ENGINEERING AND COMPUTER SCIENCE

How would you like to develop technology that helps people hear, talk or walk again, send a robot explorer into space or design a hacker proof security system? How about creating the next hottest phone game or the latest special effects in film? Digital technology is everywhere – in homes, schools and businesses, walking around with you in your pocket. It's what makes global communication and space travel possible, and takes medical science where no one has been before. Engineers and computer scientists are some of the most sought after people in the modern world, wanted for their technological know-how, problem solving and creativity, their abilities to understand how things really work and make continual improvements. A degree in digital engineering or computer science will prepare you for a great range of interesting and well-paid careers that include electronics, robot design, systems development, hardware development, programming, software engineering, systems management and research – the sky is no longer the limit.

SOFTWARE ENGINEERING

Computer software controls many aspects of our lives, from safety critical nuclear power plants, airlines and medical devices to the computer applications you use everyday such as Google, Twitter and Facebook; Trade Me, Dropbox and more. Software engineers design computer programmes that give digital technology the intelligence to work safely and reliably. Software systems are increasingly complex and interconnected; working with them is continually challenging. Software engineers need a range of technical expertise, however those skills are just part of the job. You also must be able to work with other people—other engineers, clients and systems users. Studies in software engineering teach you how to manage software projects involving many people and how to work as a team to solve problems and start building experience.

Sample Job Titles: Cloud architect • programmer • software engineer • software quality assurance analyst • system administrator • systems analyst • system architect • system designer • system analyst • system software engineer.

NETWORK ENGINEERING

Communication networks have totally changed the way we work and play. We now demand instant communication with anyone via voice, text and video, and immediate access to all kinds of information and services. The networks that make this possible involve a wide range of engineering challenges. They use different technologies - wireless, wired and fibre optics – which have to be seamlessly interconnected and work in

a reliable, highly efficient manner. The designs are complex and incorporate different protocols that determine how information flows over the networks and how the networks respond to faults. The study of networking includes the network elements, applications, content and the distributed systems that make up the service-enabling technologies.

Studies in Network Engineering will give you an understanding of the full range of modern communication technologies, network protocols and middleware required for modern networks. You will also learn how to design, build, configure and test modern networks and networked services.

Sample Job titles: Network architect • network engineer • network system administrator • systems engineer.

ELECTRONIC AND COMPUTER SYSTEMS ENGINEERING

Electronic and computer technology is constantly at our fingertips whether it's the latest smart phone, high definition digital television, temperature controlled refrigerators, environmental sensors, aircraft controls or sophisticated GPS tracking systems. Electronics and computer engineers play a key role in the design and manufacture of these systems, and many more. The global telecommunications network includes both satellite links and fibre-optic undersea cables that connect people around the world.

Engineers design and develop the hardware that makes up the physical systems, and the software that defines what they do. In the modern electronic age the difference between hardware and software is blurring. The speed of microprocessors has increased and the cost decreased. A few lines of code (software) now perform many functions that were once carried out by a dedicated electronic chip (hardware). Hardware and software solutions solve many complex real-life and engineering problems. Artificial intelligence, security systems, user interfacing, industrial and interaction design are all part of this field. You may even find yourself working on one of New Zealand's most diverse collection of autonomous mobile robots or developing new sensors and techniques to monitor the health of unborn babies.

Sample Job titles: Electronic engineer • mechatronic engineer • robotics engineer • electronics test development engineer • hardware engineer – electronic • product development engineer or technician.

COMPUTER SCIENCE

Skilled computer professionals keep our high-tech world moving. As computers contribute increasingly to our creativity, communication, entertainment and wellbeing, the demand for computer scientists continues to grow. Computer science ranges from theory through programming to the development of cutting-edge computing solutions. As a computer scientist you are likely to work in one of three main areas: a) designing and building software; b) developing effective ways to solve computing problems such as storing information in databases, sending data over networks or troubleshooting security problems; c) thinking up new and better ways of using computers in areas such as robotics, computer vision or digital forensics.

A computer science degree combines well with other disciplines such as commerce and design. In fact these days business knowledge is absolutely essential for IT professionals.

"IT *is* the business – there is no longer a divide. Gone are the days where the IT crowd hung out in dark basements and did their own thing. These days IT empowers and enhances businesses and without an understanding of the organisation around them, IT professionals can't help these organisations reach
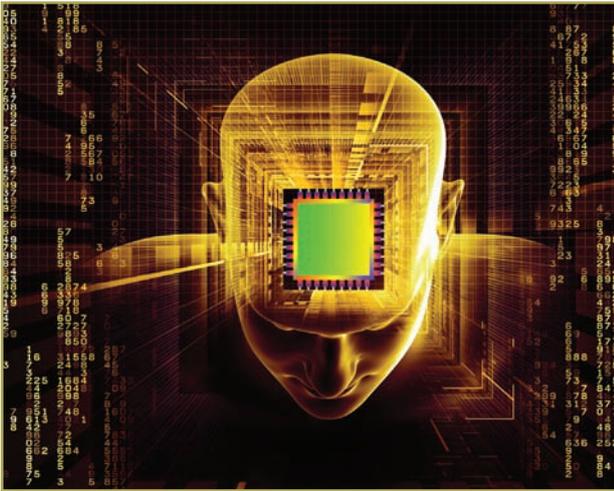
their potential through technology." (Institute of IT Professionals NZ)

Sample Job titles: Business analyst • business architect • computer systems analyst • computer scientist • game developer • help desk analyst • Java developer • website administrator • website developer.

WHAT EMPLOYERS LOOK FOR

As well as high-level technical skills and excellent grades, employers look for skills like:

- Lateral thinking and problem-solving

- Effective inter-personal skills

- Teamwork

- Outstanding communication and documentation skills - including spelling and business writing, and the ability to listen to instructions

- Willingness to pitch in

- Genuine interest in the role and the company

- Perseverance - get in and get it done

- Passion for the IT industry

- Strong customer service ethic

- Well-rounded individual with diverse interests

Employers also look to see that your values fit well with those of the organisation's. Values could include:

- Continual learning

- Share knowledge

- Committed to customer success

- Respect for all

- Work at a sustainable pace

ALWAYS CHANGING

IT can be applied in any context. Technology enriches every industry – in traditional areas such as accounting systems or business management tools, or in new mobile app or game development - the options are always changing. With the invention of app stores, and the change in usage from PC and laptops to tablets and smart phones, any developer or team can reach the sort of scale previously only dreamed. The kind of data now available has opened up whole new industries in business intelligence and "big data" - the analysis of vast stores of information. Harnessing all of this power for the good of businesses, people and communities are IT Professionals with qualifications such as Digital Engineering and Computer Science.

- Integrity

- Work hard and play hard too

Some companies use interns as a way to recruit permanent staff. That way they get to know the people they employ. "Team fit is so important to us; we think the best way to find this out is for students to work for us to see if there is a good fit. When they start with us at the end of their final year they "hit the ground running" which I think makes them feel more productive and satisfied." (Abletech)

WHERE DO DIGITAL ENGINEERING AND COMPUTER SCIENCE GRADUATES WORK?

The only constant in digital technology is change. Some of the roles that you will graduate into won't even exist when you start studying. "Cloud" technology delivered over the Internet is replacing on-premise hosted software and services such as business software and email. This change has opened up a whole new raft of opportunities for those in IT, especially in software.

Depending on your qualifications and experience there are many roles across every sector – you could even create a new one.

Central Government

Government ministries and agencies do business through IT systems. New developments in digital technology bring changes to the ways data is stored and retrieved and the ways business is done. Government employs people to roles such as: project
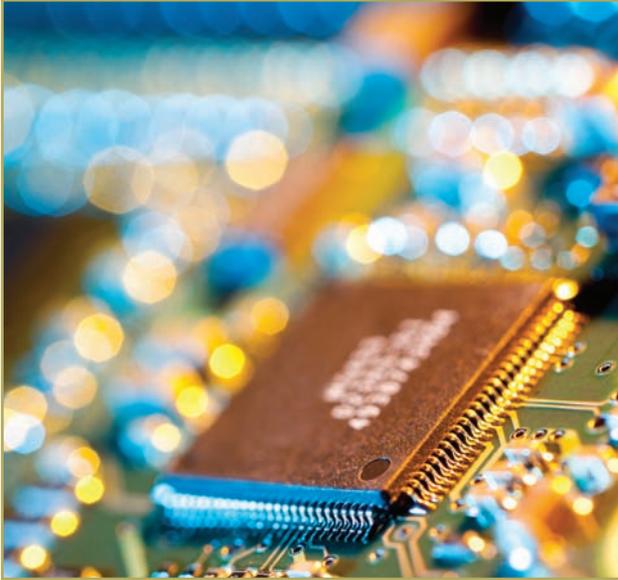
managers, business analysts, test analysts, developers, system administrators, contact centre analysts, procurement officers, contract developers, business advisors, project co-ordinators, technical support, data/business/enterprise architects, security advisors, change managers, programme administrators, delivery managers, engagement managers, trainers.

Local and Regional Authorities

IT capability is an integral part of city, district and regional council operations. Roles could be in business analysis, applications support, IT operations or strategy, support services, telecommunications and infrastructure among others.

Private Sector

Computer software and hardware companies design electronic systems for industry - banking and finance, retail, insurance, defence, manufacturing, the petroleum industry, telecommunications, the dairy industry, transport, insurance, energy, medical research, market research, forestry, film production, interactive gaming and many more. ***Civil and mechanical engineering*** firms specialising in building bridges and power plants also hire computer software engineers to design and develop advanced geographic data systems and automated drafting systems. ***Telecommunications companies*** have many job opportunities for both computer software applications and computer systems engineers.

Companies specialising in software solutions employ graduates in areas such as: IT and telecommunications management consulting; telecommunications systems; information technology project management; custom ICT solutions; content management systems; business analysis and process re-engineering; systems analysis and design; software design and development; website design and development; domain name registration; computer networks (design, specifications and implementation).

Business Start-Ups

Graduate entrepreneurs can create their own companies or join start-up companies. Prior work experience with a company or government agency can be useful.

Consultancies

A growing number of engineers who work on their own as self-employed consultants work on contract for firms that specialise in the development and maintenance of the web sites and intranets of client companies. Businesses need help to manage, upgrade, and customise increasingly complex computer systems - this means more work for those with the technical expertise who can relate well with clients.

Education Sector

Every school and tertiary institution has its own IT systems for education and the daily running of the organisation. Some employ specialists to maintain their systems and troubleshoot any problems. A managed network is also connecting New Zealand schools and tertiary institutions through a secure data network using ultra-fast, rural, and remote broadband. All educational organisations will be able to connect to the network by the end of 2016 when they will have access to fibre and upgraded internal IT networks. Graduates with a teaching qualification and computer science or engineering degree majors also teach information technology in secondary schools. Academic teaching and research careers require PhD qualifications.

Professional Associations

Belonging to a professional body such as the Institute of IT Professionals (IITP) is a good way to make contacts, learn more and find out about job opportunities in the industry.

GRADUATE PROFILES

Anna Friedlander

Software Engineer
Google, Sydney

I came to Victoria intending to major in biology and enrolled in first year computer science because I had an idea of how useful programming skills are in the sciences. I soon found that I loved the problem solving of computer science and switched my major.

There's nothing quite like the sense of achievement you get when cracking a problem that initially seemed almost impossible. This is still my favourite part of computer science. Computer scientists and engineers have the reputation for being a bit socially introverted, but I found that to be untrue. There was a real sense of camaraderie in the computer labs - always people who were interested in talking about their work and hearing about yours. As well as learning how to programme I also developed critical thinking and "soft" skills like time management. A Victoria summer research scholarship gave me research experience from developing an idea through to publishing results, as well as working in an interdisciplinary team. These skills helped me in studying for a Master's degree. I worked under Victoria's radio astronomy group, where we developed machine-learning methods to automate the process of finding galaxies in astronomical images. I also built a great network of contacts at Victoria. It was through this that a recruiter from Google contacted me and I'm now a Software Engineer at Google Sydney. To students thinking of studying computer science I'd suggest taking a wide range of subjects across disciplines, which give different insights into your work. Work in the computer labs as much as you can, harness the brain-power of your classmates and lab tutors and take advantage of the many opportunities Victoria offers, from extra-curricular activities to summer research projects and internships. These will give your CV an edge and help you develop the networks to build a great career.

Aleks Ristich

Technical Manager
Tekron International

When I first started studying at Victoria University it was in the field of Information Technology, but after a year I realised this didn't engage me sufficiently so I shifted to Electronic Engineering which provided me with a more hands on approach to learning. The realisation that this was the right decision came to me when I found myself determined to further my studies in this field. I took my degree to Honours then through to a Master's Degree. I enjoyed having the freedom to manage my own time, university workload, and social engagements to best suit what I wanted out of my time at Victoria University. The one project I found most enjoyable was a project with Lego Mindstorms, where we had to implement a fully working robot. A particularly useful skill that I gained whilst at Victoria University was to take initiative and follow through with a concept from start to finish. My current position is Technical Manager at Tekron, a GPS clock manufacturer based in Wellington, where I manage the R&D team and am responsible for making sure that our products are developed on time, to budget and to a very high standard. Originally my primary focus at Tekron was on software development, however it then branched out into different areas such as hardware, mechanics and manufacturing. This experience has allowed me to expand my skill set and develop each facet of an electronic product. Life is funny. Sometimes your plans don't turn out the way you intend, but somehow these deviations from the original path could lead to unexpected surprises that bring out what you are truly (and naturally) passionate about. Give it a go.

Hugh Davenport

RedEye Development Manager
Aura Information Security Limited

I got into computers as a kid as my dad had a few lying around. Then during high school I started learning programming, which led me into doing a Bachelor of Science in Computer Science. I enjoyed study a lot so went on to complete Honours and studied various different topics to decide where I

wanted to go. I quite enjoyed security and managed to get some funding for a Master's degree in software engineering with a security spin on it.

At Victoria I enjoyed meeting new people, learning new things and just being in the general atmosphere of intelligent people wanting to share knowledge. Skills I learned as a student proved useful later on – like working with teams, meeting deadlines, improving personal skills (study doesn't end once you leave uni!), communication skills and more. The experience I gained in software development allowed me to fall into a full time development position at Catalyst IT Ltd for a couple of years. There I also gained experience working in the real world (which is a tad different to university). After a few years, I had the opportunity to join Aura Information Security as a developer, which I took because it would allow me to improve my security skills. I had really only learnt the theory behind security but had no practical. I think if you're interested in engineering or computer science just go for it. It's very rewarding and you can learn what you want to learn if you put your head to it. The outcome will be worth it as you can carve out your own future anywhere you like.

Cameron Fowler

Technical Consultant
Abletech

High school revealed a couple of interests for me - all in the area of technology and computers. I chose Victoria as it had recently acquired one of the top minds in Mechatronics Engineering in New Zealand (Dale Carnegie). The first two years of the Computer Engineering degree at Victoria expanded my view of software and mechatronics and I discovered a real passion for creating software. The ability to create something out of nothing but an idea and my time enticed me to swap to a Software Engineering degree. Studying at Victoria was a testing ground for me. I was pushed to take my knowledge of software to a greater level and to grow my capacity, especially in my final Honours year. I really enjoyed the fact that my degree gave me a tangible ability to create software products. A software engineering degree gave me a very broad understanding of software. Specifically, it gave me a strong understanding of relation databases, confidence in the tools of project management and software architecture, a grasp of my own ability and

capacity, and the ability to be specific and precise both in my writing and in my software development. I also participated in the Summer of Tech (www. summeroftech.co.nz) internship programme in my fourth year and was hired again the following year by Abletech to do Ruby on Rails open source web framework, which I have continued for around three years. I have built high capacity web application programming interfaces (API's), dealt with databases containing millions of rows and worked closely with clients to understand and solve complex problems with web applications. Look at what jobs are out there and find a company you think you could work for. Ask them what they want you to know at the end of your degree and make sure you learn it. University will give you the opportunity to learn, but it's up to you to keep an eye out for opportunities that will set you apart from the rest of the crowd.

David Kydd

Software Engineer
GreenButton

Before studying software engineering I never paid any attention to the man behind the curtain – meaning that while I had a wealth of experience using computers, I had never written a computer programme. When I moved to Wellington, Software Engineering at Victoria was the obvious choice – the opportunity to learn not only the fundamental algorithmic and architectural "magic" of software, but also the executive soft-skill aspects of engineering such as communication, leadership, and lateral problem-solving which initially sounded like fluffy nonsense but which I came to value. The course is designed to lead towards learning "soft" skills as the first couple of years focus on developing core competencies, followed by an increasing focus on team projects. How much you enjoy and succeed in the later years of the degree depends on the structure you build early on, so I strongly advise students to put the effort in early and build a solid foundation. When you get to the group project stages of the degree, it's obvious which team members drank their way through first year…

The degree exposes students to a wide variety of software facets, from the human facing elements of user interfaces and project management through hard core theoretical fomalisms, all of which are applied to practical problems. There's also plenty of diversity

in the elective courses, which reflect the range of different career paths on offer following graduation. I was personally attracted to what seemed the most magical of things that can be done with computers – artificial intelligence - and that prepared me for working at the kiwi cloud startup GreenButton, applying what I had learned to a challenging real life problem. There are huge opportunities all around the world for computer magicians. While a practised analytical mind makes it easier to pick up the technical stuff, determination and a willingness to learn are all that are really needed to succeed.

Chisato Fujii

Master's Student
KAUST University, Saudi Arabia

I have been working in web application industries for over four years, at Kiwibank as a developer and Zing Design as a web developer. But currently I'm studying for my Master's degree in Computer Science at KAUST in Saudi Arabia. When I started the Bachelor of Engineering at Victoria I was majoring in computer systems but by the end of the third year my interest had shifted towards network engineering. I switched my major and finished my Honours degree in Network Engineering. At university I learned skills relating to problem solving, general programming skills and public speaking. I liked Network Engineering because it was very applicable - you use the Internet every day; from network engineering I've learned how it is put together. You use cellphones to talk to others, and I've learned how that was made possible.

To gain more knowledge in networks and skills in research I decided to leave the industry for a few years while I pursue my Master's degree. I applied for and was offered a fully funded scholarship at KAUST because I want to go back to a network engineering related position from web development and my skills have dated since I did my studies. I was also fascinated by the idea of living somewhere different.

Adrian Jongenelen

Research Scientist
Defence Technology Agency

I started out as an undergraduate at another university learning about software development in a computing and mathematical sciences degree. But what I really found interesting were my elective courses in physics and electronic engineering – today you can make almost anything. I made the move to Wellington and switched to a Master's in Electronics and Computer Systems Engineering at Victoria. It was a really exciting time as the engineering program was just getting started and our small band of graduate students played an important role in developing the course work. I stayed on at Victoria for my PhD studies and also did tutoring and demonstrating. That was hugely rewarding as the undergraduates who were my students soon became friends and in some cases fellow graduate students. For my PhD I collaborated with researchers at another university to develop novel technologies for range imaging. Think of video cameras where rather than pixels giving you colour information, they provide depth. At Victoria our applications were for mobile robot navigation and perception, though the technology is also becoming prominent in automotive safety and video gaming. Through the PhD programme I became a worldwide expert in my field. The skills I learned relate to every area of computing: electronic circuit design; embedded microcontrollers; communications; driver development; software applications; algorithm prototyping. I even learned about camera systems, optics and mechatronics for a bit of flavour. After submitting my PhD thesis in 2010 I got a job working at the Defence Technology Agency for the New Zealand Defence Force, based in Devonport, Auckland. My background in electronics and camera systems is a great fit for the Electro-Optics and Countermeasures team, where we develop and assess packages to protect aircraft from missile threats. We cover a broad range of topics so there's plenty of variety. One week it might be writing software tools, another week it might be tinkering with camera systems, other weeks might be modelling and simulation. Next week something entirely new might crop up. I love that about my job.

ENGINEERING AND COMPUTER SCIENCE AT VICTORIA

Engineering

The Faculty of Engineering's Bachelor of Engineering (BE) focuses on the digital world so that you can design and implement real-world systems. The four-year BE has full accreditation from the Institute of Professional Engineers New Zealand (IPENZ), so you can be confident knowing that your degree will be recognised internationally.

You will be taught by staff members who are actively engaged in cutting-edge research, extending the boundaries of modern engineering knowledge and who are passionate about transmitting their excitement about their chosen profession to you. Your learning will be supported by our research and development projects, and by opportunities to work with industry.

There are three specialisations to choose from:

- *Electronic and Computer Systems Engineering* focuses on the development of electronic-based systems to solve problems. You will learn to design and construct the electronics and systems that our modern world is based on. You will develop the skills that will give you mastery over the intelligent control of moving systems, while also learning about power and energy systems, signal processing and telecommunications.

- *Network Engineering* gives you an understanding of the full range of modern communication technologies, network protocols, middleware and knowledge about the reliability and security techniques required for modern networks.

You will learn to design, build, configure and test modern networks and networked services, such as mobile phone networks, sensor grids, internet communications, wireless aps and search engines.

- *Software Engineering* enables you to design, implement and maintain complex computer systems. You learn to build software systems that not only solve a problem, but are also efficient, robust and reliable. From computer games to reliable software to mobile apps; if it can be coded then you will learn about it!

Postgraduate study: The Faculty of Engineering also offers a Master of Engineering and a PhD.

Computer Science

Victoria's Bachelor of Science (BSc) has a three-year programme in Computer Science and in Electronic and Computer Systems, enabling careers in computer graphics and games development, distributed systems, software engineering, artificial intelligence, logic and computation, communications, electronics, computer systems and mechatronics.

- *Computer Science* focuses on programming, artificial intelligence and graphics design, implementation and maintenance of software systems that behave reliably and efficiently.

- *Electronic and Computer Systems* focuses on learning the design, theory, techniques and tools of electronics and computer systems.

Postgraduate study: These programmes can also lead to postgraduate diplomas, Honours, Master's and PhDs. The new Master's in Computer Graphics is offered under the tuition of staff who have worked on films such as *The Matrix* sequels and *Avatar*.

Special thanks to:

Vic Careers
CAREER DEVELOPMENT AND EMPLOYMENT