UNSW SYDNEY

Undergraduate Prospectus

Electrical Engineering & Telecommunications


FUTURE STUDENTS
FUTURE STUDENTS

Welcome from the Head of School

UNSW Electrical Engineering and Telecommunications is the largest School of its kind in Australia, and its international standing consistently attracts high calibre students from around Australia and the world. The School spans five research disciplines – Energy Systems, Telecommunications, Systems and Control, Nano / Micro Systems and Signal Processing.

Our education is recognised within UNSW and beyond for its quality and innovation, reflected in high student experience scores and many teaching awards. Our academic, professional and technical staff are internationally renowned experts in their fields and offer the widest range of specialised elective courses and honours thesis/masters project topics nationally.

Our research has received the maximum 5-star rating of "well above world class" in all Excellence in Research Australia evaluations: 2010, 2012, 2015 and 2018. Multiple university rankings list us as the top School in Australia, and within the top 50 globally. We work closely with industry globally on dozens of cutting-edge projects that underpin and advance our technological society. Electrical Engineering continues to feature in lists of the best, highest-paying or most in-demand jobs, e.g. Indeed https://www.indeed.com/lead/best-jobs-2020 (27/2/20), Business Insider https://www.businessinsider.com.au/highest-paid-jobs-australia-2020-7 (17/7/20) and Forbes https://www.forbes.com/sites/jonyounger/2019/05/17/the-best-paying-and-most-sought-after-jobs-for-new-grads-and-freelancers-now/#79e5457a687d (17/5/19).

With $104M recently invested, we are now home to many cutting-edge laboratory facilities that are unique nationally and offer our students fantastic opportunities to develop as engineers.

The School continues to provide a world-class, challenging and well-balanced learning environment that has produced excellent and valued engineering graduates since its inception.

Professor Julien Epps
Head of School of Electrical Engineering & Telecommunications

Programs Available:

SINGLE DEGREE PROGRAMS
> BE (Hons) Electrical Engineering
> BE (Hons) Telecommunications
> BE (Hons) Quantum Engineering

INTEGRATED DEGREE PROGRAMS - 5 YEARS
> BE (Hons) ME Electrical Engineering with broadening discipline (minor)

DOUBLE DEGREE PROGRAMS
> BE (Hons) BA Electrical , Telecommunications, Quantum
> BE (Hons) BSc Electrical , Telecommunications, Quantum
> BE (Hons) BCom Electrical , Telecommunications, Quantum
> BE (Hons) MBiomedE Electrical , Telecommunications

Other double degrees are also available such as:

> BE (Hons) LLB
> BSci (Adv Science)/BE (Hons)
> BSci (Adv Maths)/BE (Hons)
> BMus/BE (Hons)

Details available via: http://unsw.to/eet

UNSW EE&T graduates find themselves in constant demand everywhere, whether they are building motors for electric vehicles, designing new brain-computer interfaces, programming control systems for autonomous aircraft, pioneering quantum electronic circuits, doing financial modelling for a bank, developing gigahertz switching technology using microelectromechanical systems, or planning the next generation of wireless networks.

Our graduates work in more than 90 countries around the world. A UNSW Electrical Engineering degree will always have high value in the job market.

For more information, please contact:

A/Prof Jayashri Ravishankar
Deputy Head of School (Education)
jayashri.ravishankar@unsw.edu.au

Bachelor of Engineering (Honours) - Electrical Engineering

Electrical Engineering is a broad and creative profession concerned with the design, development, planning and management of systems and devices which underpin modern economics and contribute to the quality of life.

An Electrical Engineer may be responsible for the research , design, development, manufacturing and management of complex hardware and software systems and reliable, cost effective devices, many involving the use of new information and computer intensive technologies. These include:

- Computer systems, data telecommunication networks including the internet
- Mobile communications and wireless networks
- Optical and microwave commnications
- Integrated electronic systems
- Advanced robotics and intelligent machines
- Video and image processing
- Quantum devices and quantum computing
- Generation, transmission and distribution of electrical power
- Renewable energy systems and solar energy conversion
- Biomedical instruments and applications, such as medical imaging scanners, the cochlear implant (bionic ear), pacemakers and hearing aids

Accredited by:

ENGINEERS AUSTRALIA

Career Opportunities

Potential employers include service industries such as Energy Australia, Eraring Energy or Waubra Wind Farm; large private industrial groups, such as Alstom, BHP, Boeing Australia, Downer EDI, Honeywell, Google, Canon, Transfield and Alcatel; and small innovative private firms specialising in the application of new technologies to new products and services, for example Cochlear.

Electrical Engineering Program

YEAR 1

TERM 1	
MATH1131 or MATH1141	Mathematics 1A or Higher Mathematics 1A
ELEC1111	Electrical Circuit Fundamentals
ENGG1000	Introduction to Engineering Design and Innovation

TERM 2	
MATH1231 or MATH1241	Mathematics 1B or Higher Mathematics 1B[2]
COMP1511 or COMP1911	Introduction to Programming[1] or Computing 1A
PHYS1131	Higher Physics 1A

TERM 3	
COMP1521	Computer Systems Fundamentals
PHYS1231	Higher Physics 1B
MATH2069	Mathematics 2A

YEAR 2

TERM 1	
ELEC2134	Circuits and Signals
ELEC2141	Digital Circuit Design
GENXXXXX	General Education course

TERM 2	
ELEC2133	Analogue Electronics
DESN2000	Engineering Design and Professional Practice
MATH2099	Mathematics 2B

TERM 3	
L3 Elective	Choose from L3 Elective List
GENXXXXX	General Education course
ELEC3104	Digital Signal Processing

YEAR 3

TERM 1	
ELEC3106	Electronics
TELE3113	Analogue and Digital Communications
ELEC3115	Electromagnetic Engineering

TERM 2	
ELEC3117	Electrical Engineering Design
ELEC3114	Control Systems
ELEC3105	Electrical Energy

TERM 3		
Industrial Training	or	International Exchange

YEAR 4

TERM 1	
ELEC4122	Strategic Leadership and Ethics
ELEC4123	Electrical Design Proficiency
ELEC4951	Research Thesis A (4 UoC)

TERM 2	
ELEC4952	Research Thesis B (4 UoC)
Elective	L4 Elective
Elective	L4 Elective

TERM 3	
ELEC4953	Research Thesis C (4 UoC)
Elective	L4 Elective
Elective	L4 Elective

[1] COMP1511 is recommended. Students with no previous programming experience may consider taking COMP1911 as an alternative (note that COMP1911 may not run in some terms).

[2] For advice on selection see https://www.maths.unsw.edu.au/futurestudents/choosing-first-year-courses

Notes:

- Duration: 4 years
- A total of 192 UOC are required for the completion for this single degree program.
- This structure allows students to take one L3 elective and four L4 electives, thus providing the depth and breadth required for an Electrical Engineering Degree.
- L3 courses may be drawn from other Schools and Faculties as well as ELEC/TELE courses.

Bachelor of Engineering (Honours) - Telecommunications

Telecommunications engineering is concerned with communicating information at a distance. It is strongly associated with data communications, largely because of the need to encode, compress and encrypt all information, and because of the growing importance of digital and wireless (eg mobile telephony) networks. Telecommunications engineering will appeal to those who are interested in the following fields:

- Satellite communications
- Signal and image processing
- Optical fibres and photonics
- Mobile satellite communications
- Data networks
- Software systems including e-commerce
- Microelectronic devices and systems
- Data coding, compression, encryption and transmission
- Real-time embedded systems
- Quantum telecommunications

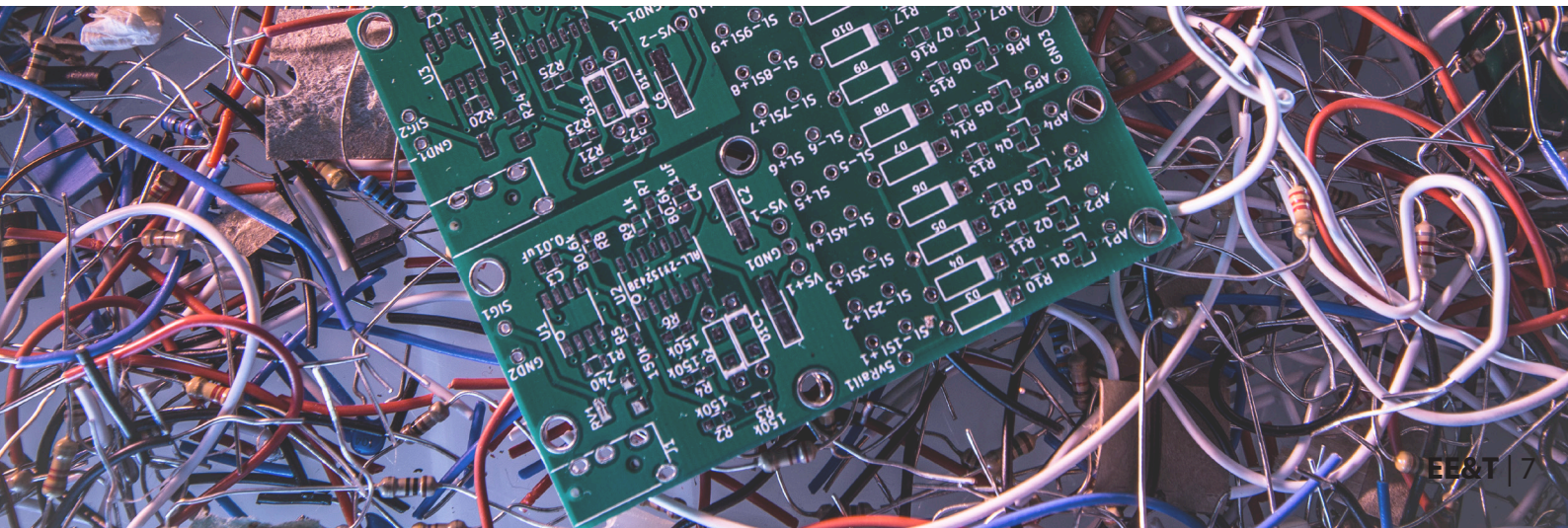
Accredited by:

ENGINEERS AUSTRALIA

Career Opportunities

Telecommunications engineering is developing rapidly and the demand for graduates in telecommunications is evolving as the technology advances and broadens its scope of applications.

You could work for telecommunications service providers such as iiNet, Skype or Amazon Web Serwices (AWS), major equipment and device manufacturers such as Cisco, Apple or Huawei; and a wide range of start-up companies such as Airhop Communications, Simble, Devicescape or UNSW's own Zedelef. Demand for telecommunications engineers is boosted by huge infrastructure projects like the National Broadband Network.



Telecommunications Program

YEAR 1

TERM 1	
MATH1131 or MATH1141	Mathematics 1A or Higher Mathematics 1A
ELEC1111	Electrical Circuit Fundamentals
ENGG1000	Introduction to Engineering Design and Innovation

TERM 2	
MATH1231 or MATH1241	Mathematics 1B or Higher Mathematics 1B[2]
COMP1511 or COMP1911	Introduction to Programming[1] or Computing 1A
PHYS1131	Higher Physics 1A

TERM 3	
COMP1521	Computer Systems Fundamentals
PHYS1231	Higher Physics 1B
MATH2069[3]	Mathematics 2A

YEAR 2

TERM 1	
ELEC2134	Circuits and Signals
ELEC2141	Digital Circuit Design
GENXXXXX	General Education course

TERM 2	
ELEC2133	Analogue Electronics
DESN2000	Engineering Design and Professional Practice
MATH2099	Mathematics 2B

TERM 3	
ELEC3104	Digital Signal Processing
TELE3118	Network Technologies
GENXXXXX	General Education course

YEAR 3

TERM 1	
ELEC3106	Electronics
TELE3113	Analogue and Digital Communications
ELEC3115	Electromagnetic Engineering

TERM 2	
ELEC3117	Electrical Engineering Design
ELEC3114	Control Systems
Elective	L3 or L4 Elective (refer to page 11)

TERM 3		
Industrial Training	or	International Exchange

YEAR 4

TERM 1	
ELEC4122	Strategic Leadership and Ethics
TELE3119	Trusted Networks
ELEC4951	Research Thesis A (4 UoC)

TERM 2	
ELEC4952	Research Thesis B (4 UoC)
Elective	L3 or L4 Elective (refer to page 11)
Elective	L4 Elective (refer to page 11)

TERM 3	
ELEC4953	Research Thesis C (4 UoC)
ELEC4123	Electrical Design Proficiency
L4 Elective	L4 Elective (refer to page 11)

[1] COMP1511 is recommended. Students with no previous programming experience may consider taking COMP1911 as an alternative (note that COMP1911 may not run in some terms).

[2] For advice on selection see https://www.maths.unsw.edu.au/futurestudents/choosing-first-year-courses

Notes:

- Duration: 4 years
- A total of 192 UOC are required for the completion of this single degree program.
- This structure allows students to take four electives (at least two L4 electives) from the six disciplines within the School, thus providing the depth and breadth required for a Telecommunications Engineering Degree.

Bachelor of Engineering (Honours) - Quantum Engineering

The progress of nanotechnology allows the fabrication of devices whose physical dimensions approach the atomic scale. For over 100 years, it has been known that the behaviour of physical systems at the atomic scale does not obey the familiar laws of classical physics. Atomic-size systems behave according to quantum mechanics, which allows them to exhibit rather spectacular properties and dynamics. Quantum engineering is concerned with the design and development of technologies that exploit the laws of quantum mechanics, unlocking novel functionalities and improved performance. This broad field draws skills from a diverse range of disciplines, including fundamental physics, electrical engineering, telecommunications and computer science.

A quantum engineer will apply their knowledge of quantum science and the principles of engineering design to the following fields:

- Quantum electronic devices and computers
- Quantum sensors
- Quantum communications and quantum-safe cryptography
- Quantum control

Career Opportunities
There are rapidly-evolving new opportunities in innovative nanoelectronics, quantum computing, sensing, measurement and communications companies serving the healthcare, defence, natural resources and financial services sectors. Example employers include Silicon Quantum Computing, Microsoft, QuintessenceLabs, Q-CTRL, Redback Systems, Lucigem, IBM, Nomad Atomics and Google. Graduates of quantum engineering will also have opportunities across the conventional electrical engineering industry, including electronics, telecommunications, signal processing and systems and control.

Quantum Engineering Program

YEAR 1

TERM 1	
MATH1131 or MATH1141	Mathematics 1A or Higher Mathematics 1A
ELEC1111	Electrical Circuit Fundamentals
ENGG1000	Introduction to Engineering Design and Innovation

TERM 2	
MATH1231 or MATH1241	Mathematics 1B or Higher Mathematics 1B[1]
COMP1511	Introduction to Programming
PHYS1131	Higher Physics 1A

TERM 3	
PHYS1231	Higher Physics 1B
MATH2069	Mathematics 2A

YEAR 2

TERM 1	
ELEC2134	Circuits and Signals
ELEC2141	Digital Circuit Design
ELEC3115	Electromagnetic Engineering

TERM 2	
ELEC2133	Analogue Electronics
DESN2000	Engineering Design and Professional Practice
MATH2099	Mathematics 2B

TERM 3	
ELEC3104	Digital Signal Processing
ELEC3705	Fundamentals of Quantum Engineering
GENXXXXX	General Education Course

YEAR 3

TERM 1	
ELEC3106	Electronics
TELE9757	Quantum Communications
GENXXXXX	General Education course

TERM 2	
ELEC3117	Electrical Engineering Design
ELEC3114	Control Systems
PHYS3118	Quantum Physics of Solids and Devices

TERM 3	
ELEC4123	Electrical Design Proficiency
Elective	L3/L4 Elective

YEAR 4

TERM 1	
Elective	L4 Elective (ELEC4604 RF Circuit Design - Theory and Applications - suggested)
ELEC4122	Strategic Leadership and Ethics
ELEC4951	Research Thesis A (4 UoC)

TERM 2	
ELEC4952	Research Thesis B (4 UoC)
Elective	L4 Elective List or cross-institutional study

TERM 3	
ELEC4953	Research Thesis C (4 UoC)
ELEC4605	Quantum Devices and Computers
Elective	L4 Elective List or cross-institutional study

[1] For advice on selection see https://www.maths.unsw.edu.au/futurestudents/choosing-first-year-courses

Notes:

- Duration: 4 years
- A total of 192 UOC are required for the completion for this single degree program.
- This structure allows students to take two electives, thus providing the depth and breadth required for an Engineering Degree.
- L3 courses may be drawn from other schools and faculties as well as Electrical and Telecommunications Engineering core courses.
- L4 electives are provided from the six disciplines within the School.

Electives for BE (ELEC) & BE (TELE) & BE (QUANTUM)

SYSTEMS & CONTROL
ELEC3145 Real-Time Instrumentation (L3)
ELEC3146 Electrical Engineering Modelling and Simulation (L3)
ELEC4631 Continuous-Time control System Design (L4)
ELEC4632 Computer Control Systems (L4)
ELEC4633 Real Time Engineering (L4)

DATA & MOBILE COMMUNICATIONS
TELE3113 Analogue and Digital Communications (L3)
TELE3118 Network Technologies (L3)
TELE3119 Trusted Networks (L3)
TELE4642 Network Performance (L4)
TELE4651 Wireless Communication Technologies (L4)
TELE4652 Mobile and Satellite Communications Systems (L4)
TELE4653 Digital Modulation and Coding (L4)

ENERGY SYSTEMS
ELEC3105 Electrical Energy (L3)
ELEC3111 Distributed Energy Generation (L3)
ELEC4611 Power Systems Equipment (L4)
ELEC4612 Power Systems Analysis (L4)
ELEC4613 Electrical Drive Systems (L4)
ELEC4614 Power Electronics (L4)
ELEC4617 Power System Protection (L4)

NANO/MICRO SYSTEMS
ELEC3705 Fundamental of Quantum Engineering (L3)
ELEC4601 Digital and Embedded Systems (L4)
ELEC4602 Microelectronic Design and Technology (L4)
ELEC4603 Solid-State Electronics (L4)
ELEC4604 RF Circuit Design - Theory and Applications (L4)
ELEC4605 Quantum Devices and Computers (L4)

PHOTONICS
PHTN4661 Optical Circuits and Fibres (L4)
PHTN4662 Photonic Networks (L4)

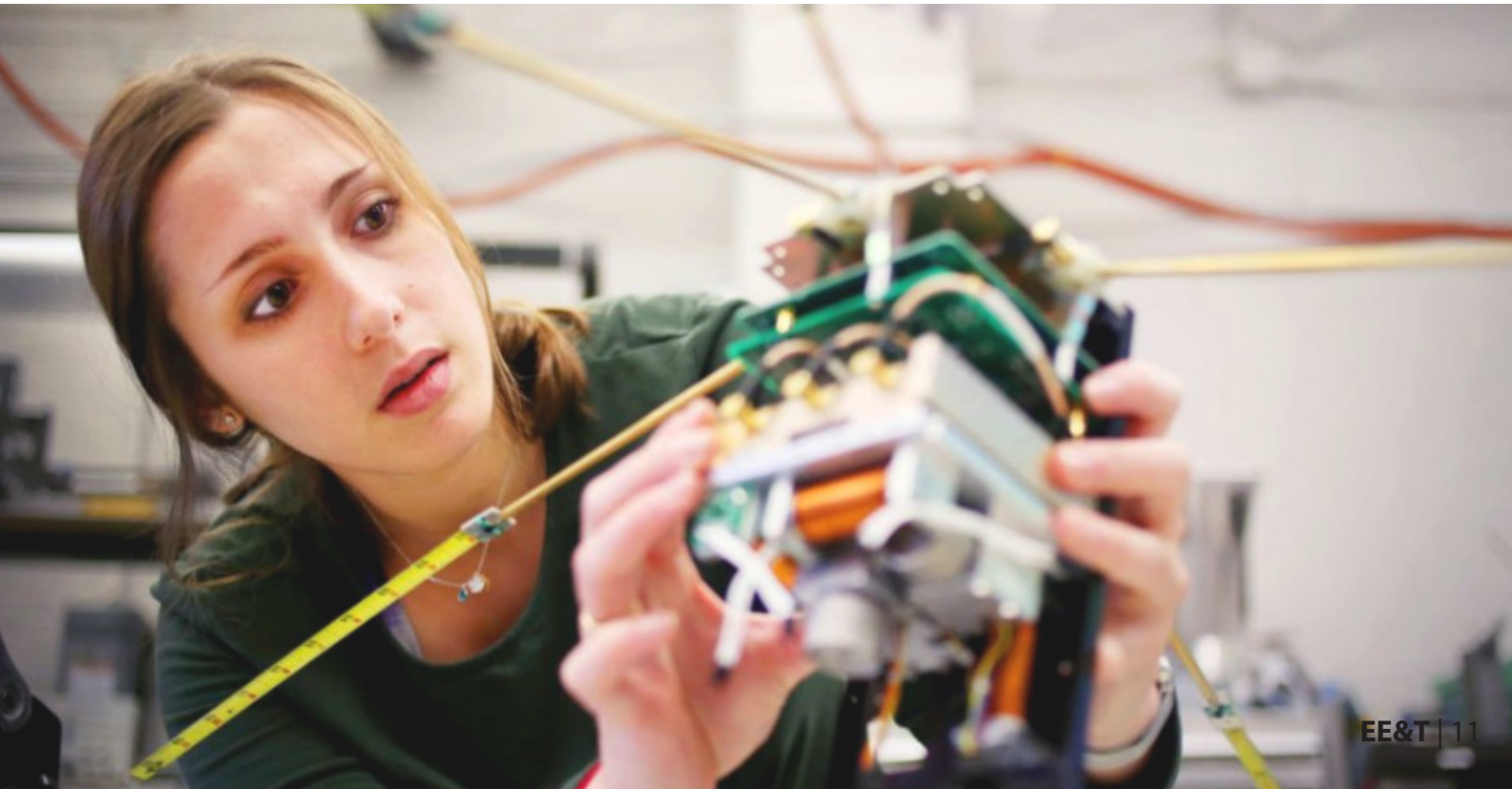
SIGNAL PROCESSING
ELEC4621 Advanced Digital Signal Processing (L4)
ELEC4622 Multimedia Signal Processing (L4)
ELEC4623 Biomedical Instrumentation, Measurement and Design (L4)

COMPUTER SYSTEMS
COMP3211 Computer Architecture (L3)
COMP3231 Operating Systems (L3)

BUSINESS ADMINISTRATION
ELEC4445 Entrepreneurial Engineering (L4)

MATHEMATICS
MATH3161 Optimisation (L3)
MATH3201 Dynamical Systems and Chaos (L3)
MATH3411 Information, Codes and Ciphers (L3)

Key: L3: Level 3 Elective
L4: Level 4 Elective



5-Year Integrated
Bachelor of Engineering (Hons)
Master of Engineering BE (Hons) ME
In Electrical Engineering with Broadening Discipline

Improved flexibility:

- Choose a broadening discipline (similar to a minor) in many interest areas - computer science, music, mechatronics, photovoltaics, maths, physics and more, either at UNSW or overseas . . . it's up to you.
- Significant elective choice from year 2 onwards, including choice of more than 20 postgraduate electives not normally accessible to 4-year BE (Hons) program students.

Better specialisation:

- Maximise your learning in the Electrical Engineering disciplines of your choice.
- Work right at the cutting edge on your fourth and fifth year project.

More design:

- Coursework thread in engineering design in every year of the program.

Easier integration with international exchange:

- Four to six courses can be arranged overseas as a part of the broadening discipline.

More details:
https://www.unsw.edu.au/engineering/electrical-engineering-and-telecommunications/study/undergraduate

Take advantage of this leading new
program from UNSW Engineering, the largest faculty of engineering in Australia, recognised for excellence throughout Asia.

Contact:
A/Prof Jayashri Ravishankar
Deputy Head of School (Education)
jayashri.ravishankar@unsw.edu.au

Bachelor in Engineering (Hons)
Masters of Engineering BE (Hons) ME Program

YEAR 1 (48 UOC CORE)

- MATH1131 Mathematics 1A or
- MATH1141 Higher Mathematics 1A
- MATH1231 Mathematics 1B or
- MATH1241 Higher Mathematics 1B
- PHYS1131 Physics 1A
- PHYS1231 Physics 1B
- COMP1511 Introduction to Programming
- ENGG1000 Introduction to Engineering Design & Innovation
- ELEC1111 Electrical Circuit Fundamentals
- ELEC2141 Digital Circuit Design

YEAR 2 (36 UOC CORE)

- ELEC2133 Analogue Electronics
- ELEC2134 Circuits & Signals
- DESN2000 Engineering Design and Professional Practice
- ELEC2117 Electrical System Design
- MATH2069 Mathematics 2A
- MATH2099 Mathematics 2B
- 6 UoC Free elective
- 6 UoC of Broadening Discipline in chosen area (see p14)

YEAR 3 (30 UOC CORE)

- ELEC3115 Electromagnetic Engineering
- ELEC3104 Digital Signal Processing
- ELEC3105 Electrical Energy
- ELEC3114 Control Systems
- ELEC3117 Electrical Engineering Design
- 6 UoC of Broadening Discipline in chosen area
- 6 UoC of General Education
- 6 UoC L3 Elective (see p11)

YEAR 4 (24 UOC CORE)

- ELEC4122 Strategic Leadership & Ethics
- ELEC4123 Electrical Design Proficiency
- ELEC4951 Research Thesis A (4 UoC)
- ELEC4952 Research Thesis B (4 UoC)
- ELEC4953 Research Thesis C (4 UoC)
- 6 UoC of Broadening Discipline in chosen area (see p14)
- 18 UoC L4 Electives (see p11)

YEAR 5 (12 UOC CORE)

- ELEC9451 ME Project A (4 UoC)
- ELEC9452 ME Project B (4 UoC)
- ELEC9453 ME Project C (4 UoC)
- 6 UoC Engineering and Technical Management Course
- 6 UoC of Broadening Discipline in chosen area (see p14)
- 24 UoC L5 Electives (see p15)

Note: A total of 240 UoC are required for the completion of this program.
Note: Program structure/schedule may have to be adjusted depending on the broadening discipline chosen.

Broadening Disciplines for the BE (Hons) ME in Electrical Engineering

Program Code: 3736 CRICOS Course Code: 074733F

INTERNET OF THINGS (IoT)

Year 2/3	COMP2521 Data Structures and Algorithms (6 UOC) COMP2911 Engineering Design in Computing (6 UOC)
Year 4/5	COMP4336 Mobile Data Networking (6 UOC) COMP6733 Internet of Things Design Studio* (6 UOC)

MUSIC

Year 2	MUSC1101 Music reinvented
Year 3/4/5	Select two courses in Musicianship AND Select one from the following: Electronic Music; Film Music; Popular Music; Music history; Psychology of Music; Music analysis; Ethnomusicology; Musicianship C

LANGUAGE

Year 2/3/4/5	Select six language courses; available in different languages

COMMERCE: SUB-DISCIPLINES AVAILABLE:

Year 2/3/4/5	Accounting Finance Business Economics Business Strategy International Business Management Human Resource Management Marketing

GEOSPATIAL

Year 3/4/5	GEOS9016 Principles of Geographic Information Systems GMAT4900 Introduction to GPS Positioning GMAT9300 Aerial & Satellite Imaging Systems GMAT9600 Principles of Remote Sensing

PSYCHOLOGY

Year 2/3/4/5	PSYC1001 - Psychology 1A PSYC1011 - Psychology 1B PSYC2061 - Social and Developmental Psychology PSYC2071 - Perception and Cognition PSYC2081 - Learning and Physiological Psychology PSYC2101 - Assessment, Personality and Psychopathology

MECHATRONICS

Year 3/4/5	MTRN3020 Modelling and Control of Mechatronic Systems MTRN41100 Robot Design MTRN4230 Robotics MTRN4010 Advanced Autonomous Systems

PHOTOVOLTAICS

Year 2	SOLA2540 Applied Photovoltaics
Year 3/4/5	Select three from the following of: SOLA3020 Photovoltaic Technology & Manufacturing SOLA3507 Solar Cells SOLA5509 Fundamentals of Photovoltaics Materials Processing SOLA5508 High Efficiency Silicon Solar Cells OR SOLA4012 Grid-Connected Photovoltaics SOLA5054 PV Stand-Alone Sys. Des.& Inst SOLA5057 Energy Efficiency SOLA5053 Wind Energy Converters SOLA3010 Low Energy Buildings and P hotovoltaics

COMPUTING

Year 2	COMP1521 Computer Systems COMP2521 Data Structures and Algorithms COMP3231 Operating Systems COMP3xxx Level 3 Computing Elective
Year 3/4/5	Select two from many breadth and depth courses available

SPACE SYSTEMS

Year 3	AERO9500 Space Systems Architectures and Orbits
Year 4/5	Select three from the following of: AERO9610 The Space Segment ELEC9762 Space Mission Development ELEC9764 The Ground Segment and Space Operations ELEC9765 Space Law and Radio Regulations

L5 Electives for BE (Hons) ME

NANO/MICRO SYSTEMS
ELEC9701 Mixed Signal Microelectronics Design
ELEC9702 RF IC design
ELEC9703 Microsystem Design & Technology
ELEC9704 VLSI Technology

ENERGY SYSTEMS
ELEC9711 Power Electronics for Renewable & Distributed Generation
ELEC9712 High Voltage Systems
ELEC9713 Industrial & Commercial Power Systems
ELEC9714 Electricity Industry Planning & Economics
ELEC9715 Electricity Industry Operation & Control
ELEC9716 Electrical Safety
ELEC9719 Real-time Digital Simulations

SIGNAL PROCESSING
ELEC9721 Digital Signal Processing Theory & Applications
ELEC9722 Digital Image Processing Systems
ELEC9723 Speech Processing
ELEC9725 Satellite Navigation
ELEC9741 Electrical Engineering Data Science

CONTROL SYSTEMS
ELEC9731 Robust & Linear Control Systems
ELEC9732 Analysis & Design of Non-Linear Control
ELEC9733 Real Time Computing & Control

DATA AND MOBILE COMMUNICATIONS
TELE9751 Switching Systems Architecture
TELE9752 Network Operations & Control
TELE9753 Advanced Wireless Network
TELE9754 Coding & Information Theory
TELE9755 Microwave Circuits, Theory and Techniques
TELE9756 Advanced Networks
TELE9757 Quantum Communications
GSOE9758 Network Systems Architecture

SPACE SYSTEMS
ELEC9762 Space Mission Development
ELEC9764 The Ground Segment and Space Operations
ELEC9765 Space Law and Radio Regulations
GMAT9200 Principles of GPS Positioning

ENGINEERING AND TECHNICAL MANAGEMENT ELECTIVES
GSOE9210 Engineering Decision Structures
GSOE9445 Entrepreneurial Engineering
GSOE9820 Engineering Project Management
GSOE9830 Economic Decision Analysis in Engineering

Comparison between the BE (Hons) & BE (Hons) ME

YEAR 2 ▶ YEAR 3 ▶ YEAR 4 ▶ BE (Hons) in ELEC, TELE or QUANTUM

YEAR 1 ▲ ▼

60 Days of approved Industrial Training ▲ ▼

YEAR 2 ▶ YEAR 3 ▶ YEAR 4 ▶ YEAR 5 ▶ BE (Hons) ME in ELEC ENG with Broadening Discipline

Additonal Information:

Broadening Disciplines consist of a minimum of 4 courses and a maximum of 6 courses, mutually agreed upon by the School of Electrical Engineering & Telecommunications and the School providing the broadening dicipline.

Undergraduate Scholarship Programs

UNSW Co-op Program Scholarships

For high achieving school leavers, the UNSW Co-op Program offers an ideal combination of challenge and opportunity.

- $18,200 pa for every year of study
- 18 months of relevant industrial training with up to three different companies during your degree
- Network with leading employers and make valuable contacts within your industry

Other Scholarships

Other scholarships are also offered at different levels of study within the school. Please check regularly at http://www.scholarships.unsw.edu.au

More details:
https://www.coop.unsw.edu.au

THE RISE OF QUANTUM ENGINEERING

From the Research Lab into Mainstream Industry

UNSW Electrical Engineering and Telecommunications has been at the forefront of silicon quantum computing developments worldwide for many years. Highlights include:

2011: Profs Andrew Dzurak and Andrea Morello win the Eureka Prize for Scientific Research for their research in advancing the realisation of quantum computers.

2012: First functional electron based quantum bit, published in Nature.

2013: Nuclear Spin Qubit in Silicon paper published in Nature

2014: New world record for operation accuracy and coherence times in silicon, using two different types of qubits

2015: UNSW-led research team encode quantum information in silicon using simple electrical pulses for the first time, bringing the construction of affordable large-scale quantum computers a step closer to reality

Today, quantum engineers are in demand as industry rapidly applies quantum computing to a raft of challenging problems that are slow or impossible to solve using conventional computers.

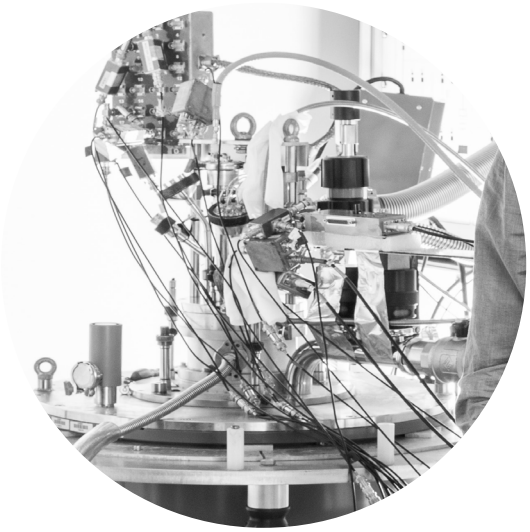
Taste of Research Scholarships

The Taste of Research Scholarships give 3rd year students the chance to do a 45 day project with an existing research team within the Faculty, and receive a tax exempt allowance of about $5000 in total. UNSW Bachelor of Engineering students may use their Taste of Research as a contribution towards their industrial training requirements (up to 30 days).

Example Projects:

- Advanced Photonics
- Data and Mobile Networks
- Energy System Modelling and Economics
- Multimedia Signal Processing
- Quantum Computing and Microelectronics
- Satellite Systems
- Smart Grid and Energy Systems
- Systems & Control and Biomedical Systems

For more information about projects and an example topic list visit:
https://www.engineering.unsw.edu.au/study-with-us/future-students/scholarships/taste-of-research-scholarships



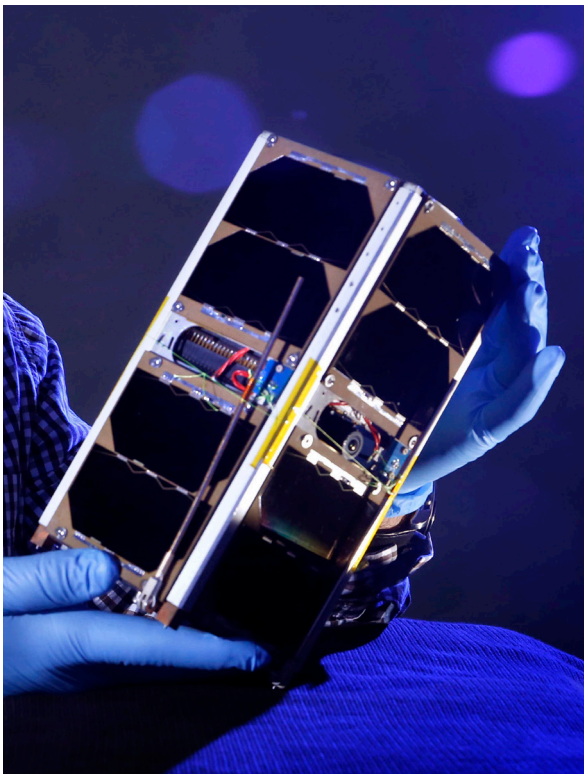
IEEE SPS Signal Processing Cup win by EE&T undergraduate students

A dedicated team of four EE&T students competed in the 2017 IEEE Signal Processing Society Cup, led by lecturer Dr Vidhyasaharan Sethu. This competition was organised as part of the premier international signal processing conference IEEE ICASSP, and included 280 students from 20 countries, in 40 teams. In 2017 the challenge was real-time beat tracking, and it required teams to accurately detect the beat and output it innovatively. The EE&T team not only made it to the top three for their accuracy but decided that its output should be a robotic drum kit, built it and made it a new member of their band. At the final in New Orleans, they edged out University of Maryland, and Johannes Kepler University/Télécom ParisTech/Joanneum Research to take out first prize.

SATELLITE SYSTEMS ENGINEERING

Extensively covered by media, EE&T staff Dr Elias Aboutanios and Prof Andrew Dempster and their team reached a milestone achievement on Tuesday, 19 April 2017. A cubesat named UNSW-EC0, together with two other Australian satellites (one also led by UNSW EE&T), were launched from Cape Canaveral in Florida, USA. The satellites were transported to the International Space Station and were deployed from it. They were the first Australian satellites in 15 years and only the third mission ever (after Wresat in 1967 and Fedsat in 2002). They are part of an international collaboration to study the thermosphere.

UNSW-EC0 was 5 years in the making (established in 2012) and was led by Dr Aboutanios. It was an extensive team effort involving ACSER staff and a large number of undergraduate and postgraduate UNSW students. Beside the international mission, UNSW-EC0 carried out a number of missions including the 3D printed structure, the GPS-based reflectometry and occultation experiments, the RUSH computing experiment, and SEL4 computer (Data61).
Since 2013, UNSW Sydney has been offering a world class Masters level program in satellite systems engineering developed in collaboration with the international space industry and global leaders in space education. As Australia's first comprehensive postgraduate program of its type - and one of only a handful of similar programs worldwide - the new Satellite Systems Engineering program is designed to produce "industry ready" graduates for the Australian, regional and international satellite and space industries.



The program includes contributions from UNSW key partners Optus (Australia's only satellite owner and operator), Thales group (France-based multinational), and Institut supérieur de l'aéronautique et de l'espace (ISAE) (Toulouse-based internationally renowned leader in space education). These ensure that Masters program is informed by, and up to date with, the latest industry developments worldwide.

The program was developed as part of the Warrawal Project led by A/Prof Elias Aboutanios of the School of Electrical Engineering and Telecommunications.

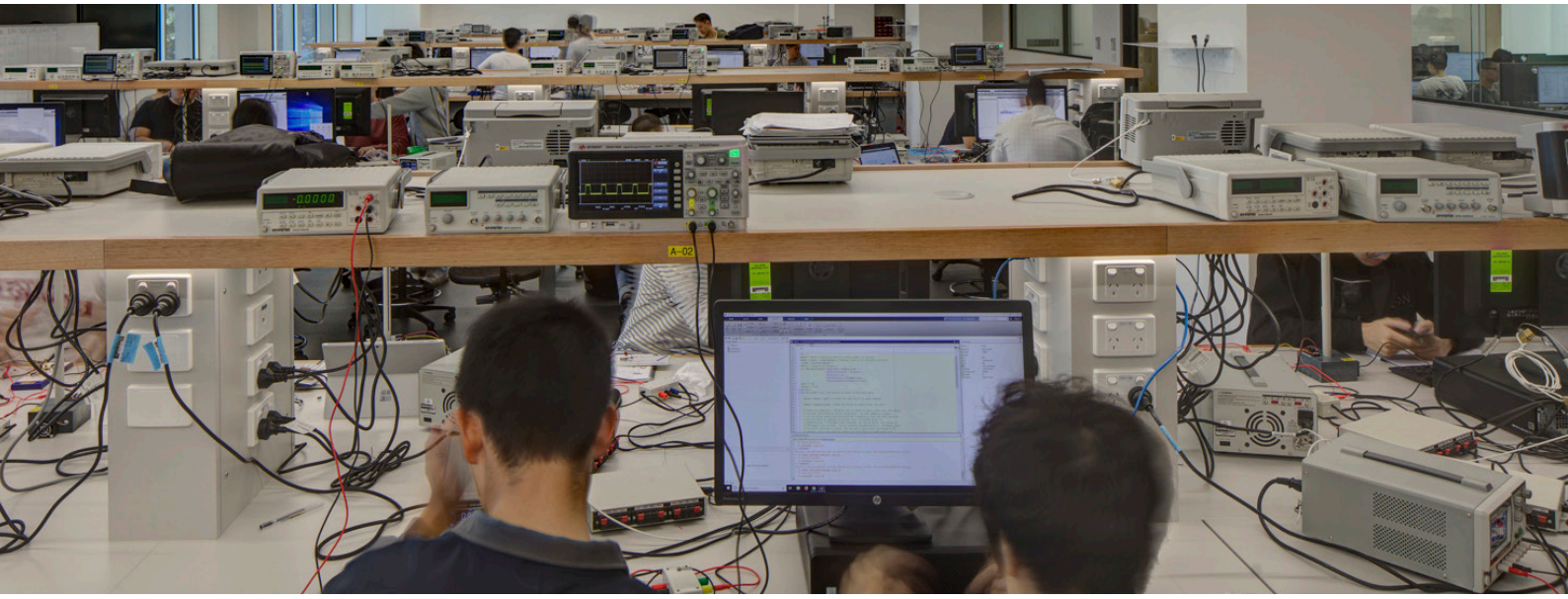
THE HIGH VOLTAGE LABORATORY

The UNSW High Voltage Laboratory provides a unique facility in Australia for teaching, testing and research activities in High Voltage Power Engineering. The Faculty of Engineering and UNSW invested $1.16M to modernise and refurbish the laboratory totally. Major facilities available include 5 screened high voltage test bays equipped with a 400kV/20kJ impulse generator, AC supplies up to 250kV/25kVA, variable frequency and DC supplies, and a wide range of advanced as well as industry-standard test and measurement instruments.

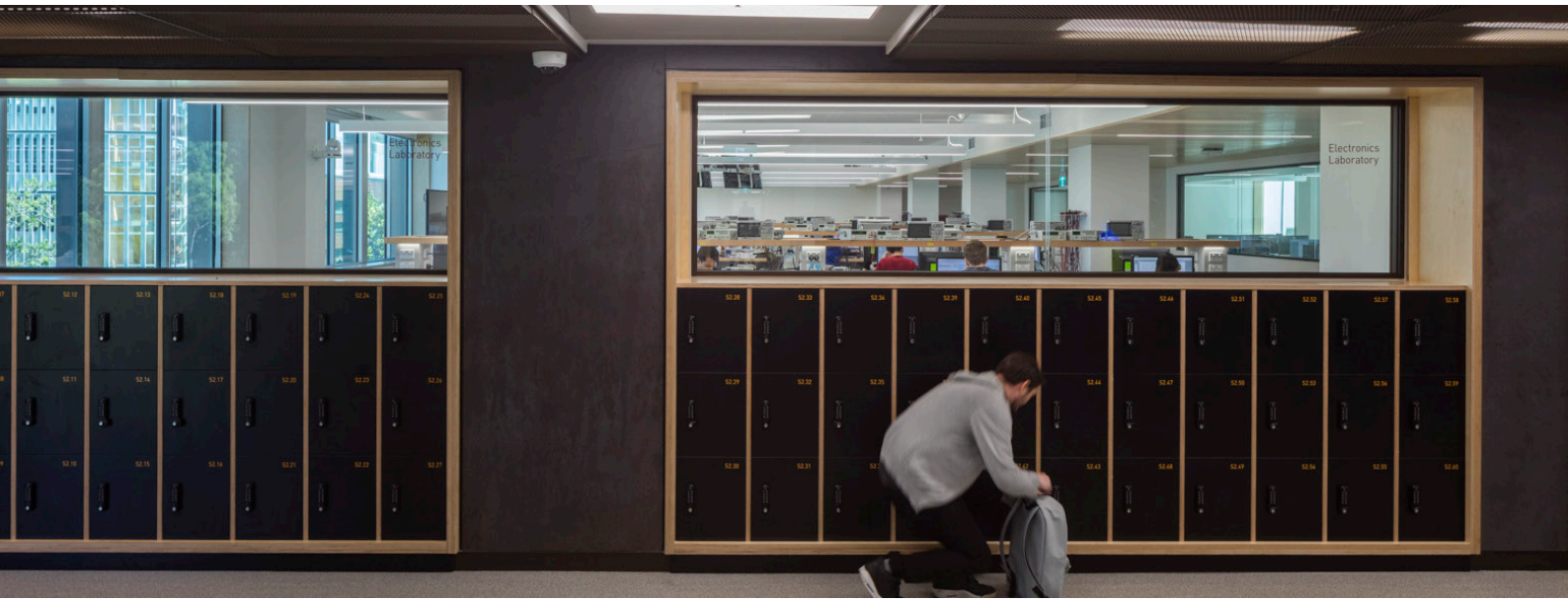
Large-scale electricity generation, transmission, and distribution systems operate at high voltage so facilities for teaching, research and testing of the design and operation of high voltage high power components and apparatus (e.g. transformers, rotating machines, cables, switchgear, etc) are essential. The use of electrical insulating materials plays a critical role in preventing breakdowns under severe electrical stress and it is necessary to know design requirements and diagnostic features for such applications of insulation materials.

Research focuses on developing diagnostic techniques for condition monitoring, and in particular insulation assessment of power system equipment based on partial discharge measurements. The UNSW High Voltage group is recognised internationally and is the leader in Australia in the area of partial discharge research. There has been a long, ongoing, and close interaction between the group and power utilities throughout Australia.

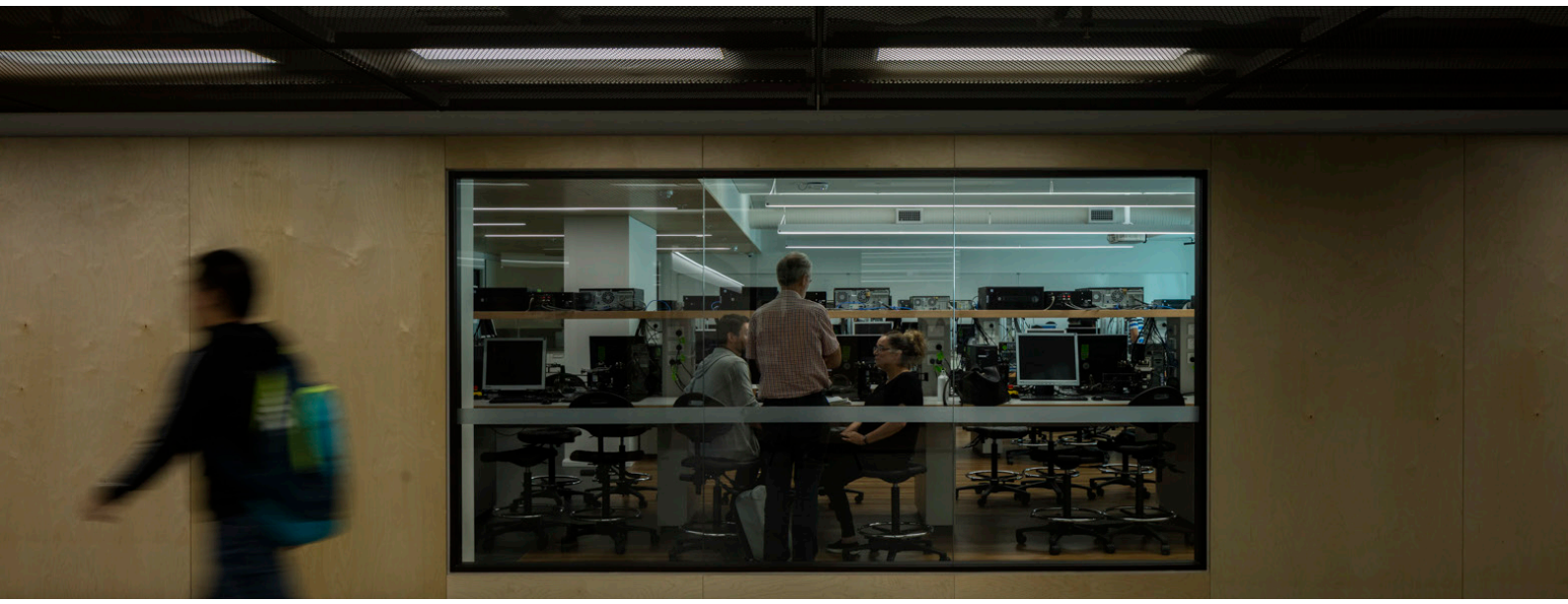
Real Time Digital Simulation Laboratory



Modelling and simulations, especially when performed in real-time, are essential tools for understanding entire electricity grids, which can't be taken out of service just for research and teaching. The real-time digital simulations laboratory (RTS@UNSW) hosts a large variety of hardware and software tools, including one of the largest RTDS simulators globally, which enable research, testing and verification of power electronics, power systems analysis, power systems protection and smart grid technologies. The School of EE&T also offers the opportunity to postgraduate and final-year undergraduate students to learn and work with the simulators through both coursework and thesis project work. Notably, the new "Real-Time Digital Simulations" course created by Dr Georgios Konstantinou is a unique UNSW offering, allowing students to develop skills across a whole range of real-time modelling and simulation methods, software and hardware tools.



World Class Teaching and Research Facility



After 60 years, the Electrical Engineering Building has undergone a $104m refurbishment which provides a world class teaching and research facility for this world ranking school.

The Electrical Engineering Building is home to 5000m^2 of new teaching labs, 2000m^2 of new research labs, including a state-of-the-art Advanced Design Laboratory, huge public areas for informal and group learning, offices for student societies, and new storage for student projects and breadboards. The 35 new research laboratories are available to honours thesis and masters project students, bring new capability for microgrids, distributed energy systems, wind turbines, Internet-of-Things, software defined networks, quantum control, radar signal processing and optical fibre fabrication to the building. Over 20 new teaching laboratories bring new capability for quantum engineering and satellite systems to the School, in addition to extended opening hours for self-learning and non-curricular student projects.

Be part of ELSOC

Founded in 1954, the Electrical Engineering Student Society, ELSOC is one of the largest and most active student societies on campus. They provide all undergraduate UNSW Electrical and Telecommunications Engineers with regular social events, academic mentoring and professional networking opportunities with members of the engineering industry. ELSOC has continued to play an important role in Electrical Engineering and Telecommunications students' social and academic lives.The staple ELSOC event is their lunchtime BBQs. Students from all years enjoy a free lunch and have a chance to socialise and meet new people.

Industry Night is a huge success every year, drawing dozens of exhibiting Electrical Engineering companies and hundreds of EE&T students. Academically ELSOC provides "crash courses" to help revise for assessments, run by some of our top performing senior students, and an extensive textbook borrowing scheme. To find out more, please visit ELSOC at:

https://www.elsoc.net
https://www.facebook.com/eeunsw

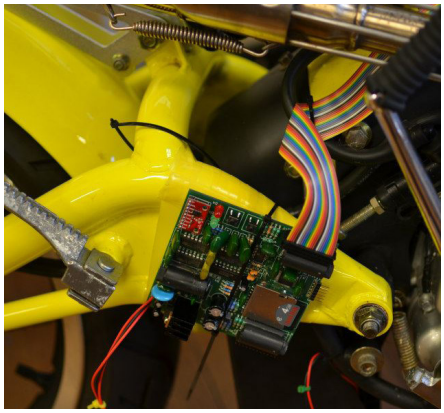
ELSOC
EST. 1954

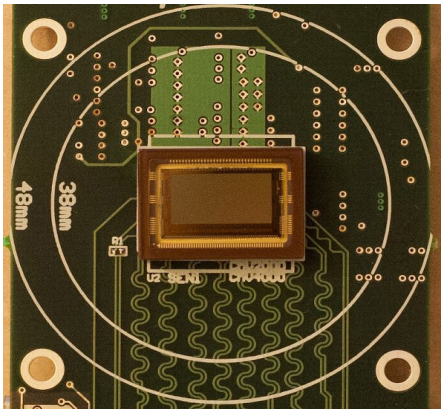
Be part of ELSOC

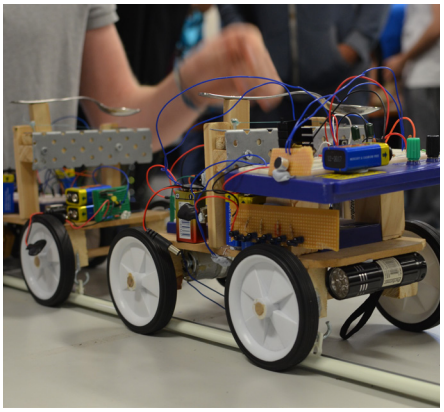
Some BBQs also coincide with time honoured traditions, such as the annual 4Pi marathon. Representatives from engineering firms are regular guests at ELSOC BBQs providing assistance to students looking for information on industrial training or graduate programs.

ELSOC holds annual special events such as the First year Camp, the ELSOC Harbour Cruise (where they are joined by a non-engineering student society) and ELSOC Paintball.

ELSOC hosts several engineering companies who all send representatives to meet students and provide insights into professional life, what companies look for in graduating students as well as information for internships and graduate programs.







The Art of Electrical Engineering Design

In the School of Electrical Engineering & Telecommunications, we emphasise electrical engineering design from the start to the end of your undergraduate degree. We believe practical application of the theory learned in the classroom is crucial in developing real world problem solving engineering skills.

ENGG1000 Introduction to Engineering Design and Innovation (Year 1)

In this course, students will experience first hand one of the major things that engineers do: designing and building creative solutions to problems. You will learn to think the way that engineers think, coming up with good solutions to problems despite being limited by budget, time and resources, the requirement to also meet environmental and social objectives and of course the limitations of the laws of physics.

ELEC2117 Electrical System Design (Year 2)

This second year design course complements knowledge gained in first year courses on electronic circuits, programming, and digital circuits, such as those gained from the first year ENGG1000 course. Students will carry out a practical electrical engineering design solving an electrical engineering problem involving computer interfacing of electronic circuits.

ELEC3117 Electrical Engineering Design (Year 3)

Design Project Management: Introduction to scheduling, costing, marketing, standards, patents, quality, safety, (electronic) manufacturing methods, engineering innovation, design methodology: systematic design procedures and design documentation.

ELEC4123 Electrical Design Proficiency (Year 4)

The course involves three core competency components (electronic circuit design, control system design, signal processing design) and an elective component (power system design, network communications, physical communications). The design work requires the construction of a working system to solve a specified problem.

Experience Life as a First Year

Apart from the maths, physics and computing, a highlight for many of our first-year students is the ENGG1000 course. Aiming to teach principles of engineering design and methodology through project-based learning, ENGG1000 is a hands-on course with a lot of scope for creativity, effective team organisation and fun.

TEAM 1

"We found that the most effective time for learning was in the laboratories, where we were able to learn things for ourselves, experiment with components and circuits, and observe the results"

TEAM 4

"More glue isn't always better, especially when you are gluing something to the wrong side of the car"
"Overall, I enjoyed the project a great deal"
"We never previously had any experience of team work on such a large project"

TEAM 7

"These challenges have taught us the value of collective effort in researching and communicating our attained knowledge to each other. With these efforts, we were able to overcome most problems"

Insight into the Undergraduate Thesis from Our Students

Ben Hutton

Demand for electricity is on the decline due to the prevalence of energy efficient appliances and exciting new renewable distributed generation technologies. This is challenging the way we traditionally operate our electricity networks. I investigated methods for electricity network businesses to adjust their business models to embrace this new operating environment in a way that is both environmentally and economically sustainable.

Erica Barett

In my undergraduate thesis I investigated electricity load forecasting models from the angle of time series analysis. I built layered statistically based models which capture the structure of the univariate time series data, and analyze the residual diagnostics to assist in parsimonious model development. Forecasting electricity distribution network loads informs decisions regarding the various operational and economical needs of industry entities, which are facing new challenges in maximising the capacity of the existing network infrastructure and actively managing demand.

Cameron Brown

My thesis involved new research and prototyping in the backscatter RF area, a radical change to the way implantable biomedical systems can communicate with ultra low power consumption. A highly practical thesis, my work spanned from using coherent full-duplex software defined radio, to old HAM radio techniques for resonant antenna construction. The support and environment that the university provided has allowed me to learn and achieve the maximum from the experience.

Thomas Fisk

As a final year student, I chose a thesis project that involved designing an electronic payload for a small satellite (the UNSW-EC0 CubeSat), capable of detecting and correcting radiation-induced bit errors in reconfigurable logic. I found the project to be an exciting, challenging and rewarding experience.

Extraordinary Experiences of Our Graduates

Varuni Fernando
ResMed Ltd

Electrical engineering was definitely the right choice for me. Being able to link theory and the real world, as well as working in teams throughout my studies have been the highlights of my degree. I chose ResMed Ltd as my employer as I have always had a passion for the application of electrical engineering in the medical industry.

Mitchell Ward
Google Sydney

Studying at EE&T has given me an excellent, hands on, education. I have been able to develop practical engineering skills, participating in several of UNSW's thriving hobby societies. With a confidence to tackle all kinds of complex problems, I have started work at Google Sydney.

Jaclyn Egan
Coca-Cola Amatil

Excelling in maths, science and problem solving I was always drawn to the engineering industry, anticipating the challenges that an engineering degree would bring both technically and mentally. Studying EE&T at UNSW enabled me to enhance my technical skills in such a large array of industries (Power, Telecommunications and Control Systems) and has opened up so many wonderful opportunities for my future career. I am currently a graduate at Coca-Cola Amatil, where I am using my engineering skills to build innovative solutions to production issues within our manufacturing facilities.

Christopher Hines
Dolby

Working in the industry at a company like Dolby has been the ultimate payoff for all the hard work put in at UNSW. The courses in EE&T helped me develop solid engineering design and problem solving experience. It's these skills that have enabled me to pursue a dream career path in acoustic digital signal processing. UNSW EE&T has a strong practical focus, there will be no shortage of interesting labwork and projects on your plate should you come and join us!

Daniel Floyd
Jacobs

Completing my Bachelor of Electrical Engineering at UNSW has allowed me to begin my career at a first class engineering consultancy. The breadth of courses offered by the School of Electrical Engineering served as the ideal preparation for the diverse workload I now have at Jacobs, whilst completing group projects during electrical labs was a surprisingly great introduction to the project teams that I now work with each day. I've made some of my greatest friends at this school and am very proud to count myself as one of its alumni.

EXTRAORDINARY JOURNEYS OF OUR ALUMNI

MATTHEW BROWN

The man behind Polyphonic Music Transcription

Matthew Brown's idea came to him when he was music vice-captain at Scots College in Sydney. The then 17-year-old wanted to spend less time tediously transcribing music compositions and more time composing with his orchestra, and stage and jazz bands. He thought: "Wouldn't it be great if there was a piece of software that could listen to the music and transcribe it for me?"

Fast forward a few years and his unique software, Polyphonic Music Transcription, now exists courtesy of Matt's love of music and his degree in Electrical Engineering and Telecommunications (EET) at UNSW. It seems the only thing separating Matt and international recognition is the release of his secret, patent-pending algorithm and smartphone app.

Q&A

What exactly is Polyphonic Music Transcription?

It's the process of analysing a live musical performance and producing its musical notation. Picture an orchestra playing live, recording it using a microphone, and then printing out the exact manuscript of what was just played.

In the past, skilled musicologists faced the difficult and time-consuming task of notating musical performances music by hand. This often required intensive auditory training, especially for polyphonic music – where several instruments are played simultaneously. My motivation was to provide a tool that eased the workload for musicians and composers.

Back then, how long did it take you to transcribe a piece of music you had composed?
It used to take hours! A two to three minute piece of music for a 30-piece orchestra could easily take 30 hours to notate by hand and then type into a computer.

Why did you choose Electrical Engineering and Telecommunications at UNSW?

I knew what I wanted to develop but had no idea how I would actually make it, or what I'd need to study to learn how to make it. It wasn't until I went to UNSW's Open Day in 2007 and got talking to Professor Eliathamby Ambikairajah, that I got my first clue. I gave him a brief outline of my idea and he said to me: "You like music? You should look up audio signal processing". I looked it up, and saw there was a whole area of electrical engineering devoted to the electrical representation of sound. So I enrolled at UNSW and started the degree.

I didn't have much of a mathematics or physics background so I had to study particularly hard for a few years to understand the basics of electrical engineering. By the beginning of my fourth year, I started majoring in digital signal processing. It was around this time I had enough understanding to start to create my own software.

EXTRAORDINARY JOURNEYS OF OUR ALUMNI

RAMI BANNA

The inspirational world of Rami Banna

Q&A

How would you describe your career since leaving UNSW?

Exhilarating! Before finishing my degree I'd worked with Telstra and Alcatel-Lucent – thanks to UNSW's excellent Co-op Program Scholarship. After graduating I worked with Lucent Microelectronics (later Agere Systems) designing the world's first chips for 3.5G and 5G mobile phones. Chip design and silicon was my first engineering passion. From there I transitioned into medical devices and the wonderful world of product development and last year I started an MBA at London Business School to combine my love of product and technology with commercialisation and start-ups. I now run my own consulting company, working with start-ups all over the world. It's been a privileged and wonderful career so far.

What have been your major successes?

In product development and technology, success is a product of two things: teams and history. At Cochlear, a medical device company developing groundbreaking implantable hearing aids, I was part of a tremendous international team that built on a 30-year legacy of invention and pioneering to deliver several Red Dot-winning, International Design Award-earning and Engineering Excellence Award-leading products. One of which, the Cochlear Nucleus 5 System, was truly groundbreaking and set the industry benchmark for many years.

Another major success was winning the Medical Design Excellence Award and the Powerhouse Award in 2013. It started in a café with a 'back-of-napkin' sketch with a great friend and colleague. This conversation led to a series of revolutionary healthcare products and started a movement to make Cochlear implants accessible to many more people that needed them.

Why did you choose Electrical Engineering and Telecommunications (EET) at UNSW?

I believed then, as I do now, that engineering and technology is the most valuable degree for today and tomorrow. You just have to look at the explosion in the tech sector and its multi-billion dollar companies today to find evidence of that. Every major trend has electrical engineering at its core – internet, smartphones, wearable technology, virtual reality – you name it. It's the Golden Age of electrical engineering and the demand for engineers is insatiable. Companies fight for great talent the world over. So, I didn't need convincing that electrical and telecommunications engineering was what I wanted to study. It was just a matter of finding the best place in Australia to do it. That search didn't take too long.

What's your favourite/fondest or most striking memory of studying at UNSW?

UNSW meant so many things. It meant being out of high school; it meant starting to pursue my career; it meant living away from home; it meant being in a new city; it meant meeting life-long friends and it meant growing up to take on the world. I lived on campus for the majority of my time at UNSW and my fondest memories are the simple thinks like taking breakfast in hand and strolling into class two minutes before it started; like spending hours on the library lawn sipping coffee and debating with students from every field. I was even fond of the seemingly never-ending construction on campus – as cumbersome as it was, it really symbolised the pace of change, growth and success of UNSW.

I also remember the large contact hours in first year of Electrical Engineering and the countless all-nighters spent on projects and my final year thesis. You don't forget that mission easily!

EXTRAORDINARY JOURNEYS OF OUR ALUMNI

VIRIYA CHITTASY

"When UNSW Electrical Engineer Viriya Chittasy unleashed his inner inventor on a problem facing his young son, little did he know he was laying the groundwork to establish his own company."

When UNSW Electrical Engineer Viriya Chittasy unleashed his inner inventor on a problem facing his young son, little did he know he was laying the groundwork to establish his own company.

You don't need to talk to Viriya Chittasy for very long to realise he has a special knack for plugging gaps.

As a cadet with Ausgrid, Chittasy enjoyed the benefits of being sponsored through his Electrical Engineering degree at UNSW and immediate exposure, following his graduation in 2012, to a variety of fascinating projects. "In one project, we closed George Street [a main Sydney artery] to install fibre optic cables, which was quite amazing; but one of the most interesting things they gave me was responsibility for the billion-dollar revenue model. That was quite confronting at the time, but after a few months I had senior managers coming to me for advice. It was a great way to start my career."

With a long-held ambition to start his own company, Chittasy found that day came much sooner than he imagined after some tinkering in his garage ultimately led to the establishment of Innovateur in 2015. "It all started with my frustration at my son's sippy cup," says Chittasy. "At home, we had this cupboard full of baby cups for different developmental stages, many of which were completely over-engineered. I came up with a solution that was simple and could be used for several stages of development.

Chittasy designed and prototyped the new cup, applied for a provisional patent, offered it for commercialisation and it wasn't long before he was signing a licensing agreement with Dr. Brown's, a big US baby product manufacturer. "I wouldn't say it was easy, but I was surprised how accessible it was. I didn't need a fancy logo or a massive team of experts around me; my strategy was to basically take the idea to the right level at which a company might show some interest in it," explains Chittasy.

This got him thinking about the gap between an idea and its commercialisation so he and his business partner Kevin Dam started talking to innovators and companies. To test the water publicly, they decided to run a community invention hackathon. The Innovateur Weekend was aimed at helping industrial designers, inventors and entrepreneurs develop and launch a new consumer product in 48 hours. The success of the event came with demand for product development and commercialisation help which led to establishing Innovateur as a company in July 2015.

Chittasy and Dam then started laying the groundwork for Innovateur: "We did a lot of research to find what companies were looking for and what level of IP they were after. We soon realised that it's not black and white, there's a grey area where you won't know if company is willing to take it on unless you ask them and just give it a crack," he continues.
On the other side of the fence, they also started collecting data on PhDs with IP, inventors, spinoffs and start-ups. What they started to notice was that the success rate between them was almost the same. "We came across a lot of stories of people with a napkin sketch and a crude prototype having equal, if not more, success than many start-ups and some spinoffs. We found a lot of people trying to venture IP through a company, but not many people taking smaller steps and trying to give commercialisation a shot at an earlier stage," he says.

"Innovateur is about helping companies source and commercialise new IP from the community of innovators, so universities like UNSW, research institutions, SMEs, start-ups and inventors. During our first year of operation, we realised that the innovation ecosystem had some serious flaws. We witnessed companies investing poorly in R&D and failing to innovate, and a start-up culture creating an enormous supply of new ventures, many of which aren't solving real problems, so we are working on a series of processes and resources to really help all innovators get their IP out there."

EXTRAORDINARY JOURNEYS OF OUR ALUMNI

NISHA PRADHAN

My journey to Electrical Engineering

When I think back to my high school years, I like so many other teenage girls, didn't even consider engineering as a possible career.

Some engineers I know had their hearts set on the profession from the very first time they stepped onto a plane and realised how engineering allowed them to fly; others knew it the instant they first gazed up at a skyscraper and felt a vertiginous pull toward high-tech construction; some had always known because they grew up surrounded by engineers and saw how rewarding the work can be. For me however, engineering wasn't always a burning ambition.

I grew up in Wollongong on the NSW South Coast. I had always had an interest in maths and science; so much so that my high school maths teacher, Mrs. Wilcock, got sick of me finishing the entire maths chapter before I even came to class. So, in year 10, when I was asked what I wanted to do when I graduated, the choice was obvious: I was going to be a hairdresser. I knew that I wanted to make a positive difference to the world. I wanted to bring joy to people's lives and give them a reason to smile.

Becoming a hairdresser seemed the perfect opportunity to make others happy — everyone loves a good haircut! Most of my friends intended to follow similar career paths, either as beauticians or hairdressers, and so it seemed like the right thing to do and, honestly, I didn't want to be left out. When I told my careers advisor about my plans he agreed that this was a great idea. Hairdressing offered stable, life-long employment: people were always going to need haircuts, right? So, my love of maths aside, the beauty industry beckoned. Until I told Mrs. Wilcock. She had something completely different in mind for my future. Thank God for Mrs. Wilcock!

She suggested that I think about engineering. My first thoughts were: "No way! I'm definitely not smart enough for that and, secondly, I wouldn't exactly be able to help people if I became an engineer. Don't engineers wear hardhats and build stuff all day?"

At a UNSW Women in Engineering event I had the opportunity to engage in hands-on engineering work as well as to meet current female engineering students. They were nothing like I had imagined. Speaking to them reassured me that, although the industry may be male-dominated, women are just as capable of becoming engineers as men. This is when I decided that I COULD, in fact, become an engineer, and that's exactly what led me to study engineering here at UNSW.

Initiatives such as these are incredibly important, not just for women but for the industry and society as a whole. I strongly believe that gender diversity is a driver of innovation and growth. Female engineers bring variety, fresh perspectives and new ideas to the profession, which is why we need to encourage more girls and young women to study Science, Technology, Engineering and Maths (STEM). Since being at university, I have come to realise that it is not only a matter of increasing the number of women studying STEM disciplines but of also lifting their retention rates. Programs like Women in Engineering are essential to creating a supportive environment at university and throughout our careers to sustain our social and professional development.

Nisha was awarded Faculty of Engineering Student of the Year by the then Dean Prof Mark Hoffman. The award recognised Nisha's outstanding service to engineering over several years while studying. Her leadership efforts are too numerous to fully list here, but included serving as President of The Women in Electrical Engineering and Telecommunications (TWEET), Engineers Australia Campus Coordinator, ENGSOC Executive member, Faculty Board and Faculty Program Committee member.

Enlighten your sensors

Professor François Ladouceur is feeling pretty chuffed. It's not every day that an industry specialist turned academic finds himself at the helm of a successful start-up company that has already attracted more than $3 million in investment funding and research opportunities.

Professor Ladouceur and his partners Dr Zourab Brodzeli and Dr Leonardo Silvestri from UNSW Electrical Engineering and Telecommunications incorporated their company Zedelef Pty Ltd in 2012 after realising the unique "liquid crystal" technology they created had significant commercialisation opportunities. In a particularly nice parallel, Prof Ladouceur is also responsible for the School's Entrepreneurial Engineering course, so he has become the very definition of "practice what you preach". Discover what he has to say in this inspiring Q&A:

Tell us about your liquid crystal technology. What can it do and why is it unique?
In its simplest form, our liquid crystal technology can take a small electrical signal from any type of sensor and turn it into an optical signal. It can do this passively and safely, which means it doesn't require any power and can be used in hazardous environments. This is breakthrough technology because in many industrial contexts where a single spark could cause an explosion – think mining for example – our technology presents substantial advantages over competing technologies.

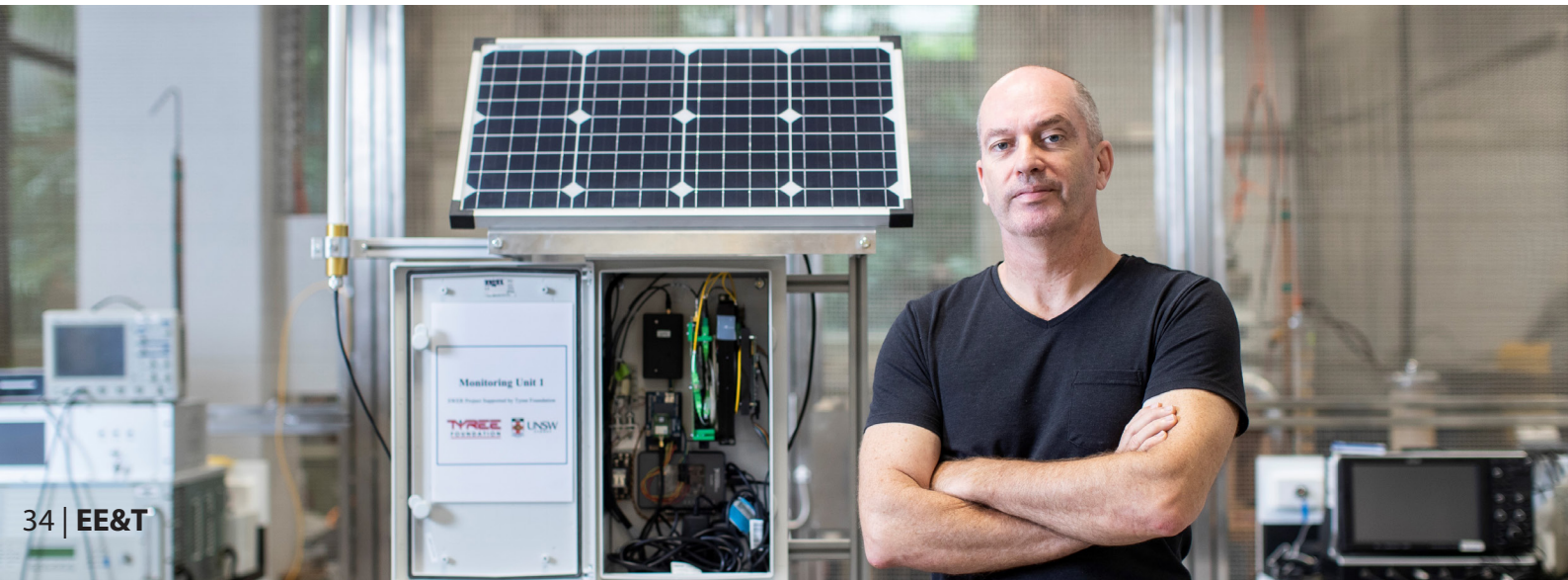
Firstly, we can take the optical signal, put it in an optical fibre and transport it across very long distances, many kilometres in fact. Secondly, optical signals are what we call "intrinsically safe"; they cannot spark and create an explosion. Thirdly, by assigning different colours of light to different sensors, we can use the same optical fibre to monitor many types of sensors over a very large area.

Who might be interested in this technology?
There are numerous applications. Let's say you're a petrochemical company operating a refinery. Of course, you need to measure continuously temperatures, vapour pressures, liquid levels at various places. Using our technology, we can "transduce" your sensor information into an optical signal, then carry it over long distances without the risk of starting a fire or cause an explosion. This has been difficult and costly in the past.

The same idea is true in the mining industry where safety of workers is paramount. In coal mines, the levels of CO, CO_2, methane, oxygen and coal dust must be precisely tracked as their drift outside of their allowed ranges can spell disaster. With our technology, we can string an optical fibre along the mines tunnels and have hundreds of sensors monitoring these quantities in complete safely.
Interestingly, the exact same technology is also being developed in collaboration with UNSW's Graduate School of Biomedical Engineering to look at the brain-machine interface. So, all of a sudden, the technology we developed for industrial sensing is now being used to detect neuronal activity in the brain and retina.

Can you describe what you're working on at the moment and what your next steps might be?
The life of a professor is one of exploration. Of course, we are pushing the commercialisation of our existing technology but we are also looking at new and exciting challenges.
With our startup, we are working in collaboration with industry partners to develop new types of lasers enabled by our technology (Lastek), to find a viable solution to the thorny problem of leak detection in water distribution networks (Sydney Water), to bring better, simpler solutions for safe monitoring of coal mines (Ampcontrol, BHP).

With my academic colleagues, we are focussing our effort on developing optical technologies that will allow a patient who has lost a limb to control her prosthesis with a great degree of accuracy. With more work on our part, the same technology could also be used to treat spasticity in children by using sophisticated neuro-modulation techniques that are yet to be fully invented. Science never sleeps!



Notes:

School of Electrical Engineering and Telecommunications
UNSW, Sydney
NSW 2052, Australia

http://unsw.to/eet