POSTGRADUATE COURSES 2020

SCHOOL OF ENGINEERING AND COMPUTER SCIENCE – TE KURA MĀTAI PŪKAHA, PŪROROHIKO

http://www.wgtn.ac.nz/ecs

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CONTACT INFORMATION

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2020 Postgraduate Study Options

	Degree Programme	Intake (start date)	Minimum duration (academic year)	Total points for full qualification	Programme Structure	Minimum entry requirements
Research Degree	**Bachelor of Science with Honours** (Computer Graphics, Computer Science, Electronics and Computer Systems, Renewable Energy)	Mar, Jul	1	120	Coursework + Research Project	Satisfactory completion of Part 1 and at least a B+ average in subject area at 300 level
	Master of Science by coursework and thesis (Computer Graphics, Computer Science, Electronics and Computer Systems)	Part 1: Mar, Jul Part 2: Anytime	Part 1: full year Part 2: full year (2 years total)	Part 1: 120 Part 2: 120 (240 total)	Coursework + Thesis	Bachelor's degree or equivalent in a relevant subject area with at least a B+ average.
	Master of Engineering by thesis (Electronic and Computer Systems Engineering, Network Engineering, Software Engineering)	Anytime	1	120	Coursework + Thesis	Bachelor's degree or equivalent in a relevant subject area with at least a B+ average.
	Doctor of Philosophy (PhD)	Anytime	3	Not Applicable	Thesis	Honour's degree with at least a B+ average or equivalent, or Master's degree with at least B+ average or equivalent.
Coursework Degree	**Master of Computer Science**	Mar, Jul	Part 1: full year Part 2: half year (1.5 years total)	180	Coursework + Project	Bachelor's degree or equivalent in a relevant subject area with at least a B+ average
	Master of Engineering Practice	Mar	Part 1: full year Part 2: half year (1.5 years total)	MEP: 180 *PGCertEP: 60* *PGDipEP: 120*	Coursework + Project	Bachelor's degree or equivalent in a relevant subject area with at least a B+ average.
	Postgraduate Diploma in Science (Computer Graphics, Computer Science, Electronics and Computer Systems)	Mar, Jul	1	120	Coursework	Bachelor's degree or equivalent in a relevant subject area with at least a B average
	Postgraduate Certificate in Science (Computer Graphics, Computer Science, Electronics and Computer Systems)	Mar, Jul	1	60	Coursework	Bachelor's degree or equivalent

Conversion Degree	**Graduate Diploma in Science** (Computer Graphics, Computer Science, Electronics and Computer Systems)	Mar, Jul, Nov	1	120	Coursework	Bachelor's degree or equivalent
	Master of Software Development	Jul	Part 1: half year Part 2: half year (1 year total)	MSwDev: 180 *PGCertSD: 60* *PGDipSD: 120*	Coursework + Project	Bachelor's degree not in computing with at least a B average. Basic level of competence in programming required.

COURSES OFFERED: 400-LEVEL COURSES

CGRA 402 CRN 28326 **Special Topic: Project in Computer Graphics Programming** 15 PTS **Tri 1**

Prerequisites: Permission of Head of School

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.

CGRA 408 CRN 28327 **Computer Graphics Rendering** 15 PTS **Tri 1**

Prerequisites: COMP 308 or at least B- in CGRA 401 and 402 (or COMP 471 and 472 in 2014-15)

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.

CGRA 409 CRN 28328 **Geometry Processing Algorithms** 15 PTS **Tri 2**

Prerequisites: COMP 308 or at least B- in CGRA 401 and 402 (or COMP 471 and 472 in 2014-15)

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.

CGRA 463 CRN 28330 **Computer Graphics Practicum** 30 PTS **Tri 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.

CGRA 489 CRN 28333 **Computer Graphics Project** 30 PTS **Full Year**

Coordinator: Prof Neil Dodgson

All candidates for BSc(Hons) in Computer Graphics are required to take CGRA 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. CGRA 489 is a two-trimester course. It can be done over any two consecutive trimesters.

COMP 421	CRN 986	**Machine Learning**	15 PTS	**Tri 2**

Prerequisites: COMP 307, one further 300-level COMP, ECEN, NWEN or SWEN course

This course covers a range of topics in machine learning, with a focus on inference and uncertainty. Topics include optimization, Bayesian probability theory, learning from rewards, unsupervised learning, Belief networks and particle filters.

COMP 422	CRN 2324	**Data Mining, Neural Networks and Genetic Programming**	15 PTS	**Tri 2**

Prerequisites: COMP 307, 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.

COMP 423	CRN 4962	**Intelligent Agents**	15 PTS	**Tri 1**

Prerequisites: COMP 307, 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.

COMP 424	CRN 31156	**Big Data**	15 PTS	**Tri 1**

Prerequisites: One of (COMP 307, 309, STAT 393, 394); STAT 193 or ENGR 123 or approved background in Statistics;

Big Data refers to the large and often complex datasets generated in the modern world: data sources such as commercial customer records, internet transactions, environmental monitoring. This course provides an introduction to the theory and practice of working with Big Data. Students enrolling in this course should be familiar with the basics of machine learning, data mining, statistical modelling and with programming.

COMP 489 CRN 1027 **Research Project** 30 PTS **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 COMP 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. COMP 489 is a two-trimester course. It can be done over any two consecutive trimesters.

ECEN 403 CRN 29034 **Microfabricated Devices** 15 PTS **Tri 2**

Prerequisites: ECEN 303 (or PHYS 340); ECEN 220 or MATH 243 or 244;

Advanced analogue and digital electronics, design principles, transform methods of analysis, active and passive filters, oscillators, phase-locked loops, digital signal processors, digital synthesis, communication principles, RF design.

ECEN 405 CRN 18521 **Power Electronics** 15 PTS **Tri 1**

Prerequisite: ECEN 303 (or PHYS 340)

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

ECEN 410 CRN 18522 **Advanced Communications Engineering** 15 PTS **Tri 1**

Prerequisite: ECEN 310

This course provides an introduction to the fundamentals of wireless communication systems, in particular, digital wireless communications. The characteristics of fading channels are considered, and their effect on the propagation of signals. Countermeasures such as diversity, forward error control, and modulation schemes for wireless communications are studied. Multiple-access techniques such as time-, frequency-, and code-division multiple access are examined.

ECEN 415 CRN 18519 **Advanced Control Systems Engineering** 15 PTS **Tri 2**

Prerequisite: ECEN 315

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.

ECEN 422 CRN 29035 **Engineering Optimisation** 15 PTS **Tri 2**

Prerequisite: ECEN 321, or ECEN 220 (prior to 2016), or ECEN 320 (in 2016)

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.

ECEN 425 CRN 18524 **Advanced Mechatronic Engineering 1: Hardware and Control** 15 PTS **Tri 1**

Prerequisite: ECEN 301 (or PHYS 340)

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.

ECEN 430 CRN 18576 **Advanced Mechatronic Engineering 2: Intelligence and Design** 15 PTS **Tri 2**

Prerequisite: ECEN 301 (or PHYS 340)

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.

ECEN 431 CRN 31155 **Musical Robotics** 15 PTS **Tri 2**

Prerequisite: ECEN 301 (or PHYS 340)

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.

ELCO 489 CRN 23071 **Research Project** 30 PTS **Full Year**

Prerequisite: A research project on a topic approved by the Head of School.

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.

ENGR 401 CRN 18690 **Professional Practice** 15 PTS **Tri 1**

Prerequisite: 75 300-level pts from the BE(Hons) schedule including ENGR 301, 302

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.

ENGR 440 CRN 26008 **Directed Individual Study** 15 PTS **Tri 1**
27189 **Tri 2**

Prerequisite: Permission of Head of School

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

ENGR 441 CRN 26239 **Directed Individual Study** 15 PTS **Tri 1**
26009 **Tri 2**

Prerequisite: Permission of Head of School

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

ENGR 489 CRN 18688 **Engineering Project** 30 PTS **Full Year**

Prerequisites: 75 300-level pts from the BE(Hons) including ENGR 301, 302

Students will work on an individual project of a complex nature in order to develop a solution to an engineering problem. In addition to the technical engineering development work, the project may require consideration of issues such as customer specifications, cost analysis, IP and product testing and delivery. Students will be required to give an oral and a poster presentation as well as a final report on their project.
ENGR 489 is a two-trimester course.

ENGR 491 CRN 18701 **Professional Work Experience** 0 PTS **Full Year**

Prerequisites: ENGR 391, 401

Students will complete a range of activities in preparation for the work experience requirement of the BE(Hons):

- attended a second reflective writing workshop

- undertaken a minimum of 800 hours of work experience
- at least 350 hours of which is professional IT experience
- completed required documentation to gain pre-approval for each element of work experience and record its completion.
- submitted a reflective report on each work experience undertaken
- improved their prospects of finding suitable employment after graduation

NWEN 403 CRN 18604 **Advanced Network Engineering** 15 PTS **Tri 1**

Prerequisites: NWEN 302, 30 further 300-level pts from (COMP, ECEN, NWEN, SWEN)

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.

NWEN 404 CRN 18605 **Mobile Computing** 15 PTS **Tri 1**

Prerequisites: NWEN 302, 30 further 300-level pts from (COMP, ECEN, NWEN, SWEN)

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.

NWEN 406 CRN 18592 **Distributed Computing in Grids and Clouds** 15 PTS **Tri 1**

Prerequisites: NWEN 301 and NWEN 302 or 303

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.

RESE 411 CRN 31173 **Power Systems Analysis** 15 PTS **Tri 1**

Prerequisites: ECEN202, 203

This course introduces the electricity industry and its components along with techniques for modern electric power system modelling and analysis. Topics include transmission line models, transformers and per unit systems, generator models, network matrices, power flow analysis and computation, real and reactive power control, voltage control, and protection. The course incorporates lab and simulation based exercises, an industrial tour, and an industrial project.

RESE 412	CRN 31165	**Advanced Development of Renewable Energy Systems**	15 PTS	**Tri 2**
Prerequisites:		Permission of Head of School		

This course presents techniques used to design advanced, integrated renewable energy solutions for given situations. The design of nano- and micro-grids will be analysed, with students applying this knowledge to designing, constructing and testing a fit-for-purpose renewable energy system. This course also presents the concept of systems engineering, introducing systems thinking principles.

SWEN 421	CRN 18661	**Formal Software Engineering**	15 PTS	**Tri 1**
Prerequisites:		SWEN 324 (or 224), 30 300-level pts from (COMP, SWEN)		

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.

SWEN 422	CRN 18662	**Human Computer Interaction**	15 PTS	**Tri 2**
Prerequisite:		SWEN 303		

This course covers principles of human-computer interaction that underlie good design of software user interfaces. Advanced topics are introduced with a focus on current research areas.

SWEN 423	CRN 18663	**Design: Patterns, Frameworks and Languages**	15 PTS	**Tri 2**
Prerequisites:		COMP 304 or SWEN 301; 15 further 300-level pts from COMP, NWEN or SWEN pts		

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.

SWEN 424	CRN 18664	**Model-Driven Development**	15 PTS	**Tri 1**
Prerequisite:		30 300-level pts from (COMP, NWEN, SWEN)		

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.

SWEN 430 CRN 18668 **Compiler Engineering** 15 PTS **Tri 2**

Prerequisites: COMP 261, SWEN 324 (or 224); 30 further 300-level pts from (COMP, NWEN 303, SWEN)

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.

SWEN 432 CRN 18670 **Advanced Database Design and Implementation** 15 PTS **Tri 1**

Prerequisites: SWEN 304, 15 further 300-level COMP, NWEN or SWEN pts

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.

SWEN 433 CRN 18671 **Web Information Systems Engineering** 15 PTS **Tri 2**

Prerequisites: SWEN 304, 15 further 300-level COMP, NWEN or SWEN pts

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.

COURSES OFFERED: 500-LEVEL COURSES

ENGR501 CRN 28383 **Engineering Research and Communication** 15 PTS **Tri 2**

PREREQUISITES: Admission to the MEP

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 CRN 28384 **Engineering Professional Practice** 15 PTS **Tri 1**

PREREQUISITES: Admission to the MEP

The course addresses a range of issues in the professional practice of engineering, including critical thinking and problem solving, working in teams, innovation and entrepreneurship, social, cultural, legal, health & safety, environmental, and sustainability impact of engineering problems and solutions, and professional ethics and codes of conduct. Students will gain skills required to work as a professional engineer in the New Zealand engineering industry.

ENGR510 CRN 31182 **Engineering Project 1** 15 PTS **Tri 1**

PREREQUISITES: Admission to the MEP

Project management including aspects of life cycle, requirements analysis, principles of design, project tasks and deliverables, contracts, feasibility analysis, cost estimation and cost/benefit analysis, project scheduling, critical path analysis, risk management, quality assurance, managing project resources, testing and delivery, maintenance, interpersonal communication, teamwork and project leadership.

ENGR511 CRN 31183 **Engineering Project 2** 15 PTS **Tri 2**

PREREQUISITES: ENGR502, 510 (co-requisite: ENGR501)

The course develops more advanced skills in executing and managing engineering projects. Students will work in teams on a project of appropriate complexity, practising teamwork and project execution, monitoring and closing. The course concludes with the delivery of a successful project outcome to a client.

ENGR588 CRN31187 **Engineering Research and Development Projects** 60 PTS **Tri 3**

PREREQUISITES: Part 1 of MEP

Supervised project, working on an engineering research and development problem.

ENGR589 CRN28385 **Industry Project** 60 PTS **Tri 3**

PREREQUISITES: Part 1 of MEP

Supervised project, working on an engineering research and development problem.

SWEN 501 CRN 28340 **Professional Programming Skills** 15 PTS **Tri 2**

Prerequisites: Admission to the MSwDev

Focussed on teaching core programming skills as well as complex programming concepts and techniques, this course covers a range of topics including programming commands, data structures, object orientation, fundamental algorithms and data structures, among others. The course focuses on the core principles while teaching Java, thereby enabling students to pick up other languages on their own.

SWEN 502 CRN 28341 **Software Development Studio I** 45 PTS **Tri 2**

Prerequisites: SWEN501 (with B grade or better)

Building on the skills learnt in SWEN501, this course introduces methods for development in teams, including professional practice and communication skills in the context of software development. Advanced topics, such as networking, cybersecurity, and human-computer interaction (HCI) will be introduced.

SWEN 504 CRN 32075 **Software Development Studio II** 60 PTS **Tri 3**

Prerequisites: SWEN502

This course teaches students a range of advanced technical techniques, professional practices, and project planning, and covers topics like web development, testing, mobile apps and AI. The main focus of the course is on agile development methods where students learn from working on real-life industrial problems.

SWEN 589 CRN 28344 **Industry Research and Development Project** 60 PTS **Tri 1**

Prerequisites: Part 1 of MSwDev

This course involves a substantial software research and development project, undertaken as a paid internship where the student is placed in a local ICT business. Alternatively, in certain cases, this could be an industry-sourced (or industry-related) project done within the school. The project involves supervision by an academic as well as the industry employer, and will involve formal and informal reporting and presentations.

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: Room 144, Cotton Building
Phone: 04-463 5101
Email: **engineering@vuw.ac.nz** (or **science-faculty@vuw.ac.nz**)
Hours: 8.30am–4:00pm Monday, Wednesday, Thursday, Friday
9.30am–4:00pm 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.

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