEN304, 15 further 300-level COMP, NWEN or SWEN points		
Restriction:		COMP442		
Coordinator:		Pavle Mogin		

This course explores a selection of the following topics: Data Warehouse, Internet and XML Databases, Object-Relational Databases, and Distributed Databases. It examines features of these advanced database systems and analyses the new applications they facilitate.

SWEN433	CRN18671	**Web Information Systems Engineering**	15 Points	**Trimester 2**
Prerequisites:		SWEN304, 15 further 300-level COMP, NWEN or SWEN points		
Restriction:		COMP443		
Coordinator:		Dr Hui Ma		

This course gives a technology-centred introduction to web information systems and services. On successful completion of the course, students are able to explain basic concepts used in building and managing web information systems. They know central technological standards underlying web information systems and web services, understand architectural principles, and are able to evaluate and critically discuss such systems.

ECEN 400-LEVEL COURSES

BE ECEN 400-level courses can be taken by ME and BSc(Hons), MSc, PGDipSc, PGCertSc, students. Details of 100 to 300-level ECEN courses are in the SECS undergraduate prospectus.

ECEN404	CRN29034	**Microfabricated Devices**	15 Points	**Trimester 2**
Prerequisites:		ECEN303		
Coordinator:		Dr Gideon Gouws		

The course will introduce students to the theory and practice of fabrication processes and techniques that can be used to produce electronic, electromechanical and optical devices with micron-sized features. The operating principles of structures such as solar cells, energy harvesters, optical super lenses, metamaterials and microfluidic devices will be covered. The course has will enable students to gain hands–on experience in the design, fabrication, and characterisation of a range of these devices.

ECEN405	CRN18521	**Power Electronics**	15 Points	**Trimester 1**
Prerequisite:		ECEN303 (or PHYS340)		
Coordinator:		Dr Ramesh Rayudu		

The course covers the theory, design and application of power electronic circuits and the transformation and control of electrical energy.

ECEN410	CRN18522	**Advanced Communications Engineering**	15 Points	**Trimester 1**
Prerequisite:		ECEN310		
Coordinator:		Dr Pawel Dmochowski		

The course covers advanced topics in physical layer wireless communications. It begins with a brief introduction to Information Theory, leading to the concept of channel capacity. Multiple antenna techniques for both single and multiple user communications are discussed, including diversity, orthogonal space time block coding and digital beamforming. Advanced channel models, including the 3GPP-based models are discussed. Matlab system simulations are used throughout for assessing system performance.

ECEN415	CRN18519	**Advanced Control Systems Engineering**	15 Points	**Trimester 1**
Prerequisite:		ECEN315		
Coordinator:		Dr Chris Hollitt		

This course builds on and extends the principles of modern control systems engineering introduced in ECEN 315 to enable students to develop skills in developing mathematical models and in using these to design optimal control systems for real-world multivariable engineering systems. Kalman filters and linear quadratic regulators will be introduced and the principles and benefits of modern model-based predictive control systems will be outlined. Methods will be developed for continuous time system descriptions but techniques for converting to discrete time descriptions and for designing controls for discrete time systems will also be presented.

ECEN422	CRN29035	**Engineering Optimisation**	15 Points	**Trimester 2**
Prerequisite:		ECEN321, or ECEN 220 (prior to 2016), or ECEN320 (in 2016)		
Coordinator:		Prof Bastiaan Kleijn		

Convex optimisation problems are common in science, engineering, and economics. The course teaches identifying and solving convex optimisation problems. It discusses convex sets and functions, linear and quadratic programs, semi-definite programming, and duality theory. It uses these concepts to solve practical optimisation problems.

ECEN425	CRN18524	**Advanced Mechatronic Engineering 1: Hardware and Control**	15 Points	**Trimester 1**
Prerequisite:		ECEN301 (or PHYS340)		
Coordinator:		Prof Dale Carnegie		

This course provides an introduction to the techniques of mechatronics. It begins by covering the engineering concepts of compromise in the choice of sensors. It then covers basic signal conditioning and noise concepts, derivation of the transfer function and the output from a mechatronic system - specifically some form of actuator. The course continues with some specific ranging sensor circuits and applications, including practical implementation. Practical control systems for industrial plant and mechatronic systems are detailed, e.g. PID, dynamic response and stability. Students design and construct their own microcontroller development system. Mechatronic design considerations are discussed based on implementation through the SolidWorks CAD package.

ECEN427	CRN28462	**Special Topic: Musical Mechatronics**	15 Points	**Trimester 3**
Prerequisite:		ECEN301 (or PHYS340)		
Coordinator:		Prof Dale Carnegie		

This course is dedicated to development of a pathway for problem solving using mechatronic techniques. A musical paradigm is chosen in framing the problems that need to be addressed. Based on the specific problems, a number of objectives are defined and undertaken through a process involving design, construction and evaluation of a series of mechatronic projects.

ECEN430	CRN18576	**Advanced Mechatronic Engineering 2: Intelligence and Design**	15 Points	**Trimester 2**
Prerequisite:		ECEN301 (or PHYS340)		
Coordinator:		A/Prof Will Browne		

This course provides a guide to advanced techniques in the field of Mechatronics. The course material studies the interaction between hardware, software and communication components as it relates to embedded systems. Instrumentation systems and robotics are frequently used to illustrate the mechatronic theory. Artificial Intelligence techniques are introduced as a practical method for addressing the complex interactions between the electronic, mechanical and software components. The course is very practically orientated and primarily uses project-based assessments. These include a robotic competition, real-world customer design, industrial design considerations and cognitive robotics.

ELCO489	CRN23071	**Research Project**	30 Points	**Full-Year**
Prerequisite:		A research project on a topic approved by the Head of School.		
Coordinator:		Dr Bryan Ng		

All candidates for BSc(Hons) in Electronic and Computer Systems are required to take ELCO 489, which is a research project conducted under the supervision of a staff member. The purpose of the BSc(Hons) research project is to provide students with an opportunity to study a particular problem within this area. It is also intended to provide training and experience in individual study and research, and communicating the results thereof. ELCO 489 is a two-trimester course.

ENGR401	CRN18690	**Professional Practice**	15 Points	**Trimester 1**
Prerequisite:		75 300-level points from the BE(Hons) schedule including ENGR301, 302		
Coordinator:		Dr James Quilty		

This course will prepare students' 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.

ECEN 400-LEVEL COURSES FOR ME AND MEP

BE ENGR 400-level Special Topic and Directed Individual Study courses can be taken by ME and MEP students.

ENGR439		**Special Topic: Mechatronic Design**	15 Points	
Prerequisite:		30 300-level ECEN points		

This course presents the fundamentals of sensor and actuator technologies as well as rapid prototyping techniques in the development of mechatronics projects. A number of different sensors and actuators are presented, and the use of microcontroller programming in sensor data measurement, analysis, and actuator control are examined. Basics of PCB design and structural design (using CAD and CAM techniques) and their utilisation in projects involving sensor and actuator technologies are also covered.

Not offered in 2018.

ENGR440	CRN26008 CRN27189	**Directed Individual Study**	15 Points	**Trimester 1** **Trimester 2**
Prerequisite:		Permission of Head of School		

A supervised programme of study approved by the Head of School.

ENGR441	CRN26239 CRN26009	**Directed Individual Study**	15 Points	**Trimester 1** **Trimester 2**
Prerequisite:		Permission of Head of School		

A supervised programme of study approved by the Head of School.

DESIGN COURSES FOR COMPUTER GRAPHICS

MDDN412	CRN23047	**Interaction Design**	30 Points	**Trimester 1**
Prerequisite:		40 300-level MDDN points		

Students will gain advanced level experience with newly emerging interaction design techniques: computer vision, spatial design, user-focused generative feedback and advanced physical computing. An emphasis will be placed on experimentation and pushing the boundaries of the status quo of this discipline.

MDDN441	CRN23067	**Computer Graphics for Film**	30 Points	**Trimester 2**
Prerequisite:		40 300-level points from MDDN		

This course covers computer graphics techniques that are used as current practice in the film industry. While working on projects that span a range of approaches for generating special effects, and algorithmic treatment of media, students will also review and analyse cinematic examples.

500-LEVEL AND 600-LEVEL COURSES (INCLUDING THESES)

CGRA591 CRN28345 **Thesis** 120 Points **Full-Year**
MSc Thesis in Computer Graphics

COMP501 CRN25020 CRN25021 **Research Essay in Computer Science** 15 Points **Trimester 1** **Trimester 2**
Prerequisites: 60 400-level COMP, NWEN or SWEN points

An investigation into an advanced topic in an area of computer science, reported in an essay.

COMP540 CRN25022 CRN25023 **Directed Individual Study** 15 Points **Trimester 1** **Trimester 2**
Prerequisites: 60 400-level COMP, NWEN or SWEN points

A supervised programme of study approved by the Head of School.

COMP588 CRN8245 **Project** 30 Points **Full-Year**
All candidates for MCompSc are required to take COMP588, which is a project conducted under the supervision of a staff member. COMP588 is a two-trimester course.

ELCO580 CRN23072 **Research Preparation** 30 Points **Full-Year**
Research preparation for ELCO degrees and qualifications.

ELCO591 CRN23073 **Thesis** 120 Points **Full-Year**
MSc Thesis in Electronic and Computer Systems.

ENGR581 CRN18693 **Directed Individual Study** 15 Points **Trimester 1**
Prerequisites: Permission of Head of School

Directed individual study in a topic in Engineering

ENGR582 CRN18694 **Directed Individual Study** 30 Points **Trimester 1**
Prerequisites: Permission of Head of School

Directed individual study in a topic in Engineering.

ENGR591 CRN18695 **Thesis** 120 Points **Full-Year**
ME Thesis in Engineering

ENGR592 CRN18696 **Thesis** 90 Points **Full-Year**
ME Thesis in Engineering.

CGRA691 CRN28321 **Computer Graphics for PhD** 120 Points **Full-Year**
This is a PhD Thesis, covering all areas of computer graphics.

COMP690 CRN1091 **Computer Science for PhD** 120 Points **Full-Year**
This is a PhD Thesis, covering all areas of computer science including artificial intelligence, computer graphics, database and document management, data mining and knowledge discovery, distributed systems, formal method, human-computer interaction, information retrieval, and programming languages.

ELCO690 CRN23074 **Electronic and Computer Systems for PhD** 120 Points **Full-Year**
This is a PhD Thesis, covering all the science aspects of electronic and computer system engineering subjects.

ENGR690 CRN17446 **Engineering for PhD** 120 Points **Full-Year**

This is a PhD Thesis, covering all areas of engineering at the University, particularly Electronic and Computer System Engineering, Cybersecurity Engineering, Software Engineering, Intelligent System Engineering, and related interdisciplinary engineering programs.

MASTER OF ENGINEERING PRACTICE

ENGR501 CRN28383 **Research and Communication Skills** 15 Points **Trimester 3**

Prerequisite: Admission to the MEP degree
Corequisite: ENGR502

The course addresses research and communication skills for engineering practice. It will include finding, understanding, and summarising research papers and engineering resources, writing engineering proposals and reports, and oral communication skills.

ENGR502 CRN28384 **Engineering Practice** 15 Points **Trimester 3**

Prerequisite: Admission to the MEP degree
Corequisite: ENGR501

The course addresses a range of engineering problems that will require students to apply their technical knowledge to design, implement and evaluate practical engineering problems. Students will work on a variety of industry relevant individual and group projects and will also learn teamwork skills, professional practice skills, and communication skills in the context of engineering problem solving.

ENGR585 CRN28386 **Engineering Project** 30 Points **Trimester 1**

Prerequisite: ENGR501, 502; 15 further points from MEP Part 1

The course involves a major group project to design, implement and evaluate a solution to an industry based engineering problem. The course will also address a variety of professional, enterprise, and research skills, and a range of topics in engineering practice including legal and IP issues, business contexts, social and environmental issues.

ENGR589 CRN28385 **Industry Project** 15 Points **Trimester 2**

Prerequisite: Part 2 of the MEP

Supervised project, working on an industrial software research and development task, generally as a placement in industry.

MASTER OF SOFTWARE DEVELOPMENT

SWEN501 CRN28340 **Professional Programming Skills** 15 Points **Trimester 2**

Prerequisite: Admission to the MSwDev
Coordinator: Dr Dionysios Athanasopoulos

The course builds on basic programming skills, addressing more complex programming and core programming concepts and techniques, including collection data structures, inheritance and object orientation, fundamental algorithms and data structures, exceptions, testing, version control, and security, networking, and databases.

SWEN502	CRN28341	**Software Development Studio I**	45 Points	**Trimester 2**
Prerequisite:		SWEN501		
Corequisite:		SWEN505		
Coordinator:		Dr Dionysios Athanasopoulos		

The course addresses a range of software development skills and builds an understanding of technical and software engineering concepts and techniques. Students will work on a variety of industry relevant group projects which address a range of topics in software development and computer science. The course will teach teamwork skills, professional practice skills, and communication skills in the context of software development.

SWEN503	CRN28342	**Software Development Studio II**	45 Points	**Trimester 3**
Prerequisite:		SWEN502		
Corequisite:		SWEN505		
Coordinator:		Dr Craig Anslow		

The course addresses a range of advanced technical concepts and techniques for software development and advanced professional practice skills, including software development methodologies, software project planning, and entrepreneurial practices. The course is based around a series of group projects on a variety of industry relevant problems/tasks, interspersed with instruction based elements addressing advanced technical concepts and methods.

SWEN505	CRN18598	**Professional Seminar**	15 Points	**Trimesters 2,3**
Prerequisite:		SWEN 501		
Coordinator:		A/Prof Kris Bubendorfer		

The course addresses a variety of professional enterprise and research skills, and a range of topics in software development including legal and IP issues, business contexts, social and environmental issues for software, and research and communication skills. The course will include a range of case studies from the local software development industry.

SWEN589	CRN28344	**Industry Research and Development Project**	60 Points	**Trimester 1**
Prerequisite:		Part 1 of the MSwDev		
Coordinator:		A/Prof Kris Bubendorfer		

The course will consist of a substantial project, working on a software research and development task. Generally it will be done as a placement in industry, but could, in certain cases, be an industry-sourced (or industry-related) project done within the school. The project would involve supervision by an academic as well as the industry employer, and will involve formal and informal.

ACADEMIC STAFF – RESEARCH AREAS

PETER ANDREAE BE(Hons) *Cant*, MS PhD *MIT*, Associate Professor

Peter's research interests lie in the areas of machine learning and program construction tools. He is particularly interested in the area of learning procedural knowledge from examples – how an agent acting within some world can learn to do actions that achieve reward or generate interesting behaviour. He is exploring the use of non-standard reward mechanisms and agents in worlds containing complex objects. He is also collaborating on other research projects in text mining and evolutionary computing. He is particularly interested in clustering problems.

CRAIG ANSLOW MSc PhD *Well*, Lecturer

Craig's research interests are Empirical Software Engineering, Human Computer Interaction, Information Visualization, and Visual Analytics. In particular focusing on the human aspects of work experiences for software development, emergency management, cyber security, and environmental impact.

DIONYSIS ATHANASOPOULUS MSc PhD Ioannina, Lecturer

Dionysis' research interests belong to the areas of data and software engineering, and cloud computing. In the area of data engineering, he has focused on proposing mechanisms for matching service interfaces and XML schemas automatically. In the area of software engineering, he is interested in the software design, evolution, and maintenance. In particular, he is interested in applying fundamental design principles in service-oriented software and especially, in proposing automated mechanisms for improving the maintainability of this kind of software. Finally, he is also interested in the green-aware service-oriented architecture engineering and especially, in modelling the performance of software installed by providers in the cloud and exposed as a service.

ALAN BRENT MSc *Chalmers*, MPhil *Stellan*, MEng PhD *Pret*, Professor

Alan's research integrates the fields of engineering and technology management, and sustainability science, with a specific emphasis on the sustainability of energy technologies in various contexts. To this end he is responsible for the Sustainable Energy Systems initiative, and for the Mark Dunajtschik Chair in Sustainable Energy, Power and the Environment, at Victoria. His group focuses on the development of (energy) technical solutions for real-world problems, the development of methods to assess the sustainability of the solutions, and the utilisation of methods to understand complex (energy) systems; all with the aim to inform decision- and policy-making.

WILL BROWNE BEng(Hons) *Bath*, MSc EngD *Cardiff*, Ceng MiMechE, Associate Professor

Will's main area of research is Applied Cognitive Systems, essentially, how to use inspiration from natural intelligence to enable computers/machines/robots to behave usefully. This includes: Cognitive Robotics, Learning Classifier Systems (a branch of evolutionary computation) and Modern Heuristics for industrial application. Blue skies research includes analogues of emotions, abstraction, memory systems, 'small worlds' phenomenon, confusion/dissonance and machine consciousness.

KRIS BUBENDORFER MSc PhD *Well*, Associate Professor

Kris is conducting research into cloud related areas of distributed computing, including, services and service oriented architectures, workflows, cloud computing markets, resource allocation, cyber security, high performance computing, scientific computation, eResearch and the associated topics of social computing and reputation systems.

DALE CARNEGIE MSc PhD *Waik*, SMIEEE MNZIP, Professor

Dale heads Victoria's Mechatronics and Robotics Research Group. This Group has constructed a number of mobile autonomous robots, including MARVIN (Mobile Autonomous Robot for Indoor Navigation). MARVIN can wander office corridors after hours, question people he meets, change his shape to become larger and more intimidating, and alert security guards if required. Other developments include Urban Search and Rescue Robotics, and a growing collection of world-leading musical robotic instruments. Dale also has an interest in engineering education, specifically the identification and removal of barriers to recruitment and success in engineering study.

AARON (GANG) CHEN BE *Beijing IT*, PhD *Nanyang TU*, Senior Lecturer

Aaron has research interests in various aspects of distributed computing systems, including multi-agent systems and peer-to-peer overlay networks. He also has research interests in Artificial Intelligence, such as evolutionary computation, reinforcement learning, and swarm intelligence. Aaron's research focuses on developing AI techniques and applying them to solve problems in distributed systems. He is also exploring the use of machine learning technologies for network security and intrusion detection.

PAWEL DMOCHOWSKI BASc *Br Col*, MSc PhD *Queens (K'ton)*, MIPENZ, Senior Lecturer

Pawel's research interests lie in the areas of wireless communications and signal processing, focusing on multiple-antenna techniques and Cognitive Radio. Recent projects include the development and analysis of low complexity symbol timing synchronization framework for Multiple-Input Multiple-Output (MIMO) systems. In the realm of Cognitive Radio, the focus has been on the characterization of interference caused by unlicensed users, with the aim of developing effective mitigation strategies. Other projects include Massive MIMO and mmWave systems.

NEIL DODGSON BSc(Hons) *Massey*, PhD ScD *Camb*, CEng FIET FIMA, Professor

Neil works in three areas related to computer graphics and imaging. His engineering work involves a long-standing interest in the design and use of stereoscopic (3D) displays, including 3DTV, VR, and AR. His mathematical work is in methods for making smooth 3D models, in particular ways to improve the mathematical tools used in modelling for Computer-Aided Design (CAD) and computer animation. In imaging, he has worked on the analysis of abstract art and on tools to allow artists to work more effectively with images.

ROBIN DYKSTRA MSc PhD *Massey*, Senior Lecturer

Robin's interest is the development of scientific, industrial and educational instruments. Some examples are: (a) Portable NMR spectrometers using Radio Frequency (RF), digital transceiver, Digital Signal Processing (DSP) and power electronics technologies. (b) Earth's field NMR systems for education and for the study of the microstructure of Antarctic sea ice. (c) High-performance motor controllers and drive systems for Rheo-NMR. With many of his projects, Robin takes them to the complete product level and are commercialised through Magritek Ltd.

MARCUS FREAN BSc(Hons) *Massey*, PhD *Edin*, Associate Professor

Marcus studies machine learning, and in particular combinations of neural networks and probabilistic inference that are inspired by the way we think embodied brains might work. He is interested in how machines can learn useful representations of the world, how they use those representations to drive coherent actions, and what this might tell us about how biological creatures carry out cognition. A parallel interest is theoretical evolutionary biology and complex adaptive systems. Marcus's research has looked at the evolution of cooperation, the counter-intuitive effects that spatial structure can have on population dynamics, and ways in which network structure affects the rate of evolution.

QIANG FU BE *Harbin*, MEngSc *Adelaide*, MBA *Qld UT*, PhD *Qld*, Senior Lecturer

Qiang's research interests are in the areas of wireless and mobile networking protocols, integration and interworking of wired and wireless networks, network measurement and traffic analysis, Internet protocols and systems, and network security. Prior to his academic career, he had worked in mobile communications and aerospace industries for a number of years. Qiang is particularly interested in realistic network modelling and improving the performance of networking protocols based on "real world" scenarios.

XIAOYING GAO ME *Hebei*, PhD *Melb*, Senior Lecturer

Xiaoying's main research interests are in the area of information extraction, knowledge-based systems, and machine learning. Her research focuses on using knowledge engineering and machine learning technology to develop information agents–-intelligent programs that automatically search and extract information from the World Wide Web. She is currently working on algorithms for learning information extraction patterns from semi-structured Web pages.

GIDEON GOUWS BSc PhD *Port Eliz*, Senior Lecturer

Gideon's research interest is focused on the development of sensors or sensor systems for a variety of applications. Over the past few years he has studied various aspects of ultrasonic sensors, particularly shear mode (TSM) quartz resonators, for application as materials sensors. The use of different measurement configurations, together with signal processing techniques have shown that these sensors can successfully be used as sensors of material characteristics in the vapour, liquid or solid phase. Presently the main focus of his research is on the application of nano- and microstructured materials for ultrasonic sensors and wave propagation. Work is also in progress with Dr Malcom Ingham (SCPS) to develop instrumentation for electrical measurements on sea ice.

LINDSAY GROVES BSc *Auck*, MSc *Massey*, PhD *Well*, Associate Professor

Lindsay's main research interests are in formal methods (essentially, the use of mathematical/logical notation and reasoning) for software specification and design. The main focus of this work is the development of techniques for deriving programs from formal specifications based on the refinement calculus, and the design of tools to support program refinement, but also includes application of formal methods in industrial applications, refinement of logic programs, verification of concurrent systems, and semantics of data models. Lindsay is involved in three externally funded projects: investigating industrial applications of formal specification techniques (jointly with Ray Nickson and Waikato University, funded by FRST); proof methodologies for concurrent algorithms (jointly with Ray Nickson and Sun Microsystems, Boston, funded by Sun); and mathematical foundations for semi-structured data (jointly with Auckland University, funded by the Marsden Fund). He also has more general interests in software engineering, including program visualisation, program understanding, program maintenance/evolution and safety-critical systems.

CHRISTOPHER HOLLITT BE(Hons) BSc(Hons) PhD *Adel*, Senior Lecturer

Christopher's research focuses on the practical application of control engineering and of signal processing techniques. In particular, he is using these techniques to develop a low-level robot brain, capable of perceiving and interpreting the world and controlling the robot's actions. A range of reflexes intended to protect the robot and ensure its effectiveness are being developed, as well as a set of fundamental physical actions that can be used as the basis of more intelligent behaviours.

MICHAEL HOMER BA BSc(Hons) PhD *Well*, Lecturer

Michael’s research is in programming languages, with a focus on techniques enabling people performing programming tasks, including novices and non-programmers, to express their intentions in a way that matches their own understanding of the task. In particular, he works with domain-specific languages, extensible type systems, and visual programming, and investigates how and where disjoint programming paradigms can be usefully integrated. He is also interested in data management, the web, and parallels between programming languages and operating system organisation.

BASTIAAN KLEIJN MSc PhD *UCR*, MSEE *Stanford*, PhD *Delft*, FIEEE, Professor

Bastiaan's research interest is to develop solutions based on signal processing, information theory, and machine learning for problems relating to audio (including speech) and video signals. Examples of topics that he worked on recently are blind source separation (aiming to extract the original source signals from a set of signals acquired with microphones with unknown locations), audio and video coding for transmission over imperfect communication networks, and the enhancement of audio signals that have been subjected to noise.

THOMAS KÜHNE MSc PhD *Darmstadt*, Associate Professor

Thomas' research interests include object-technology, programming languages, (meta-) modeling, and model-driven development. He is interested in constructive software engineering – how can one produce systems with built-in quality that need not be checked by analytical methods afterwards? In particular, he is interested in the creation of software systems from high-level descriptions by a series of transformation steps to low-level executable code. Furthermore, he has an interest in multi-level description hierarchies for both modelling and programming.

ZOHAR LEVI BA *Tel Aviv-Yafo Acad Coll*, MSc *Tel Aviv*, PhD *Technion*, Lecturer

Zohar's research interest is geometry processing. Problems in the field include: low distortion mappings with applications of shape deformation and surface parametrization; shape interpolation; shape registration; and surface reconstruction. Algorithms and tools developed to address these problems are useful for shape modeling and animation.

JOHN LEWIS BS *John Hop*, SMVisS *MIT*, PhD *Well*, Adjunct Associate Professor

John ("JP") develops algorithms for computer graphics and computer vision. He works at Electronic Arts, in SEED, their new research lab, and has an adjunct position at Victoria. Previously he has worked at academic and industrial research labs including the University of Southern California and Stanford University, as well as in the film industry at companies including Weta Digital, Industrial Light and Magic and Disney. John has software credits on several films including Avatar, The Matrix sequels, and Forrest Gump. His published algorithms have been incorporated in commercial software and adopted in the film and game industries. His current work involves applications of computer vision and machine learning techniques to games.

KARSTEN ØSTER LUNDQVIST BSc(Hons) PhD *Reading*, Senior Lecturer

Karsten is interested in socio-technical research, especially how technology can be used to improve learning and teaching, both in formal and informal learning situations. Through this interest, he has studied how AI techniques can be used to automatise and improve teaching situation, for instance through the use of natural language generation and knowledge representation. He has also run his own Massive Open Online Courses (known as MOOC) with over 170000 participants, which has provided him with a test environment for socio-technical research. This has enabled him to study the implications of massive user engagement through MOOCs.

HUI MA BE *Tongji*, BInfSc(Hons) MInfSc PhD *Massey*, Senior Lecturer

Hui Ma obtained a PhD in Information Systems from Massey University in 2008. Before joining the School of Engineering and Computer Science at Victoria University in 2008, she worked as an Assistant Lecturer at the Department of Information Systems at Massey University and has been a member of the Information Science Research Centre since 2003. Hui's research areas are databases and software engineering. She has a particular interest in distributed databases, database programming, database design quality, web information systems, XML, cloud computing, service computing. Hui is also involved in international collaborations on service-oriented modelling and XML data modelling.

STUART MARSHALL MSc PhD *Well*, Senior Lecturer

Stuart is currently working in the fields of user interface modelling, agile development and software preservation. Stuart is particularly interested in techniques to create new (or annotate existing) user interface models informed by data on how users actually use their software. Stuart is also involved in investigating various features of agile development with respect to project management, and in how old software games from the 1970s/80s can be preserved for future generations. Stuart's Master's and PhD theses were in the field of software reuse, and he is still interested in how developers can better evaluate candidate reusable components.

YI MEI BSc PhD *U Sci Tech China*, Lecturer

Yi's research interests include solving complex scheduling and combinatorial optimisation problems with intelligent optimisation methods. From the problem side, his main interests include but not limited to the vehicle and arc routing problems, warehouse layout optimisation, job shop scheduling, tourist itinerary design, web service composition, and any other interesting scheduling problems with significant applications in the real world. From the technique side, he is particularly interested in meta-heuristics (evolutionary and memetic algorithms, tabu search, variable neighbourhood search, particle swarm optimisation, ant colony system, etc.), hyper-heuristics (genetic programming), and machine learning methods such as clustering, transfer learning, and feature selection and construction. He is in the Evolutionary Computation Research Group.

MARK MOIR BSc(Hons) *Well*, PhD *Chapel Hill*, Adjunct Professor

Mark's interests concern practical and theoretical aspects of concurrent, distributed, and real-time computing. His current research focuses on hardware and software mechanisms for making it easier to develop scalable, efficient, and correct concurrent programs for shared-memory multiprocessors.

CIARAN MOORE BE(Hons) PhD *CANT*, Senior Lecturer

Ciaran's areas of research include micro- and nano-fabrication, particularly via optical means (lithography, plasmonics, photonics). His work is arranged roughly into three strands:

- Nanofabrication - how can we manufacture ever-smaller devices, features or patterns to achieve goals that would otherwise be impossible with larger objects?
- Micro- and nano-scopy - assuming that we can fabricate nanoscale paraphernalia, how can we effectively view our creations in ways that identify and expose their unique properties?
- Micro-macro electrical and mechanical interfaces - given that we have started to unlock the power of the nanoscale world, how can we couple that potential into macroscopic scales that we can more readily interact with?

BRYAN NG BengSc *UTHM*, MSc *Multimedia (Malaysia)*, PhD *Malaya*, Lecturer

Bryan's research interests include performance analysis and communication protocols. In particular, he is interested in utilising stochastic processes and methods to assess the performance of networks and gain insights from the analysis. The models help networking practitioners make judicious decisions and improve the user experience on the Internet.

JAMES NOBLE BSc(Hons) PhD *Well*, FIITP, Professor

James's research centres around software design. This includes the design of the users' interface, the parts of software that users have to deal with every day, and the programmers' interface, the internal structures and organisations of software that programmers see only when they are designing, building, or modifying software. His current projects include: programming language design, agile development methods, aliasing in object-oriented systems, design patterns, and usage-centred interface design. His research in these areas is coloured by his longstanding interest in object-oriented approaches to software engineering.

DAVID PEARCE MEng *Lond*, PhD *Imperial*, Senior Lecturer

David's research interests include directed graph algorithms and program analysis. In particular, he is interested in developing efficient new algorithms for improving the execution time and precision of pointer analysis. Here, pointer analysis is the problem of tracking how pointer values flow within a program. This can be used, for example, to automatically detect NULL pointer dereferences. To this end, David is currently investigating new algorithms for dynamic topological sort, transitive reduction, transitive closure, and incremental static single assignment form.

ALEX POTANIN BSc(Hons) PhD *Well*, Associate Professor

Programming languages are the essential tools enabling software engineers to achieve their goals. Since 2012, Alex has been collaborating closely with Carnegie Mellon University on the development of a secure web programming language called Wyvern. Alex mostly concentrates on the formal work surrounding programming languages including capabilities, effects, ownership, immutability and the limits of type checking. His industry collaborations include Mozilla, Oracle, and US and NZ Government organisations. Please see Alex's webpage on the school's website for his most recent publications and feel free to get in touch to discuss any possible research projects.

JAMES QUILTY BA BSc(Hons) PhD *Well*, Senior Lecturer

James' research interests span several fields and techniques, from ferroelectric solids to nonlinear optical organic molecules and Raman spectroscopy to ellipsometry. Through these run common threads of lasers, optics and materials science and engineering. Present areas of research are novel techniques for the inscription of holographic gratings, ferroelectrics for sensor applications measured via Raman spectroscopy and UAV-based spectroscopic discrimination of organic and non-organic material. To these areas, James brings a long-standing interest in computational techniques for data analysis and theoretical calculation of materials properties.

RAMESH RAYUDU BEng(Hons) *Osmania*, MEng *Cant*, PhD *Linc*, Senior Lecturer

Ramesh's research interests are mainly in power system engineering and computational intelligence. His current research is in reactive power control and management, computational intelligence applications, power quality analysis of residential non-linear loads, non-invasive load monitoring and analysis, transformer diagnosis, and grid connection aspects of renewable energy systems.

Prior to his academic positions, Ramesh worked as an engineer at Transpower NZ Ltd., New Zealand's electric transmission company and ISO. His work experience includes power system analysis, power system operation, protection analysis, dynamic line rating, and numerical modelling of power networks and equipment studies.

Currently, Ramesh's other research areas include monitoring and analysis of wireless sensor networks (with Massey University), Computational Biology (with Lincoln University), Enterprise Architectures for Film Industry (with Wingnut Films) and Micro-Grids and Power Electronics (with IRL).

TAEHYUN RHEE BE MSc *Sogang*, MSc PhD *S Calif*, Associate Professor

Taehyun Rhee's research concern is to solve scientific problems related to computer graphics, animation, vision, and medical imaging. His current research activity is focused on realistic human body modelling and animation, soft-tissue deformation, surface/volume reconstruction from in vivo scans, and real-time global illumination. Before joining Victoria, he was a project leader and senior researcher at Samsung Advanced Institute of Technology (SAIT). He directed many research projects related to human body deformation, facial animation, real-time global illumination, and augmented reality. From 1996 to 2003, he was a senior engineer of Research Innovation Centre at Samsung Electronics. He developed photorealistic rendering algorithms, rendering systems, 3D user interfaces, VR applications, and was an internal consultant in 3D industrial design process.

WINSTON KHOON GUAN SEAH BSc, MEng *NU Singapore*, DEng *Kyoto*, Professor

Winston is actively involved in research and development in the areas of mobile ad hoc and sensor networks and co-developed one of the first Quality of Service models for mobile ad hoc networks. He has worked for more than 15-years in mission-oriented research, taking ideas from theory to prototypes. His latest research focuses on wireless sensor networks (WSNs) powered by ambient energy harvesting, WSNs for structural health monitoring, and mobility-enhanced protocols and algorithms for networked swarm robotics and sensing applications in terrestrial and oceanographic networks. He is also interested in environmentally friendly (green) technology for wireless systems.

Projects:

- Wireless Sensor Networks Powered by Ambient Energy Harvesting (WSN-HEAP)
- Robust end-to-end wireless multihop protocols for harsh environments
- Environmentally-friendly (green) protocols for wireless communications systems
- Networking protocols for swarms of unmanned air/ground/underwater vehicles
- Game-/queueing-theoretic approaches in wireless communications systems
- Cognitive approaches for wireless sensor-actuator networks.

MARCO SERVETTO MSc PhD *Genoa*, Lecturer

Marco is an active researcher in the area of Type theory for programming languages and formal programming language design. He is developing 42, a novel programming language whose main goal is to support the use of millions of libraries at the same time. To achieve such ambitious goal, libraries must be oblivious to the user and automatically composed relying on powerful meta-programming support. This, in turn, requires being able to formally reason about the intended properties of libraries, notably over immutability and aliasing of mutable of data.

MANSOOR SHAFI BSc *Lahor*, PhD *Auck*, Adjunct Professor

Mansoor's research interests are in the physical layer of Communications Systems-specifically in the following areas: Radio Propagation Models; information theoretic and practical aspects of MIMO Systems; Intelligent receiver architectures, adaptive antennas, diversity techniques; Broadband Wireless communications systems; Modulation, channel estimation and equalization; and Cognitive Radio.

DAVID STREADER BA MSc PhD *Queen Mary*, Senior Lecturer

David's research interests are in software verification. In particular the refinement and correct by construction approaches. This work being based on formal models of specification and there subsequent formal refinement, as used in the industrial tools B and Event B. His interests span formal semantics models of both event and state-based system. To make formal development easier he has developed semantics transformations to allow the representation of systems to change during the development process. This way features such as probability and real time can be added when needed during the system development. As specifications are frequently unavailable or out of date, he is interested in generating specifications from code execution.

PAUL TEAL BE(Hons) *Syd*, PhD *ANU*, Associate Professor

Paul's areas of research are in the development of algorithms and techniques of signal processing, and the application of these techniques in audio and hearing research, communications, magnetic resonance and biomedical devices. Signal processing is vital to the economy because it underpins almost all other scientific and technological endeavour. Most scientific experiments, for example, involve collection of data by some sort of electronic device. Interpretation of this data will involve some sort of signal processing, and superior techniques will result in superior data interpretation.

ALVIN VALERA BSc *Philippines Diliman*, MSc PhD *NU Singapore*, Senior Lecturer

Alvin's research interests are in the development of protocols and algorithms for the Internet of Things (IoT). IoT applications require sensing, sense-making, and actuating capabilities in order to deliver the promise of "freeing humans from mundane tasks". Alvin's research looks at new paradigms and inspirations to design networks that satisfy the unique requirements of IoT applications and scale up to support the envisaged billions of connected devices. His current research focus is on the use of information-centric networking in the context of resource-constrained IoT networks. This includes the design of schemes to efficiently collect, filter, and disseminate messages; to manage the operation of the network; and optimise and control the performance of the network.

IAN WELCH BCA *Well*, MSc PhD *Newcastle (UK)*, Associate Professor

Ian studied commercial law and accountancy at Victoria University before working for Andersen Consulting on the redesign of the Inland Revenue tax system. Subsequently, he obtained a Master's and PhD from the University of Newcastle upon Tyne. While at Newcastle he was involved in three EU projects: Design for Validation; Dependable Systems of Systems; and, Malicious- and Fault- Tolerant Internet Applications. His PhD is in the area of software engineering and application-level security. He has been working at Victoria University since 2003 in the Network Engineering Research Group although he also does work with colleagues from the ELVIS Software Research Group. Ian supervises projects on Internet Security (searching the web for malware and measuring the amount of malicious activity on the Internet), anonymous and verifiable auctions (removing the need for a centrally trusted auctioneer) and Grid-enabled Internet Instruments (managing network instruments using workflows). He is also involved with a project to preserve New Zealand's early computer gaming software.

BING XUE BSc *Henan UFEL*, MSc *Shenzhen*, PhD *Well*, Senior Lecturer

Bing is in the Evolutionary Computation Research Group at Victoria University. Her main research interests are in the areas of artificial intelligence, machine learning, data mining and big data. She focuses on evolutionary computation for feature reduction and dimensionality reduction, particularly using particle swarm optimisation, genetic programming or evolutionary multi-objective algorithms for feature subset selection and/or high-level feature construction to reduce the dimensionality of the data space to an order of magnitude, to improve the learning performance, and reduce the computational cost. Bing is working on feature reduction for classification, clustering, symbolic regression, image analysis, and she is also interested in transfer learning, text mining, bio-informatics, and cyber security.

FANGLUE ZHANG BSc *Zhejiang*, PhD *Tsinghua*, Lecturer

Fanglue is in the Computer Graphics Group at Victoria University. His main research interests are in the areas of computer graphics, image and video analysis and computer vision. He received his BSc degree from the Zhejiang University in 2009 and PhD degree from Tsinghua University in 2015. Currently, he is focusing on 360-degree video analysis and processing and the application on mixed reality, aesthetic oriented image/video editing and enhancement and real-time scene modelling for robotics.

MENGJIE ZHANG MEng *Hebei*, PhD *RMIT*, Professor

Mengjie's main research interests are Artificial Intelligence and Big Data/Data Mining, particularly Machine Learning and Evolutionary Optimisation including feature selection and big dimensionality reduction, computer vision and image analysis, multi-objective optimisation, evolutionary deep learning and transfer learning in classification, prediction, clustering and symbolic regression as well as scheduling and combinatorial optimisation. He holds a number of funded projects in these areas from Marsden, MBIE and Huawei NZ as well as international sources. The main evolutionary learning techniques he is interested in are genetic programming, particle swarm optimisation and differential evolution. He is also interested in learning theory, search based software engineering, and resource planning and allocation in cloud computing, wireless communications and manufacturing.

GENERAL INFORMATION

POSTGRADUATE RESEARCH SUPERVISION

These are prepared and written in close consultation with a staff member who acts as supervisor. Research students are expected to participate in and contribute to research-in-progress seminars organised from time to time by the School.

The Faculty of Graduate Research requires all PhD students to submit six monthly reports in May and November. These reports are prepared in collaboration with their supervisors and are expected to identify what has been achieved, outline agreed timetables for future work and identify any problems and how they can be resolved. Copies of the formal reports are provided to the student and the School's Graduate Coordinators, and put on file in the Faculty Student Administration Office.

Master's students are required to submit a one-month confirmation of study, which includes your research proposal. These are expected one month after enrolment. Master's students are also required to supply a three and eight-month progress report.

FUNDING

The Research Funding Guide is published by the University's Research Policy Office and is available at www.victoria.ac.nz/home/publications/research_funding_guide.pdf.

The Postgraduate Students' Association has information on StudyLink funding www.victoria.ac.nz/pgsa.

POSTGRADUATE SCHOLARSHIPS, PRIZES, AND GRANTS

Students should check out the University's Prizes and Scholarships database at www.victoria.ac.nz/scholarships.

Faculty Research Grants and Summer Scholarships may also be available, visit www.victoria.ac.nz/science/study/scholarships or contact Margot Neas for more information margot.neas@vuw.ac.nz.

POSTGRADUATE STUDENTS' ASSOCIATION

The Postgraduate Students' Association provides representation and other services for all Victoria's postgraduate students www.victoria.ac.nz/pgsa. You can subscribe to the PGSA email list by emailing pgsa-members-subscribe@vuw.ac.nz.

VICTORIA ABROAD

Students studying course-taught postgraduate studies are able to participate in an exchange, however, not all of our partner universities are open to postgraduate students—talk to the Victoria Abroad Office about which universities will be open to you. www.victoria.ac.nz/exchange.

WHO TO CONTACT

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

STUDENT AND ACADEMIC SERVICES — FACULTIES OF SCIENCE AND ENGINEERING

Address	Level 1, Cotton Building
Phone	463 5101
Email	science-faculty@vuw.ac.nz or engineering@vuw.ac.nz
Hours	8.30 am–5pm Monday, Wednesday, Thursday, Friday 9.30 am–5pm Tuesday

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

Staff		Contact
Patricia Stein	*Manages all Postgraduate Students* patricia.stein@vuw.ac.nz	463 5982
Johan Barnard	*Manager, Student and Academic Services*	463 5980
A/Prof Peter Andreae	*Associate Dean (Students)*	463 5834

TE RŌPŪ ĀWHINA

Address	Cotton Building, Kelburn Parade, Room 133
Phone	463 5987
Email	teropuawhina@vuw.ac.nz
Web	www.victoria.ac.nz/awhina

Established in 1999, Āwhina is about people and collective success. The kaupapa of Āwhina is to produce Māori and Pacific science, engineering, architecture and design professionals to contribute to Māori and Pacific community and leadership development. Anyone who assists the building of Āwhina is part of the whānau.

FACULTY OF GRADUATE RESEARCH OFFICE

Location	10 Kelburn Parade
Phone	463 5890
Email	pg-research@vuw.ac.nz
Web	www.victoria.ac.nz/fgr

Staff		Contact
Prof Peter Whiteford	*Dean*	463 7408
Prof Simon Keller	*Deputy Dean*	463 9638
Judith Bagley	*Manager, PGR Student Academic Services*	463 5233 x7801
Tara Fisher	*Senior Doctoral Examinations Administrator*	463 9478
Alice Hinton	*Doctoral Examinations Administrator*	463 5148
Alana Hamill	*Candidature Management Administrator*	463 5404
Dr Sara Cotterall	*Doctoral Development Coordinator*	463 6112
Maria Mavroeidi	*PGR Data Management Administrator*	463 5406
Linda Smillie	*Office Administrator*	463 5890
Sue O'Donnell	*Manager, Scholarships and PhD Admissions*	463 7493
Barry Lewis	*Senior Scholarship and PhD Admissions* Officer	463 5061
Hariaty Abu Hassan	*Scholarships Administrator*	463 5557
Emily Close	*Scholarships Administrator*	463 4754
Claire Duggan	*Scholarships Administrator*	463 5233 x8035
Tiso Ross	*Admission Administrator*	463 5233 x8008
Vicky Boswell	*Awards and Financial Administrator*	463 5233 x7058