MONASH University

GROUP OF EIGHT

Undergraduate

Engineering

Course Guide **2012**

50 Years of engineering our future

CRICOS provider: Monash University 00008C

www.eng.monash.edu

Contents

Engineers Create a Better World

Engineers have forged some of the greatest advances in humankind over the past century. Advanced medical equipment, clean water, enhanced food supplies, improved transport and traffic schemes, faster telecommunication systems, stronger yet lighter materials, are all a result of engineering.

With technology rapidly evolving and our world forever changing, the role of engineers is now more challenging, exciting and in demand than ever before.

Engineers are inventors

'Engineer' literally means 'to make things happen'. That is why engineers are often described as inventors. They convert scientific knowledge into technology, and then technology into successful innovations.

As an engineer, you will create practical solutions to everyday problems, contributing to the wellbeing of humankind.

Engineering is already a part of your world

Simply look around and you will see the work of engineers. Health, transport, telecommunications, infrastructure, mobile phones, the internet and digital television are all examples of engineering in our society.

Engineers are in demand across the globe

From Asia and Africa to Europe and America, capable engineers are needed everywhere.

Engineers possess a rare combination of skills and qualities that place them in demand all over the world. They are creative and imaginative, yet analytical and technical - with an excellent sense of judgement.

Engineering can take you anywhere

An engineering degree can lead you to any number of rewarding careers. Sustainability, climate change, communications, health, transport or energy. Whatever your passion, an engineering degree can take you there.

Your career options are virtually endless not only within engineering, but also beyond. Many engineers have gone on to become CEOs, finance managers, business consultants and successful entrepreneurs both nationally and internationally.

Are you a future engineer?

Do you want to make a difference and help create a better world?
Do you enjoy maths and science? Are you imaginative yet analytical?
Do you enjoy working in teams?

If so, then find out more about an engineering degree at Monash University.

Quality and Reputation

An engineering degree from Monash University gives you a competitive edge. As a Monash engineering graduate, you can be a highly sought-after industry professional – when you first enter the workforce and throughout your career.

Reward yourself with the prestige that comes with an engineering degree from Monash University.

The Group of Eight

Monash University is a member of the Group of Eight - a select group of Australia's leading universities. Group of Eight universities provide world-class education and are consistently the first choice for high achieving students.

A balanced approach

An engineering degree from Monash University is well-known in industry for its ideal integration of practical, hands-on training with theoretical learning. It is this balanced approach that helps transform our graduates into adaptable, innovative and highly valued professionals.

The finest facilities

Monash University hosts unique and leading-edge engineering facilities including:

- A purpose-built Monash Centre for Electron Microscopy, housing one of the world's most powerful electron microscopes.
- A world-class wave tank which simulates the action of any large body of water.
- Excellent crash test and accident research laboratories.
- Computer laboratory facilities, a modern library and resource centre all designed specifically for engineering studies.
- Multimillion-dollar communications and power laboratories equipped with commercial systems and best-in-class instrumentation.
- New optical microscopy imagery laboratories.
- The largest wind tunnel in the Southern Hemisphere.
- The Clayton campus is also next door to the Synchrotron, Australia's largest scientific and engineering facility, and the new Melbourne Centre for Nanofabrication.
- The New Horizons building initiative is a platform for excellence in future manufacturing research and teaching. Scheduled to open in 2012, New Horizons aims to transform manufacturing in areas such as biomedicine, transport, aerospace and mineral processing. The facility will bring together scientists and engineers from Monash University and CSIRO.


Undergraduate computer laboratories

Excellence in research

Monash University undertakes innovative, multidisciplinary research addressing national and international priorities. Monash engineering has a highly reputable research profile with extensive links to both industry and the research community worldwide.

Professional recognition

Monash degrees are recognised by these professional engineering bodies:

- Engineers Australia.
- The Australian Computer Society (Bachelor of Computer Systems Engineering, and Bachelor of Engineering in the field of Electrical and Computer Systems Engineering only).
- The Institution of Chemical Engineers (Bachelor of Engineering in the field of Chemical Engineering only).
- Engineering Accreditation Council of Malaysia (Malaysian engineering degrees only).
- Australia is a signatory to the Washington Accord, which enables Monash engineering graduates to work in any country in the world which is also a signatory to the Accord, without the need to re qualify. For more information about the Washington Accord and a list of signatories visit www.washingtonaccord.org

An Enriched Learning Experience

At Monash University, we open your eyes to a world outside the classroom.

As a Monash engineering graduate, you walk away with more than a piece of paper. You walk away prepared for leadership, success – and most importantly, life.

Many of our enrichment activities and programs fall under the Monash Engineering Research and Industry Training program. Commonly known as MERIT.

Leadership in a Technological Environment program

The three-year Leadership in a Technological Environment program is designed to transform you into a future engineering leader. It provides a rare opportunity for you to network, acquire life skills and learn about leadership outside the formal classroom environment.

Industry partners from a range of engineering disciplines are regularly invited to deliver workshops on the engineering profession. These free sessions allow you to network and discover the diversity offered by a career in engineering.

All Engineering Excellence Award holders are invited to participate in this program. First year students can apply to participate in the program.

Real research experience

As an undergraduate engineering student, you will have the opportunity to undertake research training while studying. There are two programs on offer:

1. The Undergraduate Research Opportunities Program (UROP) allows you to experience real engineering research environments and train alongside inspiring research leaders.

2. The Summer Research Experience Program offers up to 12 weeks of paid research work during your university break.

In both cases, you will work closely with academic staff and get involved in a broad range of fascinating research projects, which are often industry based.

Monash Motorsport

Become involved in Monash Motorsport where students conceive, design and build a formula style racing car.

The mission of the Monash Motorsport team is to create the most competitive and well designed car possible – as judged by the Society of Automotive Engineers (SAE).

As a Monash Motorsport team member, you will build strong engineering links with local industry and the community and have access to first-class facilities at Monash including the wind tunnel for aerodynamic testing. Monash Motorsport achievements include:

First place in the 2010 Australasian championships, and also taking out first place in all dynamic events including skid pad, acceleration, autocross and endurance. This represents back to back wins for the team.

First place in the 2009 FSAE Australasian Championships

Third place overall in the student run FSAE World Championships held at the world renowned Silverstone race track in the UK. Over 25 countries were represented, with the Monash team representing Australia as the 2009 Australasian Champions.

Visit: www.monashmotorsport.com for more information.

Vacation work

In order to graduate you must undertake 12 weeks of practical vacation work experience in approved engineering work during one or more of your long university breaks. This experience often leads to future employment opportunities.

Departments have a list of appropriate industries and firms you can approach, and the Faculty can assist you with preparing for the selection process via the Work Ready Program.

Work Ready Program

This valuable in-depth program equips you with job application skills to secure vacation work and employment after you graduate. A Monash engineering degree plus the Work Ready Program will give you the edge in a competitive employment market.

Engineers Without Borders (EWB)

EWB is an international volunteer organisation which aims to improve the knowledge and physical resources of people in need around the world.

EWB works with developing communities to achieve environmentally sustainable, socially responsible and economically viable solutions to engineering problems, with an emphasis on education.

The Monash University chapter is involved in a wide range of EWB projects with an increasing membership every year.

Visit www.ewb.monashclubs.org for more information.

Monash Engineering Student Society (MESS)

If you are looking for an active and social university life then check out MESS.

MESS is a student-run, not-for-profit organisation that will enrich your Monash experience through engaging and fun, social and academic experiences.

MESS also produces an annual Engineering Careers Guide - a useful resource to help you secure employment when you graduate.

Monash University Clubs and Societies

Monash has over 100 university clubs and societies you can join including chocolate and chess clubs, the Monash Association of Debaters, and the Video Game Appreciation club, to name just a few.

Why Choose Monash Engineering?

We asked various students why they were attracted to studying engineering at Monash.

Here's what they had to say...

Baher Maher

Bachelor of Engineering and Bachelor of Pharmaceutical Science

Why did you choose to study engineering at Monash?

"I talked to many people who recommended Monash as the best place to study engineering and because Monash engineering offers a broad range of double degrees, and I also received a scholarship."

Christopher Culhane

Bachelor of Science and Bachelor of Engineering

Why did you choose to study engineering at Monash?

"I was interested in the Formula SAE team and I received a scholarship."

Why did you choose to study engineering?

"I am interested in engineering, and enjoyed solving problems at school and building things that move, and thought mechanical engineering would combine those ideas."

Dale Sheahan

Bachelor of Science and Bachelor of Engineering

Why did you choose to study engineering at Monash?

"Monash offered a broader range of degrees including the option to study a double degree."

Why did you choose to study engineering?

"Engineering was recommended to me because of my interest in maths and science. After completing the common first year I believe I will choose chemical engineering to specialise in, as I believe chemical engineers can help change the world for the better."

Matthew Molloy

Bachelor of Engineering and Bachelor of Laws

Why did you choose to study engineering at Monash?

"I chose to study engineering at Monash because of its well renowned reputation as a leader in engineering education".

Why did you choose to study engineering?

"I chose to study engineering and law to keep my employment options open."

"The two degrees are one of the most employable and broad educational disciplines that can be undertaken. This year I chose civil engineering as my discipline to specialise in as I have always been interested in structural engineering, in particular buildings and architecture."

Matthew Wills

Bachelor of Science and Bachelor of Engineering

Why did you choose to study engineering at Monash?

"The right combination of double degree offerings, ease of access, and prestigious international recognition made Monash University an obvious choice."

Titan Microscope

Monash Motorsport Team

Hargrave-Andrew Library

Andy Huynh

Bachelor of Science and Bachelor of Engineering

Why did you choose to study engineering at Monash?

"I really want to make real change to people's lives and the world and feel I can achieve this with a degree in engineering."

Why did you choose to study engineering?

"I am interested in power generation and how this can be done in a more sustainable way."

Katie (Katherine) Venables

Bachelor of Science and Bachelor of Engineering

Why did you choose to study engineering at Monash?

"It is local, has an excellent reputation and a really young, fun vibe."

Why did you choose to study engineering?

"I'm still not sure what type of engineer I want to be so I chose the common first year. I didn't want to commit to a discipline before I was sure."

"I love maths and science. Engineers are highly employable and there is a great variety of options."

Jiachun (Cindy) Huang

Bachelor of Science and Bachelor of Engineering

Why did you choose to study engineering at Monash?

"Monash has a good reputation for engineering and the location of Monash in Clayton is convenient. I believe that science and engineering fit well together, and the double degree has the capacity to open windows for further career opportunities upon graduating from the degree."

Why did you choose to study engineering?

"I enjoyed maths and physics at school and chose engineering because of the mixture between concepts, theory and practical work." Cindy believes she will choose materials engineering as her specialisation with biomaterial science.

Scholarships and Bursaries

			Available to		
Scholarship	**Value**	**Number available**	**Domestic students**	**International students**	**Onshore international students**
Engineering Excellence Awards Offered to the highest achieving students entering an engineering course at Monash. Recipients must receive an ATAR or equivalent of at least 98.00. Includes an invite to participate in the prestigious Leadership in a Technological Environment program.	$6000 per 48 credit points of study for the engineering component for a maximum of four years. Total award value is $24,000.	Up to 50.	✓		✓
Monash University Scholarships for Excellence Awarded to students who achieve an ATAR or equivalent of 99.95.	CSP contributions paid plus $6000 per 48 credit points of study, for the minimum number of credit points required to complete the degree.	All eligible students who applied for the scholarship will be made an offer.	✓		✓
Monash University Scholarships for Excellence and Equity Awarded to the highest achieving students who achieve an ATAR or equivalent of at least 95.00 and who are from one or more of Monash University's defined equity or personal disadvantage groups.	$6000 per 48 credit points of study, for the minimum number of credit points required to complete the degree.	Up to 125.	✓		✓
Monash University Engineering Scholarships Awarded to the highest achieving students with an ATAR or equivalent of at least 95.00.	$6000 per 48 credit points of study, for the minimum number of credit points required to complete the degree.	Variable, depending on funding.	✓		✓
Monash University International Scholarships for Excellence Awarded to international students who receive outstanding results in their prerequisite qualification.	$6000 per 48 credit points of study, for the minimum number of credit points required to complete the degree.	Variable, depending on funding.		✓	✓
Engineering International Undergraduate Award These awards recognise high achieving international students studying Year 12 or IB in Australia who receive an ATAR or equivalent of at least 90.00.	$5000 one-off payment.	Up to 50.			✓
Women in Engineering Bursaries Offered to the highest achieving female students commencing an undergraduate engineering program offered by the Faculty of Engineering.	$5000 one-off payment.	Up to 50.	✓	✓	✓
Engineering Indigenous Scholarships Offered in conjunction with Monash College this scholarship is awarded to the highest achieving year 11 indigenous students commencing a Diploma of Engineering at Monash College, and articulating to a Bachelor of Engineering degree.	Full tuition fees paid for the Diploma of Engineering studies at Monash College, plus $6000 per 48 credit points of study for the Bachelor of Engineering, for a maximum of four years.	Variable, depending on funding.	✓		

For all scholarship and bursaries eligibility and selection criteria, visit www.adm.monash.edu/scholarships/

Graduate Opportunities


Pharmaceutical Engineering Student

Faculty guaranteed scholarships

Designed for high achieving final year students, faculty guaranteed scholarships provide an ideal pathway into research studies.

If at the end of your course you have achieved a H1 honours weighted average, we guarantee you a scholarship to undertake a higher degree by research (Masters or PhD). The scholarship value is equivalent to the Australian Postgraduate Award rate.

Conditions apply. Please ask for more information.

How will you be financially rewarded as a graduate engineer?

Before you invest time, money and energy into your studies, you should know how well you will be rewarded after graduation.

The table below gives you an indication of the salary packages you can expect as a graduate engineer and beyond.

Classification	Definition	Typical title	Median salary package $AUD
Level 1	Commencement level	• Graduate engineer	$70,850
Level 2	Conducts professional engineering without detailed supervision on more responsible assignments	• Structural engineer • Design engineer • Technical specialist • Specialist engineer • Project engineer	$89,063
Level 3	Requires application of mature professional knowledge. Deals with problems where modification to established guides are needed	• Operations manager • Works engineer • Operational planner • Consulting engineer • Engineering systems manager	$108,939
Level 4	Work involves considerable independence. Demands originality, ingenuity and judgement	• Project manager • Regional manager • Senior engineer • Quality manager • Production manager • Manager • Technical specialist	$134,019
Level 5	Responsible for directing several professional and other groups in inter-related engineering. Authority of major importance to an organisation	• Associate director • Executive director • Group manager • Manager • Project manager • Principal	$170,040
Above 5	Independently conceives programs and problems to be investigated and makes responsible decisions on all matters, including the establishment of policies and expenditure of large monies and/or implementation of major programs, subject to overall policy and financial controls.	• Professional engineer • Senior manager • Executive director • CEO	$219,815

Source: APESMA Professional Engineer Remuneration Survey Summary Report June 2010

The Monash Difference

More choice, greater flexibility

You know how important it is to keep your options open. Not everyone is sure which engineering field they want to study or precisely where they see themselves in the future.

That is why we created an engineering degree that gives you more choice and flexibility than anywhere else.

The common first year

Monash engineering offers a common first year program, entitled the Bachelor of Engineering (BE). The discipline fields which fall under the BE are chemical, civil, electrical and computer systems, materials and mechanical engineering. The BE allows you to better understand each engineering field before deciding what to pursue in level two. See page 11 for details.

Specialist degrees

Monash offers a number of exciting specialist engineering degrees including aerospace, civil and environmental, computer systems, environmental, and mechatronics engineering. See page 12 for details.

Double degrees

Monash offers a range of double degrees to broaden your career options when you graduate. Whether it is architecture, arts, biomedical science, commerce, industrial design, law, pharmaceutical science or science, Monash allows you to study engineering while pursuing other passions and interests. See page 14 for details.

Diploma of languages

The Faculty of Engineering in conjunction with the Faculty of Arts, allows students to undertake a Diploma of Languages in the second year of studies. Students undertaking a Diploma of Languages often take part in Exchange or Study Abroad in their third year of studies to consolidate their language skills.

Vacation work

Twelve weeks of vacation work is undertaken during the final year(s) of all engineering degrees, and a vacation work report must be submitted.

Final year research projects

All engineering single and double degrees have a final year research project component, and a small thesis outlining the methodology of the project work and the project outcomes.

Industry funded awards and prizes

Strong links with industry enable the Faculty of Engineering to offer current students a wide range of prizes and scholarships.

More than 50 scholarships and prizes are awarded annually in a variety of disciplines.

Some of our generous sponsors include Aker Solutions, Bosch, Engineers Australia, ExxonMobil, IMechE-UK, McConnell Dowell, Transurban and VicRoads.

Monash Exchange and Study Abroad options

Monash University encourages students to take a global view. Monash has exchange agreements with more than 100 universities in 26 different countries, which enables you to have an international experience while your overseas studies are credited towards your degree.

Exchange

Spending time overseas on exchange as part of your engineering degree will expose you to new ways of learning and living. You will also build an international network and develop independence and cross-cultural sensitivity. As part of Monash University's exchange agreement, there are no extra tuition fees to pay while on exchange, students will need to pay their usual CSP contribution.

Study Abroad

Students who take part in a study abroad program can undertake 1 – 2 semesters worth of study overseas, but will need to pay tuition fees at the overseas institution.

Intercampus exchange

Engineering students choosing to participate in intercampus exchange for 6 months at Monash University's Sunway campus in Malaysia, will receive a $3500 travel grant as well as having their accommodation and return airfares paid by Monash University. Students will also have their engineering studies credited to their engineering degree.

Travel grants

Most students who participate in an approved exchange or study abroad program are eligible to receive a travel grant from the university.

Visit www.monash.edu/students/studyabroad for more information.

Visit
www.eng.monash.edu
to learn more

The Common First Year

More time to plan your future

With so many engineering fields to choose from, how do you decide which one to pursue? From civil, chemical and electrical and computer systems to materials and mechanical, the decision can be overwhelming.

When you study the Bachelor of Engineering at Monash University, you select an engineering specialisation after your first year. This gives you time to learn more about the engineering profession and its different fields before deciding what to pursue.

Course structure

The common first year lays a foundation in the basic sciences of mathematics, physics and chemistry and introduces each field available to you for further study.

During your first year, you will learn to:

- Apply developing maths and science knowledge to real life problems
- Understand the interaction between engineering and society
- Develop important skills such as communication, report writing and teamwork.

The common first year is taught at the Clayton and Malaysia campuses.

The common first year is also available for some double degrees. See page 15.

What you will study during the common first year

You will study eight units in the common first year. The units you will take will vary depending on the prerequisites subjects you completed.

Foundation Units	Core Units	Specialist Units	*Elective Units*
You are required to select one or two of these foundation units if you did not complete VCE units 3 and 4 (or equivalent) of chemistry, physics and/or specialist mathematics.	All students are required to study these subjects.	You must choose at least four units from this list.	*You can choose to study none, one or two units from this list.*
Foundation Chemistry	Computing for Engineers	Process Systems Analysis	*Engineering Profession*
Foundation Physics	Mathematics for Engineering	Engineering Structures	*Chemistry for Engineering*
Foundation Mathematics		Electrical Systems	*Physics for Engineering*
		Engineering Dynamics	*Biological Engineering 1*
		Engineering Materials	

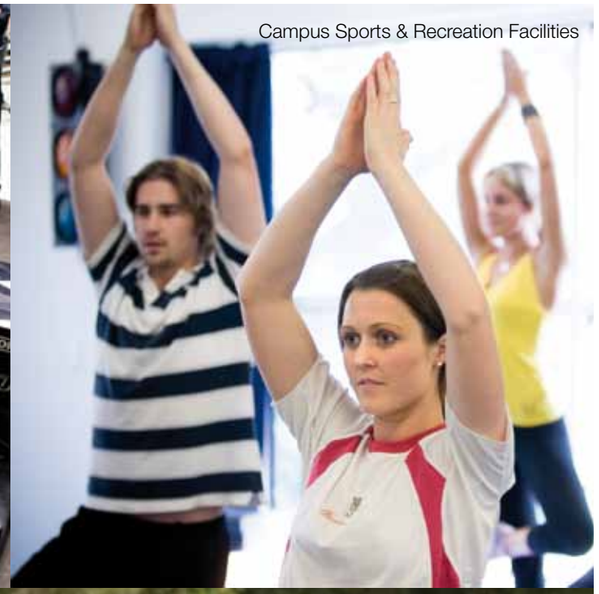
After your first year

Depending on your academic performance in your common first year, you can pursue any of the following specialisations from your second year of study:

Bachelor of Engineering Discipline	Clayton Campus	Malaysia Campus
Chemical	√	√
Civil	√	
Electrical and Computer Systems	√	√
Materials	√	
Mechanical	√	√
Mechatronics*		√

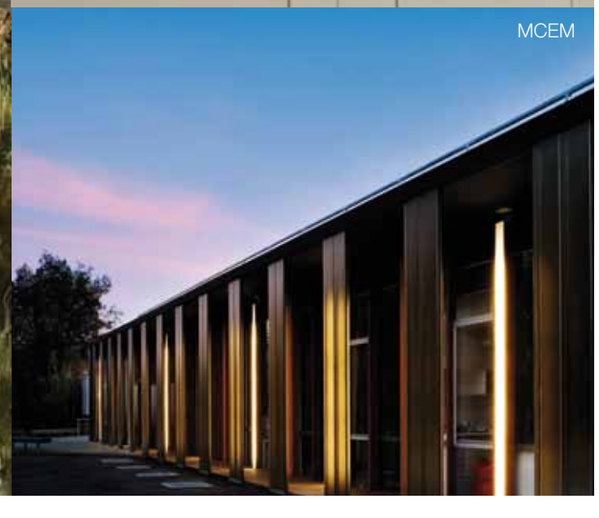
*The Bachelor of Mechatronics Engineering is available as a separate entry degree at Clayton campus.

Monash College



Specialist Degrees

Specialist programs	Page
Aerospace	16
Architecture	N/A
Biomedical Science	18
Civil and Environmental	24
Computer Systems	26
Environmental	30
Industrial (product) Design	32
Mechatronics	38
Pharmaceutical	40



Double Degrees

A double degree opens more doors

More and more organisations seek engineering graduates with expertise in other disciplines. They are continually impressed by the breadth of knowledge and insight evident in double degree graduates from Monash University.

A double degree allows you to pursue a career in either area, or to take up one of the many opportunities emerging at the interface of disciplines.

An engineering double degree offers diversity, more career choices and flexibility.

Architecture

The Faculty of Engineering in conjunction with the Faculty of Art and Design are designing a new double degree course which is the Bachelor of Engineering in the field of civil engineering combined with the Bachelor of Architecture. *This double degree course is subject to final approval but is planned to be introduced in 2012.*

Arts

Combining engineering and arts will give you complementary skills in technology and communications.

For example, languages and engineering is a valuable combination if you are interested in an international career. An engineer with a communications qualification is also well placed to translate complex technical concepts into clear, well-written documentation.

Any arts major or minor sequence can be combined with an engineering degree.

Biomedical science

If you are eager to explore a career in biological/biomedical engineering, consider a double degree in engineering and biomedical science.

Advances in biological sciences and demand for technological solutions are creating new opportunities for engineers. In the next 25 years engineering will be transformed as it parallels and fuses with developments in biomedical science.

As a leader in engineering and biomedical sciences, Monash University has pioneered this emerging field. This is your chance to be a part of an exciting revolution.

Commerce

Do you dream of making it big in the business world? If so, engineering with commerce is a powerful combination.

Many CEOs of major corporations are engineers. People with sound business skills and a strong technological background are consistently in demand across a myriad of industries and organisations.

Industrial (product) design

If you have a natural eye for design and can appreciate the aesthetics of consumer products, then consider this unique double degree. Monash University is well known for its expertise in both mechanical engineering and industrial design.

Law

An engineering and law degree bridges the gap between technological and legal issues.

This double degree combination produces engineers who are sensitive to the legal, corporate and political implications of technology and how it is applied.

As an engineering and law graduate, you are eligible to practise as a solicitor in a law firm. Alternatively, you may choose to work as part of the legal team in a large engineering, manufacturing or technology firm.

Pharmaceutical science

There is an increasing demand for pharmaceutical scientists with the expertise to take products from the design and formulation stage through to manufacturing.

Combining chemical engineering with pharmaceutical science will allow you to pursue a career in this exciting and expanding field.

Science

Engineering is concerned with the application of science. However, many engineers are fascinated by scientific investigation and eager to enhance their understanding of the pure sciences.

You may choose to combine engineering with food science or technology, or explore the fundamentals of the cosmos through astrophysics. Alternatively, you may be interested in the most fascinating machine of all, the human body.

Undergraduate computer laboratories

Double degrees and the common first year

The following table shows double degree combinations and the engineering disciplines they are available with.

Some double degree combinations require you to choose an engineering specialisation when you enrol, without undertaking the common first year.

Shaded cells indicate combinations available with the common first year.

	Other Degrees								
Engineering Discipline	Architecture	Arts	Biomedical Science	Business and Commerce	Commerce	Industrial Design	Law	Pharmaceutical Science	Science
Aerospace		√			√		√		√
Chemical		√	√		√		√	√	√
Civil	√	√	√		√		√		√
Civil and Environmental				√					
Electrical and Computer Systems		√	√		√		√		√
Environmental									√
Materials		√	√		√		√		√
Mechanical		√	√		√	√	√		√
Mechatronics		√			√				√

For a full course map visit
www.monash.edu.au/pubs/2011handbooks/undergrad/eng-courses.html

Aerospace Engineering

Full title	Bachelor of Aerospace Engineering
Abbreviated title	BAeroEng
Duration	4 years
Campus	Clayton
Double degrees	Arts, Commerce, Law, Science (Clayton Only)

The Airbus A380, A350, A400M and the Boeing 787 are just some of the astounding technological advances taking place. As an aerospace engineer, your career possibilities are exciting and diverse. What future challenge will you be a part of? Will you be involved in creating more environmentally-friendly passenger aircraft? Perhaps you will contribute to the next generation of fighter aircraft - or the space shuttle replacement? Or will you play a role in the continuing effort to build a space vehicle to explore our solar system and beyond?

What is aerospace engineering?

Aerospace engineering is concerned with the design, development and maintenance of flight vehicles. It involves advanced technologies such as aerodynamics, aerostructures, avionics, propulsion, material science and computational simulation.

What do aerospace engineers do?

Aerospace engineers apply scientific and technological theories, concepts and equations to vehicles within the earth's atmosphere or beyond.

Activities include the use of wind tunnels for aerodynamic testing, computational modelling for predicting structural behaviour and materials and structural testing.

An aerospace engineer typically studies:

- Aerostructures: principles of structural mechanics and analytical techniques to ensure a vehicle's structural integrity.
- Aerodynamics: fluid motion around a body moving through the atmosphere at subsonic and hypersonic speeds.
- Propulsion: basics of thrust generation by the application of aero/gas dynamics and thermodynamics.
- Flight control: the analysis of flight, including techniques for vehicle guidance and stability, space vehicle trajectories and orbits.
- Aerospace materials: advanced materials used on the airframe and in propulsion systems.
- Aerospace design: preliminary design of the complete aircraft which emphasises systems integration.

Careers in aerospace engineering

Aerospace engineering reaches beyond traditional aerospace applications. You might work in automobiles, energy production and conservation, lightweight materials or new manufacturing techniques.

When you graduate you are likely to work in one of these main areas:

1. Design and manufacturing
2. Research and development
3. Airworthiness operations

You might join a large aerospace company or a general manufacturer that contracts to the aerospace industry. Or you might work at an airline or a government aerospace laboratory or research centre.

Formula One teams also employ many aerospace engineers.

Aerospace engineering might also lead you towards other professions such as management consulting or finance.

Aerospace engineering at Monash University

Level 1
The first year of the aerospace engineering program is similar to the common first year of the Bachelor of Engineering (see page 11) but includes an introductory aerospace engineering unit.

Level 2
The core disciplines of fluid mechanics, thermodynamics and heat transfer, materials, structures, design and dynamics/mechanics are studied. A unit at level two in each area lays the foundations of the discipline, and is followed by an advanced unit in level three.

Level 3
Includes aerodynamics, propulsion, aircraft structures and control systems plus a project based design unit that incorporates teamwork and management principles. A numerical analysis unit, integrating computational solid and fluid mechanics completes the year.

Level 4
The final year of the program includes a full year research project enabling students to work independently on an area of interest. In addition, a professional practice unit and two advanced technical units in airworthiness and avionics are undertaken. Students also complete a business elective and two technical electives.

Subjects and Course Progression

For a full course map visit
www.monash.edu.au/pubs/2011handbooks/courses/3275.html

Aerospace Engineering

Join an exciting profession in the midst of developing the next generation of flight vehicles.

Grad Profile

Cameron Devries

Bachelor of Aerospace Engineering and Bachelor of Engineering in the field of Mechanical Engineering

Cameron graduated in 2007 with first class honours in a Bachelor of Aerospace Engineering and Bachelor of Engineering in the field of Mechanical Engineering. Whilst at Monash, he was an active member of the Monash Aerospace Club and was President in his final year. Upon completion of studies he was offered a full time position as a graduate engineer at Aerosonde.

In 2009 Cameron was promoted to the position of Lead Systems Engineer and since then has been the lead airframe and systems engineer on all major product advancements including wings, several airframe improvements, and a total ground-up redesign of the entire aircraft.

This role not only involves classical engineering duties, but also prototype fabrication, designing and implementing test plans, analysing test results and acting as the test director when conducting field tests. He is qualified as an instructor level test pilot on the Aerosonde system and can also fill the role of field technician if required. He frequently travels overseas to represent Aerosonde at design reviews and project meetings.

Since Cameron graduated from Monash he has enthusiastically participated in activities such as open day, school nights and given a number of presentations, as well as providing input to the recent accreditation of the Mechanical and Aerospace degrees. He has also actively supervised and resourced several final year projects, providing an important link to the local aerospace industry.

Biomedical Science and Engineering

Full title	Bachelor of Biomedical Science and Bachelor of Engineering
Abbreviated title	BBiomedSc/BE
Duration	5 years
Campus	Clayton
Double degrees	Combining Engineering with Biomedical Science

Victoria is Australia's pre-eminent state for biotechnology with strong government support for it to become one of the top five biotechnology locations around the world.

Biomedical research teams are looking at neuromuscular systems control and rehabilitation technology development. Designing devices such as artificial tactile sensors and pressure sensors, could lead to a dramatic increase in the quality of life for many people. The areas of applications are wide and varied, and will only continue to evolve and develop in the future.

What is biomedical science and engineering?

Biomedical science and engineering (also called 'bioengineering') represents an exciting, broad-based discipline which ties together the engineering, medical and biological sciences. The key objective is to benefit humans, animal and plant life.

Biomedical science and engineering encompasses traditional engineering disciplines, as well as cross-disciplinary areas such as:

- Biomedical engineering (clinical and medical technology, medical imaging, tissue engineering)
- Biochemical engineering (pharmaceutical design, delivery and process)
- Biomimetics and bio-inspired engineering (engineering design based on organic structure and function)
- Environmental engineering, biotechnology and sustainability (bioremediation, eco-friendly energy production)
- Food engineering.

The most important trend in biomedical science and engineering is the dynamic range of scales at which biotechnology is now able to integrate with biological processes.

An increase in micro-nano scale technology is allowing the manufacture of nanoparticles for drug delivery into cells, miniaturized implantable microsensors for medical diagnostics, and micro engineered robots for on-board tissue repairs.

The world of engineering is changing dramatically and will continue to evolve and develop over the next couple of decades, as it leverages and fuses with the exciting new developments in the biological science arenas. In the near future, new and exciting career prospects will arise from the research currently being undertaken in these areas.

What do biomedical scientists and engineers do?

Biomedical scientists and engineers bring engineering insights to the understanding of biological phenomena through:

Conducting analysis – to measure and understand intricate biological phenomena, systems and processes at the basic molecular, cellular and physiological levels; and

Undertaking synthesis – to design devices/processes and/or develop technologies/applications to model, manipulate or apply to biological systems in areas such as applied medicine, environmental science and agricultural science.

The synergies between engineering and medicine are currently the ones best known but the term biological engineering also includes a host of broader developments in other areas such as biofuels, renewable materials, improved bio-processing outcomes, environmentally sustainable development and biosensitive infrastructure.

Careers in biomedical science and engineering

Many technologies fail to make an impact in medicine either because the engineers do not understand the underlying biology and the constraints imposed by the medical industry, or because medical professionals do not understand the full capability of new technologies,

Engineers with a background in the biomedical science have the skills to bridge these boundaries.

In the coming years a vast and interesting array of new career prospects will be available for engineers with these skills both nationally and internationally. Some career areas include:

- Pharmaceutical and biotechnology engineering
- Medical diagnostics and development
- Medical device design and development
- Medical imaging, image processing
- Medical IT, computer systems and telecommunications
- Genetic and proteomic engineering in disease understanding and prevention
- Biomaterials and tissue regeneration and research
- Bio-processing and production of food and medicines
- Human biomechanics and prosthetic research
- Public health engineering as in water supply and reuse of solid and waste disposal systems
- Bio-remediation and environment engineering.

Biomedical Science and Engineering

Advances in medicine and increased awareness in the community of health issues are leading to increased investments in biomedical science and engineering education and research.

Biomedical science and engineering at Monash University

Level 1
Students study foundation engineering units, depending on VCE units completed, and are introduced to biomedical science through units such as biomedical chemistry and cells, tissues and organisms, in addition to units relevant to the engineering discipline chosen.

Level 2
Biomedical engineering is further explored and additional units in the student's engineering discipline are studied.

Level 3
Advanced units are studied in engineering and biomedical science. Units studied are dependent on the engineering discipline chosen.

Level 4 and 5
The final two levels include core units relevant to the engineering discipline in addition to electives from the biomedical science area.

Biological Engineering Studies at Monash University

All engineering students can take elective units in biological engineering as part of the BE course or students can enrol in one of the following double degree courses.

Bachelor of Biomedical Science and Bachelor of Engineering

The five-year double degree, offered by the Faculty of Medicine, Nursing and Health Sciences and the Faculty of Engineering , introduces you to a range of new interdisciplinary subjects covering modern biomedical sciences, human biology and public health, and develops a strong grounding in one of five branches of engineering.

The research and design focus of the engineering programs, along with the interdisciplinary approach of the biomedical science component, gives you qualifications in two disciplines and ensures you are able to make a unique contribution to both biomedical science and engineering.

Bachelor of Engineering and Bachelor of Pharmaceutical Science

The five-year combined degree, unique in Australia and one of only a handful worldwide, opens up a range of exciting careers in the development and manufacture of sophisticated pharmaceutical products. See page 40.

Subjects and Course Progression

For a full course map visit
www.monash.edu.au/pubs/2011handbooks/courses/3879.html

Chemical Engineering

Full title	Bachelor of Engineering in the field of Chemical Engineering
Abbreviated title	BE
Duration	4 years
Campus	Clayton or Malaysia
Double degrees	Arts, Biomedical Science, Commerce, Law, Pharmaceutical Science, Science

As populations grow and resources and energy reserves decline, the demand for chemical engineers is increasing.

A degree in chemical engineering will prepare you for a wide range of rewarding careers - in Australia and beyond.

Whether you focus on developing future energy solutions, controlling pollution or protecting our environment, your future as a chemical engineer is bright.

What is chemical engineering?

Many everyday items we take for granted involve chemical engineering during some stage of their production. Computer chips, photography film, mobile phones, petrol, paper, coffee and clean power, to name just a few.

Chemical engineering has its basis in chemistry, physics and mathematics. It is also developed from other branches of engineering, applied sciences, biological sciences and economics.

What do chemical engineers do?

Chemical engineers invent, develop and design processes that convert raw materials into useful products - with minimal environmental impact.

Chemical engineers are also involved with pollution control, protection of the environment and with energy conservation and conversion.

A chemical engineer might:

- Design or improve industrial processes and equipment for large-scale chemical manufacturing.
- Develop environmentally clean technologies for product manufacturing and power generation.
- Devise production processes that are safe, efficient, profitable and environmentally sound.
- Research naturally occurring chemical reactions that can be copied for human benefit.
- Design, develop and use new materials.
- Research new processes and products.
- Develop alternative fuels and energy sources for improved products such as sunscreen.

Chemical engineering streams

At Level three, you can choose one from the following three engineering streams to specialise in.

Each stream involves three specialised units and the opportunity to undertake a final year research project in the chosen stream.

Biotechnology

Biotechnology involves the use of biological processes for commercial and industrial applications. Applications include the use of recombinant DNA, the development of micro-organisms and new bio-processing techniques.

Sustainable processing

Sustainable processing involves the application of principles of sustainability and life cycle assessment for environmental benefit. Chemical engineers develop processes for manufacturing existing and new products from renewable raw materials.

Nanotechnology

Nanotechnology is engineering at the molecular level. It lets us fabricate an entire new generation of products that are cleaner, smaller, stronger, lighter and more precise.

Integrated industry training

A selection of high achieving students are given the opportunity to undertake six months of integrated industrial training in the first semester of their final year.

Chemical engineering at Monash University

Level 1
Students complete the Bachelor of Engineering common first year - see page 11.

Level 2
Students undertake core units in fluid dynamics, mass and heat transfer, thermodynamics and chemical engineering principles and advanced engineering mathematics.

Level 3 and 4
From third year, in addition to core units, students choose to complete electives from one of three streams: biotechnology, sustainable processing or nanotechnology.

Subjects and course progression

For a full course map visit
www.monash.edu.au/pubs/2011handbooks/courses/0032.html

Chemical Engineering

Our changing world needs more chemical engineers.

Careers in engineering

As a chemical engineer, you can work in a range of industries including oil and gas, food and beverage, mineral and mining, plastics and petrochemicals, environment, water, biomedical and pharmaceutical.

The table below lists the various industries you may work in and the responsibilities you might have in each.

Industry	Your responsibilities
Biotechnology	You will develop processes for using renewable raw materials such as biomass for the manufacture of fuels, medicines, plastics and chemicals. You might also develop and operate biological reactors for tissue engineering applications.
Chemical	You may make agricultural products, detergents or cosmetics.
Energy	You will develop new, highly efficient and environmentally sound processes to generate electric power from fossil fuels or renewable energy such as solar generated hydrogen.
Environmental	You could find yourself solving air and water pollution problems or developing new, highly efficient processes that have minimal environmental impact.
Food	You might make beer from malted barley or produce cheese and yoghurt from milk.
Minerals	You will process bauxite ore to produce aluminium, used wherever we need a lightweight strong material or a good conductor of heat and electricity.
Nanotechnology	You could be inventing, developing and manufacturing advanced nanomaterials for applications in catalysis and separations.
Oil	You will refine crude oil to produce petrol, other fuels, oils and feedstocks for the petrochemical industry.
Paper	You will recover and recycle chemicals used in breaking down wood into pulp for manufacturing paper.
Petrochemical	You will process crude oil into plastics such as polythene, polystyrene and polypropylene.
Pharmaceutical	You could be involved in making new medicines for our world's growing population.

Civil Engineering

Full title	Bachelor of Engineering in the field of Civil Engineering
Abbreviated title	BE
Duration	4 years
Campus	Clayton
Double degrees	Architecture, Arts, Biomedical Science, Commerce, Law, Science

Civil Engineers improve systems and processes that allow humans and nature to coexist with minimal impact.

As societies progress, we need more civil engineers.

We need civil engineers to, design and build higher capacity transportation systems. To, construct larger commercial and industrial complexes. For, water supply and pollution control. And, to repair or replace roads, bridges and other structures.

What is civil engineering?

Civil engineering is concerned with the design, construction, maintenance and the operation of infrastructure for the benefit of society. Types of infrastructure include:

- Highways and railways
- Buildings and structures of all kinds
- Transport and traffic systems
- Harbour facilities for transportation
- Space stations
- Power generation facilities
- Water and wastewater treatment plants and distribution systems.

What do civil engineers do?

Civil engineers design structures including multi-storey buildings, bridges, tunnels, commercial complexes, oil rig platforms, water systems, road and traffic systems, and foundation supports.

A civil engineer might:

- Talk to community leaders about the best way to solve a transport problem.
- Develop mathematical or physical models of river and tidal currents to investigate the viability of a new port.
- Advise a community group about recycling storm water.
- Develop the concept of a ‘green building’ that is environmentally sensitive and efficient.
- Interpret and organise specifications, drawings, plans and procedures for an innovative foundation system for unstable soils.
- Develop new materials for use in construction.
- Work with a consortium to design an eco-tourism resort.

Civil engineering streams

At Level three, you can choose one from the following four engineering streams to specialise in through taking electives.

Structures

Structural engineers design buildings, bridges, airports, railways, commercial complexes, towers, off-shore platforms and tunnels. They ensure structures are sound under extreme conditions such as wind, waves and earthquakes.

Water

Water engineers manage water supply systems for people, agriculture and industry. Typically, a water engineer will:

- Develop projects to control flood waters.
- Design dams, spillways and pipe networks.
- Manage rivers and develop systems to collect and treat wastewater.
- Develop urban water sensitive designs.

Transport and Traffic

Transport and traffic engineers plan the future travel needs of city and country areas. They investigate alternative transport technologies to make existing road and traffic systems safer and more efficient.

Geotechnics

Geotechnical engineers advise on foundation design, support structures, stability of slopes, tunnel design and construction, and the suitability of materials for infrastructure projects.

Careers in civil engineering

Your career prospects as a civil engineer are strong and diverse. When you graduate, you might work in any one of these sectors:

- Private industry
- Government
- Construction and mining
- Marine and resort developments
- Property and land development
- Consulting firms.

Civil Engineering

Modern society could not function without civil engineers.

Civil engineering at Monash University

Level 1
Students complete the Bachelor of Engineering common first year - see page 11.

Level 2
Students are introduced to basic analysis techniques in each of the four disciplines in civil engineering through significant project based units, including geotechnical, transport, water and structural engineering.

Level 3 and 4
Core units extend studies in engineering design and analysis, with increasingly complex tasks and a focus on tackling real engineering problems. All four disciplines are again represented with the addition of management units.

Level 4 only
Students undertake a thesis project, civil engineering practice, electives in their chosen specialisation and two electives that can be taken from anywhere in the university.

Subjects and Course Progression

For a full course map visit
www.monash.edu.au/pubs/2011handbooks/courses/0032.html

Civil and Environmental Engineering

Full title	Bachelor of Civil and Environmental Engineering
Abbreviated title	BCivEnvEng
Duration	4 years
Campus	Gippsland
Double degrees	Business and Commerce

If you are interested in both civil engineering and sustainable development, then a specialist civil and environmental degree is for you.

This growing field combines the skills of a civil engineer to design, build and manage infrastructure, with the knowledge of an environmental engineer to create a sustainable future.

Demand is on the rise for engineering graduates with environmental expertise. This is your chance to stand out from the crowd – and make a difference for generations to come.

What is civil and environmental engineering?

Civil and environmental engineering creates infrastructure that functions in harmony with the environment. It addresses the interactions between engineered and natural environments.

This specialist field of engineering involves the design, construction and management of road systems, marine and wetland developments and recreation facilities. It also involves projects such as mining and landfill site restoration.

What do civil and environmental engineers do?

Civil and environmental engineers solve problems in the context of community and environmental needs.

They manage natural resource systems such as forests, land and water, paying attention to urban water sensitive design and reducing rural soil erosion and salinity problems.

Civil and environmental engineers are also involved in land use planning and integrating transport aspects to produce sustainable urban and rural developments.

Careers in civil and environmental engineering

Demand is rapidly growing for engineering graduates with expertise in planning, designing, managing and operating environmentally sensitive infrastructure and systems.

Our increasing population and improved standard of living continue to provide many jobs in these varied sectors:

- Local, state and federal government
- Consulting and contracting firms
- Research and development
- Education organisations.

Civil and environmental engineering at Monash University

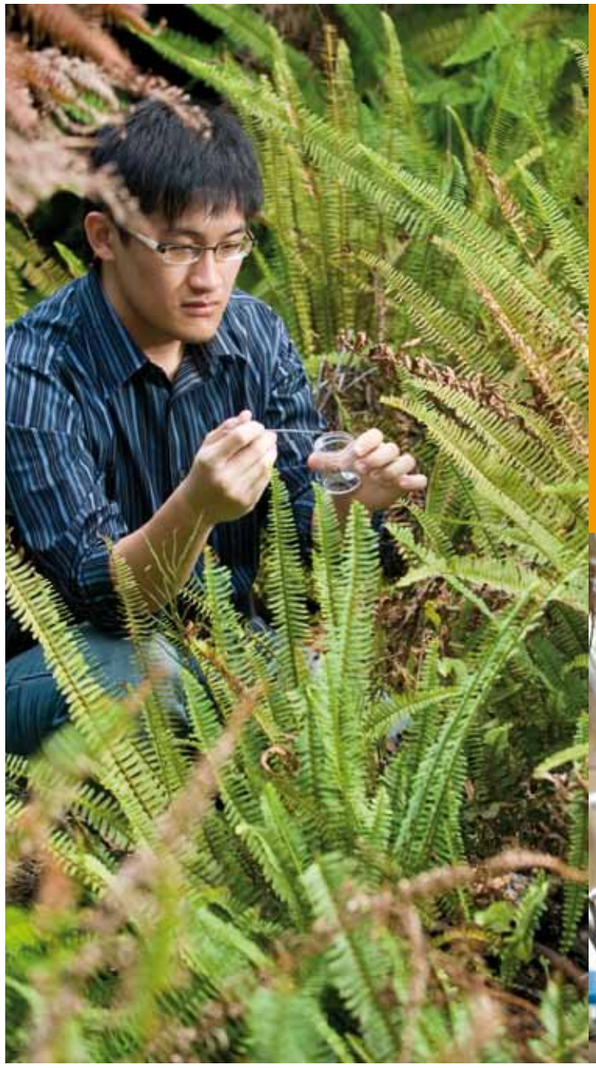
Level 1
Includes basic sciences such as mathematics, physics and chemistry, along with engineering units and an introduction to environmental science.

Level 2
Students explore basic analysis techniques in the areas of civil and environmental engineering through significant project based units, including geomechanics, structure, transport, hydrology and water supply.

Level 3 and 4
Studies are extended in environmental science, and civil and environmental engineering design and analysis but with increasingly complex tasks. Students deal with real world problems through field and laboratory experiments and computer modelling. Students also undertake two industry based thesis projects in a chosen area of interest.

Subjects and course progression

For a full course map visit
www.monash.edu.au/pubs/2011handbooks/courses/3274.html



Civil and Environmental Engineering

Are you passionate about the preservation of our natural world?

Grad Profile

Jessie Waugh

Bachelor of Civil and Environmental Engineering

"I thoroughly enjoyed studying the large array of topics within the Civil and Environmental Engineering degree at Gippsland Campus. The combination of environmental and civil engineering studies provides a great stepping stone to the future of sustainable engineering in Australia.

Travelling to the UK to study at the University of Leeds through Monash University's Study Abroad program was a highlight of my time at university. This was an amazing experience and I definitely recommend it to other students.

During my course, I was fortunate enough to receive four Gippsland Industrial Engineering scholarships. The financial support provided by the scholarships allowed me to reduce my casual working hours and have that extra time to concentrate on my studies.

I am currently working in Melbourne as a Civil Structural Engineer at Beca, an engineering consultancy. I am already using knowledge I learnt during my course to verify the designs of bridges and retaining walls. In the next few months I will be designing bridges as single projects or as part of larger civil projects. It has been rewarding to move into an exciting position following my graduation. I enjoy the culture, people and working environment at Beca."

Computer Systems Engineering

Full title	Bachelor of Computer Systems Engineering
Abbreviated title	BCSE
Duration	4 years
Campus	Clayton

With a computer systems engineering degree from Monash University, your possibilities are limited only by your imagination.

As a computer systems engineer, you will understand all aspects of computing. You will solve problems using the best mix of hardware and software and apply your expertise to a huge range of products and industries.

From large computer systems, desktops and televisions to mobile phones, to medical implants and a bionic eye, to environmental sensors – your career will be varied and forever changing.

What is computer systems engineering?

This fascinating field involves the design, analysis, implementation and application of digital systems and embedded computers.

Computer systems engineers are involved in large computer systems, desktop computers, high definition televisions as well as embedded computers for mobile phones, video games, virtual reality systems, smart domestic appliances and medical implants.

Computer systems engineers also design optimised computing and telecommunications systems.

What do computer systems engineers do?

Computer systems engineers analyse, design, develop and manufacture all kinds of digital products and systems that include both hardware and software. They also plan, design, commission, monitor, optimise and manage complex computer systems.

A computer systems engineer might:

- Develop and design recreational products and consumer electronics.
- Develop database applications, design braking systems for vehicles, implement diagnostic equipment for hospitals and design autopilots for unmanned spacecraft.
- Design and test prototypes.
- Develop microprocessor chips to control computers and other hardware.
- Design servers and switches supporting the internet.
- Use software tools to design integrated circuits.
- Implement process control systems such as navigation, guidance, detection and pollution monitoring instruments.

Careers in computer systems engineering

The career possibilities of a computer systems engineer span a vast range of industries, both locally and internationally. Likely industries include:

- Telecommunications
- Computing
- Manufacturing
- Industrial control
- Automotive.

Other major employers of computer systems engineers include the professional services industry, IT, retail, entertainment, health, transportation, banking, medical, travel and financial services.

Computer systems engineering at Monash University

Level 1
Students complete units that will give them a good grounding in computer systems engineering including digital systems, mathematics for engineering and computer science. Students also have the opportunity to study one elective unit.

Level 2
Computer systems engineering is studied in greater depth with units including signal processing, electromagnetism and telecommunications. Another elective unit is also taken at **level 2**.

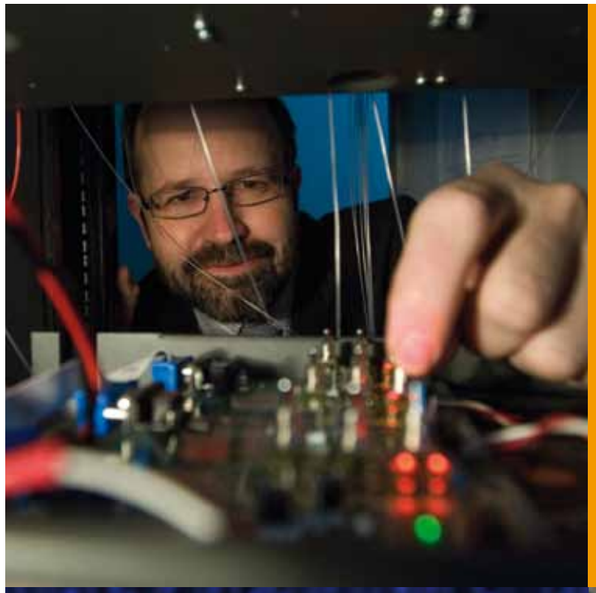
Level 3
Units include wireless and guided EM, engineering design, system engineering and reliability analysis and advanced computer architecture. Students also have the opportunity to study three elective units.

Level 4
Students complete a full year thesis project in addition to the units embedded and real time systems, professional practice and four elective units.

Students can choose electives from a range of units in computer systems engineering, telecommunications and information technology. They learn about all aspects of computers, from hardware design to software systems, and learn to solve applications problems using the best mix of hardware and software options.

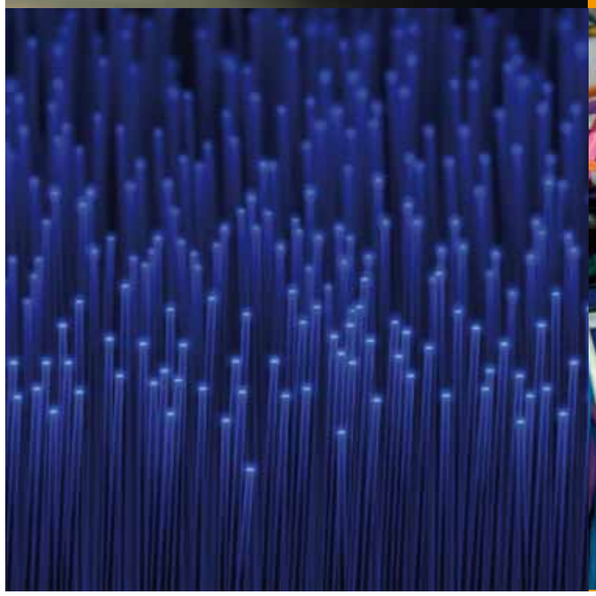
Subjects and course progression

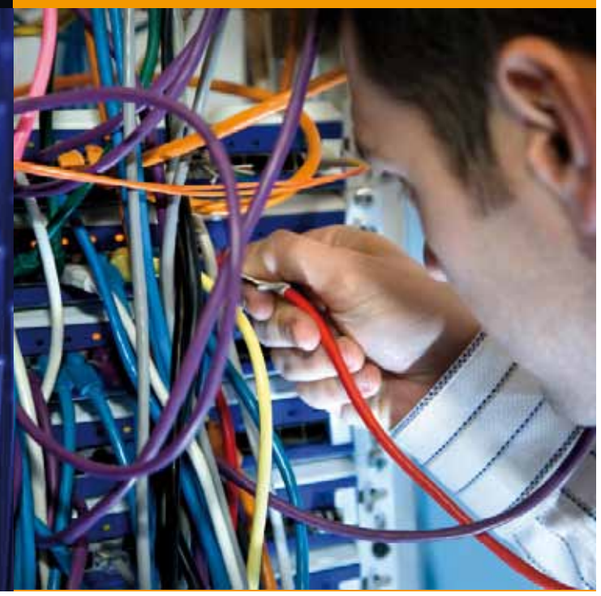
For a full course map visit
www.monash.edu.au/pubs/2011handbooks/courses/2350.html



Computer Systems Engineering

Build the technologies of tomorrow.





Bachelor of Computer Systems Engineering
Upon completing his Bachelor of Computer Systems Engineering, Rory had a range of emotions about leaving university, feeling both excited and sad. He says, "I was sad about no longer seeing my friends every day and no longer being involved in all the clubs and committee's but I was excited to be starting my career".

Rory is currently in the graduate program at ABB, working in the Power and Automation industries. As a graduate engineer Rory has had the opportunity to try various roles, which include: "developing a new business for the company to increasing the operational efficiency of a beer packaging line to upgrading the communication and control systems of power substations in the Pilbara". Working for a global company will also give him the opportunity to work overseas.

This role has allowed Rory to apply the knowledge he gained at Monash to everyday work functions. He says "the technical knowledge I gained during my studies formed the base upon which I have built the further understanding I have gained since starting at ABB". Rory also attributes a lot of his success to the soft skills, including leadership and how to learn, as being vitally important. He says that "grades alone are not enough. Study is only a part of the university experience and you are limiting yourself, and your future opportunity, if you don't take advantage of all university has to offer in terms of social, sporting and leadership opportunities".

Grad Profile

Rory Paltridge

Electrical and Computer Systems Engineering

Full title	Bachelor of Engineering in the field of Electrical and Computer Systems
Abbreviated title	BE
Duration	4 years
Campus	Clayton or Malaysia
Double degrees	Arts, Biomedical Science, Commerce, Law, Science

This diverse and rapidly evolving field patents new technologies and techniques every day.

You might design and develop digital products such as laptops, virtual reality systems or video games. You might develop tools to repair diseased organs such as prosthetic and cochlear implants. Or maybe you will design and program voice recognition systems with improved human intelligence.

Whatever your path, Monash Engineering will give you the hands-on training and theoretical insight you need for an exciting future as an electrical and computer systems engineer.

What is electrical and computer systems engineering?

Electrical and computer systems engineering encompasses biomedical, computer systems, electronics, electrical power engineering, robotics and telecommunications.

Electrical and computer systems engineering spans all aspects of electrical and electronic engineering, including:

- The fundamentals of circuits
- Electronic signals and signal processing
- Digital electronics and systems on a chip
- The design of large scale power and telecommunications systems.

What do electrical and computer systems engineers do?

Electrical and computer systems engineers investigate, plan, design, develop, construct, test, market and maintain a wide range of products and systems.

This branch of engineering covers many specialist roles:

- Automation and control engineers design, build and operate the automatic systems that control our water supply, chemical plants, oil refineries, medical equipment, factories, mines and traffic control systems.
- Biomedical engineers develop new tools to diagnose disease and repair or replace organs such as pacemakers, cochlear implants, medical imaging, prosthetic implants and life support systems.
- Computer systems engineers analyse, design, develop, and manufacture all kinds of digital products. Examples include laptops, personal computers, mainframes, supercomputers, virtual-reality systems, video games, modems, cars, and appliances.
- Electronics engineers design, develop, and manufacture computers, integrated circuits, navigation systems, pollution monitoring instruments and broadcasting equipment.
- Power generation and distribution engineers provide a reliable and safe electricity supply network for our everyday needs. They design power systems for aircraft and spacecraft and design and build solar panels and wind-powered generators.
- Robotics engineers design and program systems that perform functions associated with human intelligence such as voice recognition.
- Telecommunications, communications and signal processing engineers design systems and equipment to make information transmission systems faster, more accurate, more reliable and efficient.

Careers in electrical and computer systems engineering

As an electrical and computer systems engineer you could work locally or internationally in a wide range of industries including:

- Power generation
- Automation systems
- Robotics
- Water and energy.
- Industrial and power electronics
- Computer programming
- Health care

Many Monash graduates also work in large public and private telecommunications, manufacturing and electrical power companies. Others work for defence and intelligence organisations.

You will also be prepared for careers in other industries such as online ticketing, banking and finance - or any organisation that needs to create, store, encode and transmit data or manage complex systems.

Electrical and Computer Systems Engineering

Electrical and computer systems engineers turn ideas into reality.

Electrical and computer systems engineering at Monash University

Level 1
Students complete the Bachelor of Engineering common first year - see page 11.

Level 2
Students undertake core electrical and computer systems engineering units including signal processing, electromagnetism and telecommunications.

Level 3
Studies are taken to a more professional level with units in systems engineering and reliability analysis, optimisation estimation and numerical methods and engineering design.

Electives can be chosen from a range of fields including biomedical engineering, computer systems, robotics, power engineering, electronics, electro-magnetics, telecommunications, and control systems.

Level 4
Students undertake a full year thesis project, professional practice and five elective units.

Subjects and course progression

For a full course map visit
www.monash.edu.au/pubs/2011handbooks/courses/0032.html

Grad Profile

Elizabeth Anderson

Bachelor of Engineering in the field of Electrical and Computer Systems Engineering

After four years of study Elizabeth graduated with a Bachelor of Engineering (in the field electrical and computer systems). Today she is an electrical and instrumentation engineer in a petrochemical company.

Elizabeth describes her time at Monash University as a "home away from home and felt a mixture of happiness and sadness upon graduating."

Elizabeth's role includes "co-ordinating the function testing of safety-critical devices across all Victorian sites". She also provides the sites with electrical engineering support. This job is not what she expected to do upon graduating but she has found that she is able to apply the skills she learnt at university to her role in an everyday capacity.

Some of the skills learnt at Monash that have been most useful include: problem solving, autonomous working and learning, attention to detail and communication.

To students beginning their degree Elizabeth advises that they should seek to work hard and play hard. They should have a "good balance between hard work and enjoyable extra-curricular activities. It is worth putting in the effort to learn and absorb as much as you can".

Environmental Engineering

Full title	Bachelor of Environmental Engineering
Abbreviated title	BEnvEng
Duration	4 years
Campus	Clayton
Double Degrees	Science

Few branches of engineering have such a profound impact on our health and quality of life as environmental engineering.

All Monash engineering degrees consider sustainability, but as an environmental engineering graduate, it will be your priority.

Environmental problems exist in all countries and industries so your career opportunities are broad and far reaching. Whether it is climate change, air pollution, water supply or waste management, your passion can now become your livelihood.

Demand is on the rise for engineering graduates with environmental expertise. This is your chance to stand out from the crowd – and make a difference for generations to come.

What is environmental engineering?

Environmental engineering involves the implementation and management of solutions and programs that are in harmony with the principles of sustainable development.

It involves reducing energy and resource use and minimising waste, while providing the community with the development opportunities it needs to grow.

Environmental engineering encompasses water and air pollution control, recycling, water supply, waste disposal, land management, transport and the built environment, process engineering and public health issues.

What do environmental engineers do?

By minimising environmental problems through sustainable design and development, environmental engineers make a genuine difference to our world. They reduce the impact of human activity and help protect and restore our natural world.

Environmental engineers also help the community and industry improve their understanding of sustainable development.
They work closely with various professionals including ecologists, regulators, lawyers, economists and other engineers.

An environmental engineer might:

- Evaluate, monitor and minimise the environmental impact of engineering projects.
- Evaluate the risks of climate change for a project or business and recommend solutions.
- Develop and implement cleaner production technologies to reduce industrial pollution.
- Ensure clean water supplies are provided and distributed to a community.
- Rehabilitate or develop landfill sites.
- Develop environmentally sound building and transport systems.

Careers in environmental engineering

Environmental problems exist in all countries and industries so your opportunities are broad and far reaching.

You might work in air pollution control, water supply, land management, impact assessment, hazardous waste management, energy production, storm water and wastewater management, environmental management systems - and so much more. The list is almost endless.

Organisations employing environmental engineers include:

- Engineering consulting firms
- Industries that need cleaner production systems
- Private and municipal agencies that supply drinking water and treat wastewater
- Companies treating and disposing of carbon emissions and hazardous waste
- Government agencies monitoring and regulating environmental issues
- Universities that teach and conduct sustainability research
- International agencies that aid developing nations.

Environmental engineering at Monash University

Level 1
Offers a broad base of science, mathematics, introductory engineering and environmental units to form the basis of a multidisciplinary engineering education.

Level 2
Increases the engineering content, a mixture of core engineering units and more environmentally directed units. Mathematics continues and environmental policy is introduced to integrate the content gained from other units.

Level 3
Students choose one major or two minor elective streams from water and land management, environmental process engineering, and transport and the built environment. They are introduced to more environmentally focussed engineering units, along with advanced units that examine environmental impact and management systems, energy resources and the air environment.

Level 4
Provides applications for earlier studies by way of substantial engineering design and project work, complemented by advanced and interdisciplinary elective units from environmental law, economics and policy areas.

Environmental Engineering

Now you can make a genuine difference to our world.

Subjects and course progression

For a full course map visit
www.monash.edu.au/pubs/2011handbooks/courses/1253.html

Grad Profile

Lachlan Smith

Bachelor of Environmental Engineering

After studying full time for four years, Lachie Smith was glad to finally put his study into practice. Lachie focused on environmental engineering specialising in land and water management. While he always thought he would follow the civil side of his engineering degree, a lucky break in third year meant he took a different path. Lachie was offered an internship with Golder Associates; a Canadian based Geoenvironmental Engineering Company.

Today Lachie works as a Project Engineer for Golder Associates. His role is Site Manager for the environmental remediation and assessment of an oil refinery in Melbourne. Lachie explains his role as "managing site logistics, site operations and providing support to the Project Operations Manager".

Lachie is able to put his knowledge gained at Monash to use in his current role. He says that his "key skills from Monash are problem and data analysis, project management, solution development and critical thinking. These are all skills I use every day to ensure that the work that I am involved in delivers outcomes that are of the highest standard".

To future students Lachie advises them to "hang in there and work hard on the basics for the first few years... If you do this work carefully and with a lot of thought and extra effort, you will soon find yourself with the skills needed to contribute to efficient and effective engineering solutions which are what employers and clients want".

Industrial (Product) Design and Engineering

Full title	Bachelor of Engineering and Bachelor of Design (Industrial Design)
Abbreviated title	BE/BDes(IndDes)
Duration	5 years
Campus	Clayton and Caulfield
Double degrees	Combining Mechanical Engineering with Industrial Design

As a product designer engineer, you will design and develop consumer products with a focus on aesthetics, functionality and ergonomics.

You could design cars, hi-tech appliances, furniture, tools, industrial equipment, prosthetics or robots.

Whatever your speciality, your goal is the same; to make products stand out and deliver a unique brand experience.

But your priority will stretch beyond products that look and feel good. It is your understanding of the manufacturing process, materials and marketing – namely your engineering skills – that will give you a distinct advantage throughout your career.

What is industrial product design and engineering?

Industrial product design and engineering focuses on hi-tech consumer product design. The double degree qualification integrates the creative skills of engineering (inventiveness and project management) with those of industrial design – namely aesthetics, manufacturing technologies and graphics.

A professional with the combination of these disciplines is often called a product design engineer.

The product design engineer boasts a wide range of practical, creative and problem solving skills, making them ideal managers of innovative and diverse organisations.

What do industrial product design engineers do?

Cars, mobile phones, lighting, furniture, medical equipment and hair dryers all need good design. So they all need the services of a product design engineer.

Some place a greater emphasis on the engineering aspects, with a focus on noise and vibration control, the exploitation of high performance composite materials or improved energy use in a new product or system.

Others may concentrate on their industrial design strengths and develop architectural products, control interfaces for complex machinery, corporate image concepts or plastics and other mass-production technologies.

Careers in industrial product design and engineering

As a product design engineer, you could apply your skills to a range of specialist areas such as display design, consumer product design, packaging design and ergonomics.

You will also have the opportunity to choose from a vast range of industries including:

- Aerospace
- Manufacturing
- Transportation
- Petrochemical
- Robotics industries
- Electronic.

The strength of the Monash degree in industrial design leads many graduates to the automotive industry – with several students having won international prizes for motor vehicle design.

Other growing service sectors include communications, consulting and entertainment.

Industrial product design and engineering at Monash University

Level 1
Students complete foundation units in engineering including mathematics for engineering, computing for engineers and engineering dynamics, in addition to two art and design units.

Level 2
Students complete mechanical engineering units in addition to art and design units, including model making and workshop practice and product drawing.

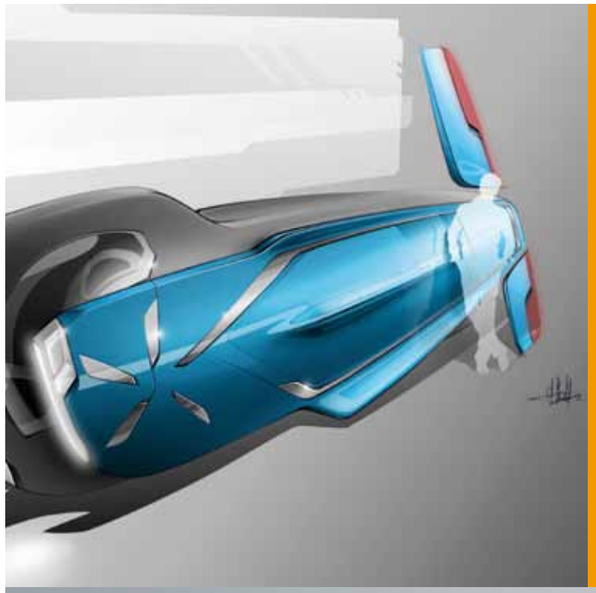
Level 3
Mechanical engineering units are taken to a professional level, and include fluid mechanics, thermodynamics and electromechanics.

Level 4
Mechanical engineering units including fluid mechanics and solid mechanics are undertaken in addition to critical issues in design.

Level 5
Final year students undertake a full year independent project in mechanical engineering in their area of interest. They also complete further units from art and design and mechanical engineering.

Subjects and course progression

For a full course map visit
www.monash.edu.au/pubs/2011handbooks/courses/2965.html



Industrial (Product) Design and Engineering

A robust combination that will give you a distinct advantage.

Grad Profile

Nedzad Mujcinovic

Bachelor of Engineering in the field of Mechanical Engineering and Bachelor of Design (Industrial Design)

Nedzad Mujcinovic graduated in 2010 with a Bachelor of Engineering in the field of mechanical engineering and Bachelor of Design (Industrial Design) with Honours.

"There was certainly a sense of accomplishment. However, there was also a bit of sadness for leaving university family and friends behind".

Nedzad has found that he is able to apply his Monash Engineering education to his professional career. He says that "every little bit of my education at Monash University gets used in one form or another".

Since graduating, Nedzad has moved to Germany to work with the Opel Design team. He is currently working as a creative car designer and is responsible for the design and development of vehicles' look, feel and function.

"A car is just about the only product that everyone has an opinion on and a feeling towards. I hope that through car design I can genuinely contribute towards improving people's lives by provoking positive feelings through design and conserving resources through efficiency".

Having achieved his own dream, Nedzad encourages other students to "have dreams and believe in them. Utilise your University education and all resources available to you to achieve your dreams. The key in achieving them is 'you'".

Materials Engineering

Full title	Bachelor of Engineering in the field of Materials Engineering
Abbreviated title	BE
Duration	4 years
Campus	Clayton
Double degrees	Arts, Biomedical Science, Commerce, Law, Science

Materials have never changed as fast as they are changing now. Nor have they been more critical to our future.

When you understand what materials do and why they do it, you are well on your way to inventing new materials and improving existing ones.

Whether it is a lighter and stronger jet engine, a biodegradable tissue scaffold to grow organs from stem cells or new types of solar cells and batteries - the structure, properties and processing of materials are crucial to the final product.

Materials engineering is truly interdisciplinary. It involves physics, mathematics, biology and chemistry – culminating in a ground breaking field of research and a thriving job market for aspiring engineers.

What is materials engineering?

Materials engineering is all about making new materials and improving existing ones. It is about making things stronger, lighter and more functional, sustainable and cost-effective.

Materials engineering plays a significant role in just about every industry you can imagine. Every single product contains at least one material, whether it is mechanical, thermal, electrical, optical, electronic or biological.

What do materials engineers do?

Materials engineers cover everything from the breathtakingly big, such as the study of corroding bridges, to the unbelievably microscopic, like the atom. They change the properties or behaviours of materials to make them more useful and include them in new applications.

Their work covers everything from the thermal protection of the space shuttle and high-tech artificial hip and cochlear implants to nanoparticles that seek and destroy cancer. It also covers advanced battery systems for green electric cars, artificial hearts and laptop computers.

Some accomplishments and challenges for materials engineers include:

- Improved thrust-to-weight ratios for aircraft and cars: developing better high temperature engine alloys and lighter, stronger materials.
- Research into exciting new technologies: developing fibre optics thinner than a human hair to support much higher amounts of information.
- High-tech prosthetic limbs: developing ultra-light weight titanium alloys that are biocompatible and do not corrode.
- Shape-memory alloys (or 'metals with a memory'): inventing anti-scald devices for showers, eyeglass frames that snap back into their original shape, and stents that can be used to clear veins of blood clots and obstructions.
- Superplasticity: creating materials that can be stretched as much as 1000% using little force, offering exciting possibilities for unique fabrication.
- Efficient recycling techniques to conserve both materials and energy: emphasise environmental protection by improving materials recycling technologies to reduce harmful wastes.

Careers in materials engineering

As a materials engineer, your career prospects are many and varied. Job opportunities continue to outstrip supply.

The ability to actually engineer – or create – materials to meet specific needs is only just being realised. Improved processing and equipment mean the possibilities are endless.

The expertise of materials engineers is needed in many areas, including:

- Recycling and energy conservation
- New biomaterials to image disease and heal the body
- Lightweight metal alloys in cars to conserve energy
- Materials for energy storage such as fuel cells
- Functional nanomaterials.

Materials engineers also work as metallurgists, plastics engineers, ceramists, adhesive scientists, process and quality control engineers and corrosion or fracture engineers.

They work in a range of industrial activities, including manufacturing, processing and recycling, and select and design materials for:

- Tissue engineering and drug delivery
- Solar energy and battery devices
- Biomedical implants and ophthalmic devices
- Electronic and magnetic devices
- Optical and opto-electronic components.

Materials Engineering

Materials engineers are achieving the impossible.

Materials engineering at Monash University

Level 1
Students complete the Bachelor of Engineering common first year - see page 11.

Level 2
Students are introduced to fundamental aspects of the nanostructure of materials and their relationship to both engineering properties and functional properties (optical, electronic, magnetic), and receive further training in mathematics and other essential skills.

Level 3 and 4
Units involve aspects of both materials science and materials engineering and wide treatment is given to the properties of metallic alloys, plastics, ceramics, nanomaterials, biomaterials, corrosion and composites.

Level 4 only
Students complete a thesis project. Attention is given to special topics such as biomaterials, modelling, recycling, materials design and selection, optimisation of properties, the performance of materials in service and mechanical behaviour including shaping and fabrication.

Subjects and Course Progression

For a full course map visit
www.monash.edu.au/pubs/2011handbooks/courses/0032.html

Mechanical Engineering

Full title	Bachelor of Engineering in the field of Mechanical Engineering
Abbreviated title	BE
Duration	4 years
Campus	Clayton or Malaysia
Double degrees	Arts, Biomedical Science, Commerce, Industrial Design, Law, Science

Almost every product or service you see in our world has in some way been influenced by a mechanical engineer.

As a mechanical engineer, you might design advanced materials for supersonic and hypersonic space travel. Or you might design robots and automatic control systems. Or perhaps you will work alongside medical professionals to investigate the human body and design aids and instruments for medicine.

Discover the countless growth sectors that you can participate in as a future mechanical engineer.

What is mechanical engineering?

Mechanical engineering is about turning energy into motion and power. It covers the generation, conversion, transmission and use of mechanical and thermal energy, and includes the design, construction and operation of devices and systems.

Mechanical engineering is concerned with the behaviour of solids, liquids and gases when they are heated and cooled and when forces are applied.

What do mechanical engineers do?

Mechanical engineers work on power plants, renewable energy systems, electrical generators, robots, propulsion systems, computer systems, climate control systems, engine cooling, respiratory and air conditioning systems, aircraft engines and cars.

New areas of investigation include prosthetic limb and joint design, noise and vibration restriction, high performance composite materials development, flexible manufacturing, mechanical design automation and industrial pollution control.

A mechanical engineer may:

- Design advanced materials and structures to meet the demands of supersonic and hypersonic space travel.
- Design electrical power plants with reactors, heat exchangers, an appropriate piping network, and other specialised components for the provision of nuclear energy.
- Design robots and automatic control systems.
- Work alongside medical professionals to design aids and instruments for medicine.
- Work with trainers, coaches and athletes to design advanced sporting equipment.
- Research elements of mechanical and thermal design for modern computers and other electronic equipment.

Careers in mechanical engineering

As a mechanical engineer you might pursue one or more of these specialist areas:

- Research and development
- Product and process design
- Technical sales and support
- Manufacturing
- Field and test engineering
- Project management
- Systems design
- Power plant operations and quality control.

Industries employing mechanical engineers include:

- Petrochemical
- Manufacturing
- Transportation
- Automotive
- Aerospace
- Electronic
- Mining
- Robotics

Other growth industries include communications, banking, public utilities, consulting practices and the entertainment industry.

Mechanical engineering at Monash University

Level 1
Students complete the Bachelor of Engineering common first year - see page 11.

Level 2
Units focus on the practice of engineering and on the engineering sciences.

Level 3
Units on engineering practice and mechanical engineering sciences are taken to a professional level, and include fluid mechanics, engineering design, dynamics, thermodynamics and solid mechanics.

Level 4
Final year students undertake a full year independent project in their area of interest.

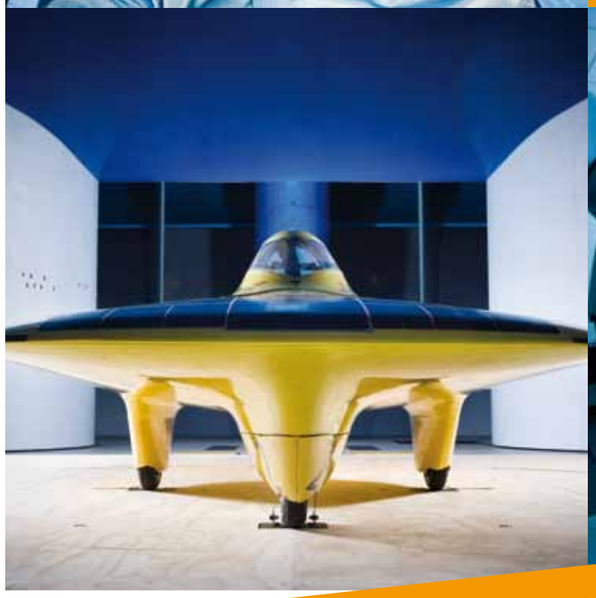
They also select four electives offering further scope for specialisation, for example aerodynamics, design or mechatronics.

Subjects and course progression

For a full course map visit
www.monash.edu.au/pubs/2011handbooks/courses/0032.html

Mechanical Engineering

Mechanical engineers design and develop everything from door locks to space shuttles.



Grad Profile

Tim Leach

Bachelor of Commerce and Bachelor of Engineering in the field of Mechanical Engineering

Tim Leach found studying a Bachelor of Commerce and Bachelor of Engineering in the field of mechanical engineering at Monash provided him with an all-encompassing background to work as a Management Consultant with the Boston Consulting Group (BCG).

"I felt the Monash course was one of the most respected engineering courses in the country with a particularly innovative and hands on approach. The common first year was very important to me and the breadth of specialisations was attractive" said Tim.

Tim participated in two exchanges while at Monash with Boston College, USA and Université Lyon III, France. Tim was also involved with various student societies including: French Club, Ski Club, Engineers without Borders, and was the 2009 president of the Monash Engineering Students' Society.

Working as an Associate Consultant with BCG, Tim has the opportunity to work with leading organisations in a diverse range of sectors including, consumer goods, energy, financial services, health care and the public sector. He tackles a broad range of business issues including corporate development, IT, marketing and sales, global advantage and strategy.

"I love my role because it is incredibly challenging with a very steep learning curve. The issues we deal with are often complex but very stimulating. I am also fortunate to work with some of Australia's best business minds which is enriching and very inspiring. I love the responsibility I am given even as a young consultant".

"Studying an Engineering and Commerce double degree provided me with a fantastic background to work as a management consultant. The technical skills I acquired from my engineering studies combined with a good understanding of business from my commerce studies, provided me with a very powerful toolkit. As a result of my studies at Monash I am used to facing problems I do not initially know how to solve, but I know I have the general skills, resilience and confidence to ultimately find a way to solve them."

Mechatronics Engineering

Full title	Bachelor of Mechatronics Engineering	Bachelor of Engineering in the field of Mechatronics Engineering	
Abbreviated title	BMechatronicsEng	Abbreviated title	BE
Duration	4 years	Duration	4 years
Campus	Clayton	Campus	Malaysia
Double degrees	Arts, Commerce, Science		

Mechatronics is at the cutting-edge of creating smarter products, devices and processes.

As a mechatronics engineer you will improve the performance, features and functionality of everyday products like cars, DVD players, dishwashers, and microwave ovens.

Or you might create completely new products such as robotic lawn mowers and floor cleaners.

Demand for professionals in this progressive field exceeds supply.

What is mechatronics engineering?

Mechatronics engineering combines mechanical engineering, computing and electronics to create functional, smart products.

Every day you come into contact with products of mechatronics engineering. They include cars, Blu-ray and DVD players, microwave ovens, dishwashers and washing machines.

The processes and production lines used to make these and many other products are also mechatronic in nature.

What do mechatronics engineers do?

Mechatronics engineers design new products or improve existing devices by adding mechatronic elements. They also design, construct and run factory production lines and processes.

Mechatronics engineers are responsible for devices such as:

- Antiskid braking systems
- Clothes dryers that adjust their operation based on the dampness of the clothes
- Washing machines that can sense the amount of dirt in the washing load and vary water and electricity to suit
- Chemical sensors in microwave ovens that can monitor the smell of food to ensure it is cooked perfectly.

Careers in mechatronics engineering

You will be equipped with the knowledge and skills to design, build and operate the intelligent products and systems of today and tomorrow.

The applications for mechatronics engineering are virtually unlimited and the need for professionals in this progressive field is increasing. You will be in high demand.

There are many research opportunities for mechatronics engineers in nanotechnology, robotics, by-wire technologies for motor vehicles, bioengineering and many other developing fields.

Mechatronics engineering at Monash University

Level 1
The first year of the mechatronics engineering program is similar to the common first year of the Bachelor of Engineering (see page 11), including engineering dynamics, electrical systems, engineering structures and engineering materials.

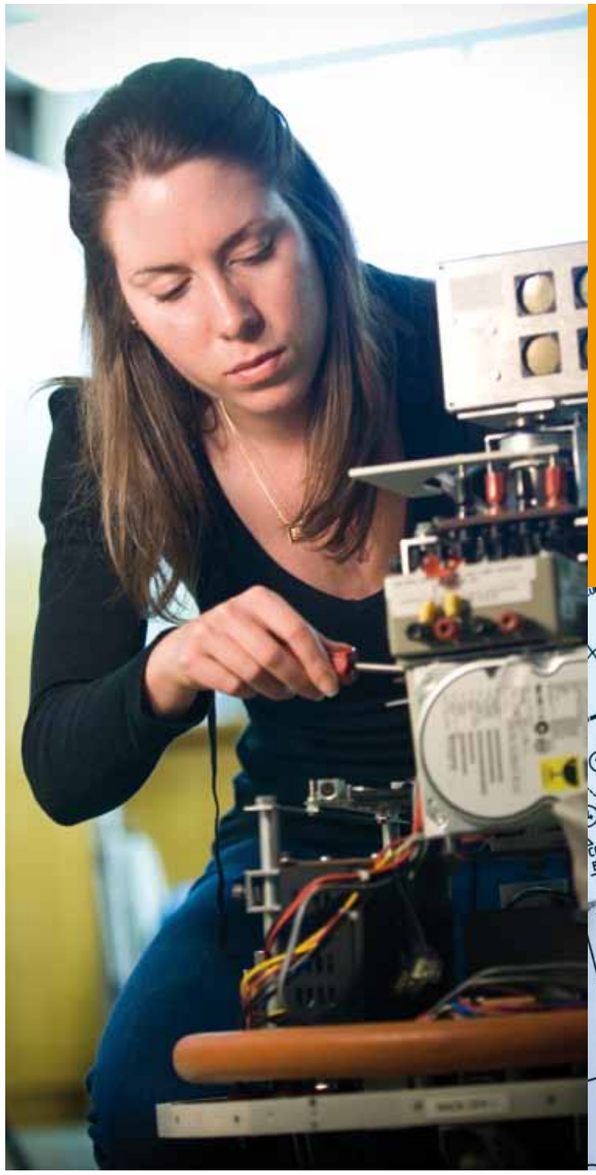
Level 2
Units focus on providing fundamental knowledge across the wide range of disciplines that form the basis of mechatronics including thermodynamics, fluid mechanics, electronics, mechanics programming and digital electronics.

Level 3
Further fundamental knowledge, plus units that take mechatronics to a professional level, including mechatronics and manufacturing, and power electronics and drives.

Level 4
Students complete a full year thesis project in addition to units in professional practice, robotics, digital communications and elective units.

Subjects and course progression

For a full course map visit
www.monash.edu.au/pubs/2011handbooks/courses/3280.html



Mechatronics Engineering

Will you create the intelligent products of tomorrow?

Grad Profile

Justin Sorbello

Bachelor of Mechatronics Engineering

When choosing Monash as a place to study Mechatronics Engineering, Justin believes the key factors in his decision were the strength of the degree, the staff, facilities, and opportunities. He was also impressed with the "student culture at Monash which was very active, lively and supportive".

When Justin started work he was excited about starting the journey as a professional engineer, though sad he would no longer be seeing his Monash friends every day. Today he is working as a "Technical Consulting Engineer in the field of ICT and control systems in particular". His role is to "provide technical designs, documentation and contract or construction management along with some project management, for a variety of projects in the ICT field, for a number of different clients." His role also includes writing proposals to bid on new projects.

While Justin believes that work experience is essential to the engineering field he says that "the studying of systems analysis and the analytic methodologies coupled with the solid theoretical basis the course provided", is essential. "The skills learnt working with and managing groups and teams through projects at Monash are useful everyday as I work with a variety of teams."

Justin encourages future students to "take opportunities out of your comfort zone. University is your chance to experiment and try new ideas, concepts and fields, so grasp them."

Pharmaceutical Science and Engineering

Full title	Bachelor of Engineering and Bachelor of Pharmaceutical Science
Abbreviated title	BE/BPharmSc
Duration	5 years
Campus	Clayton and Parkville
Double degrees	Combining Chemical Engineering with Pharmaceutical Science

This double degree combination can open doors to a range of exciting careers creating sophisticated pharmaceutical products.

Almost everything you see in a pharmacy has been developed and manufactured by people skilled in pharmaceutical science, chemical engineering or both.

You might be involved in developing advanced products such as eye drops that do not sting, or improved drugs and vaccines to target chronic diseases such as malaria, HIV and diabetes.

Beyond the pharmaceutical industry, you will also be equipped to develop cosmetics, food, and a whole host of other consumer products.

Discover the exciting world of engineering and pharmaceutical science.

What is pharmaceutical science and engineering?

Pharmaceutical engineering combines chemical engineering and pharmaceutical science to develop and manufacture formulated products such as pharmaceuticals, food, cosmetics and consumer goods.

Chemical engineers can design, run and troubleshoot production facilities, but their training typically excludes the skills to develop pharmaceutical products. Similarly, pharmaceutical science graduates can invent and test new products, but they lack the know-how to manage the product process beyond the laboratory stage.

Pharmaceutical engineering is a growing interdisciplinary field that breeds professionals capable of covering the full spectrum of the pharmaceutical product design and development process.

What do pharmaceutical scientists and engineers do?

Pharmaceutical scientists and engineers take products from the development stage right through to industrial production. They work in all aspects of the design and development process, from experimenting with innovative formulations to manufacturing commercialised products.

A pharmaceutical engineer might:

- Design, develop and improve industrial processes and equipment for large scale chemical and pharmaceutical manufacturing.
- Plan and test methods of manufacturing.
- Develop methods for the treatment of by-products.
- Devise production processes that are safe, efficient, profitable and environmentally sound.
- Research naturally occurring chemical reactions and copy these processes for society's benefit.
- Develop and implement cleaner production technologies.
- Design, develop and use new materials.

Careers in pharmaceutical science and engineering

Industry worldwide needs people with skills in both pharmaceutical science and engineering.

There will always be a demand for pharmaceutical products and therefore pharmaceutical engineers to produce them.

Pharmaceutical engineers work in an enormous range of manufacturing industries, research and development laboratories and production plants. Many go on to become managers and consultants that contribute their expertise to research and testing, design and policy.

Pharmaceutical science and engineering at Monash University

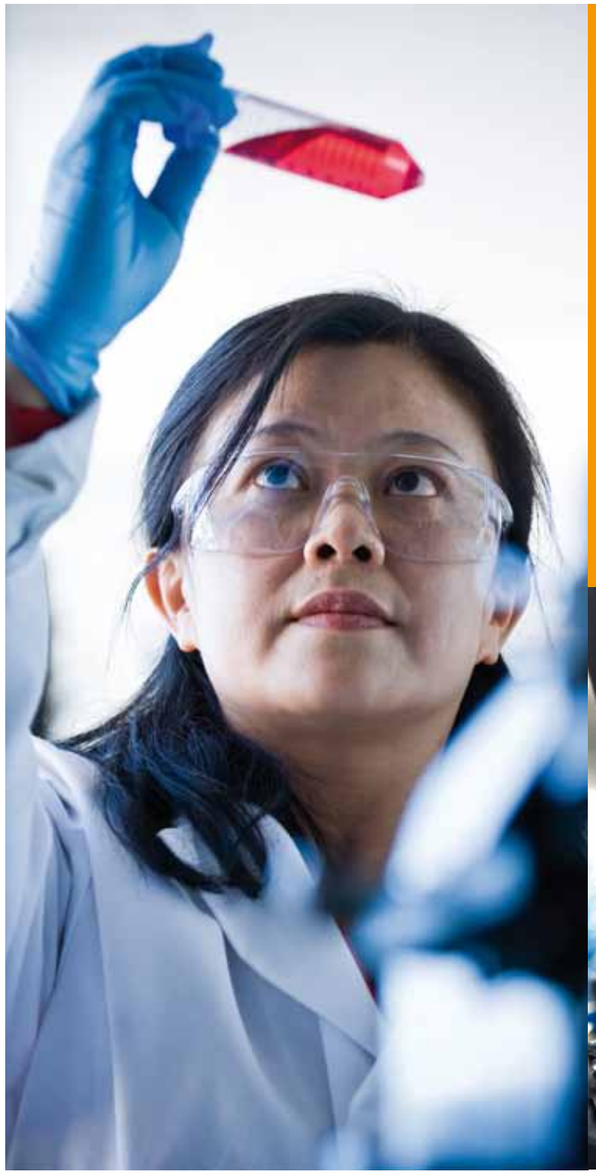
Level 1 - Parkville campus
Students complete the standard first year of the Bachelor of Pharmaceutical Science.

Level 2 - Clayton campus
Students undertake a compressed version of the common first year in engineering and selected units from the second year chemical engineering program including material and energy transfer, heat and mass transfer and engineering thermodynamics.

Level 3 - Parkville campus
Students complete the core second year units of the pharmaceutical science program and selected third year units in formulation chemistry.

Level 4 - Clayton campus
Higher level chemical engineering units, including those from the biotechnology stream are completed.

Level 5 - Clayton campus
Students undertake a thesis project in formulation or chemical engineering or both. Chemical engineering units: engineering in society, particle technology, transport and biochemical engineering, are studied.



Pharmaceutical Science and Engineering

Our world needs more people with skills in both pharmaceutical science and engineering.

Subjects and course progression

For a full course map visit
www.monash.edu.au/pubs/2011handbooks/courses/3288.html

Bachelor of Engineering in the field of Chemical Engineering and Bachelor of Pharmaceutical Science

Grad Profile

Jane Espie

After five years of study Jane felt very proud and relieved upon graduating from Bachelor of Engineering in the filed of chemical engineering (honours) and Bachelor of Pharmaceutical Science. While she was excited for her future and the opportunities that it offered she was also sad to leave behind her university days. Jane says "the chemical engineering faculty had become a second family to me over the years."

Jane also participated in the Study Abroad program during her time at Monash. She spent a semester in North Carolina, USA where she met great people and enjoyed some amazing experiences.

Today Jane is working as a Process Engineer at Kellogg Brown & Root (KBR). She is part of the Water and Environment group working predominantly on the design of water and wastewater treatment plants. She is hoping her role will continue to develop a more sustainable way of living as water is becoming an increasingly more important resource. "By designing and upgrading plants that treat our wastewater for reuse we can ensure none is wasted."

To up and coming engineering students Jane advises them to "take time to enjoy the social side of uni. Technical studies are important but the life skills that you develop when out of the lecture room end up being just as, if not more, important in the workforce". She also encourages students to "get to know your class mates as they are a great support network."

Admissions

Single degrees

	Course	Campus	2011 CSP clearly-in score	Common first year	Course length (full time)	Prerequisites	
						VCE Units 3 and 4	Minimum study score required
Single Degrees	Engineering After completing the common first year, students choose one of the following disciplines[1]: • Chemical • Civil • Electrical and Computer Systems • Materials • Mechanical	Clayton	91.20	Yes	4 years	English (ESL) or any other English + Mathematical Methods (CAS) + Chemistry or Physics	30 25 25 25 25
	Aerospace Engineering	Clayton	91.75	No	4 years		
	Civil and Environmental Engineering	Gippsland	70.45				
	Environmental Engineering	Clayton	N/A[2]				
	Mechatronics Engineering	Clayton	91.05				
	Computer Systems Engineering	Clayton	N/A[2]	No	4 years	English (ESL) or any other English + Mathematical Methods (CAS) + Physics + Specialist Mathematics	30 25 25 25 25

Bachelor of Engineering at Sunway campus Malaysia

	Course	Campus	Entry score	Common first year	Course length (full time)
Single Degrees	Engineering After completing the common first year, students may choose one of the following disciplines[1]: • Chemical • Electrical and Computer Systems • Mechanical • Mechatronics	Malaysia	DA*	Yes	4 years

*DA - Direct application to Malaysia campus. See www.monash.edu.my for further information.

1. Selection into disciplines subject to quotas and academic performance during common first year.

2. The VTAC Guide does not report clearly-in scores for programs with an intake of less than 10 students because the score may not be an accurate indication of the academic threshold for the program. In determining their prospects, students are advised to consider the clearly-in for similar programs with larger cohorts, as these provide a better indication of the target range for determining selection.

3. Available with the following disciplines: chemical, civil, electrical and computer systems, materials or mechanical engineering.

4. Students can normally expect to complete the course in five years. This is achieved by undertaking one additional unit above the four standard units (24 credit points) per semester, twice, in the later stages of the degree.

5. Individual offer based on folio, interview and ATAR. As a general rule students will require a similar academic standard to the Bachelor of Engineering to be considered for the program. This double degree is only available with the discipline of mechanical engineering.

6. Students can normally expect to complete the course in six years. This is achieved by undertaking one additional unit above the four standard units (24 credit points) per semester, twice, in the later stages of the degree.

Double degrees

	Course	Campus	2011 CSP clearly-in score	Common first year	Course length (full time)	Prerequisites	
						VCE Units 3 and 4	Minimum study score required
Arts	Aerospace Engineering/Arts[4] Engineering/Arts[4] Mechatronics Engineering/Arts[4]	Clayton	N/A[2] 92.00 92.05	No Yes[3] No	5 years	English (ESL) or any other English + Mathematical Methods (CAS) + Chemistry or Physics	30 25 25 25 25
Biomedical Science	Biomedical Science/Engineering[4]	Clayton	93.05	No[3]	5 years	English (ESL) or any other English + Chemistry + Mathematical Methods (CAS) + Physics or Specialist Mathematics	35 30 25 25 25 25
Commerce	Commerce/Engineering[4]	Clayton	94.00	Yes[3]	5 years	English (ESL) or any other English + Mathematical Methods (CAS) or Specialist Mathematics + Chemistry or Physics	30 25 25 25 25 25
	Commerce/Aerospace Engineering[4] Commerce/Mechatronics Engineering[4]	Clayton	93.80 N/A[2]	No	5 years	English (ESL) or any other English + Mathematical Methods (CAS) + Chemistry or Physics	30 25 25 25 25
	Civil and Environmental Engineering/ Business and Commerce[4]	Gippsland	N/A[2]	No	5 years	English (ESL) or any other English + Mathematical Methods (CAS) or Specialist Mathematics + Chemistry + Physics	30 25 25 25 25 25
Industrial Design	Engineering/Design (Industrial Design)[4]	Clayton and Caulfield	N/A[5]	No	5 years	English (ESL) or any other English + Mathematical Methods (CAS) + Chemistry or Physics	30 25 25 25 25
Law	Aerospace Engineering/Laws[6] Engineering/Laws[6]	Clayton	N/A[2] 98.05	No Yes[3]	6 years	English (ESL) or any other English + Mathematical Methods (CAS) + Chemistry or Physics	35 30 25 25 25
Pharmaceutical Science	Engineering/Pharmaceutical Science[4]	Clayton and Parkville	92.30	No	5 years	English (ESL) or any other English + Mathematical Methods (CAS) + Chemistry + Biology or Physics or Specialist Mathematics	35 30 30 30 30 30
Science	Aerospace Engineering/Science Science/Engineering[3] Mechatronics Engineering/Science[4] Environmental Engineering/Science	Clayton	92.00 92.10 92.00 91.85	No	5 years	English (ESL) or any other English + Mathematical Methods (CAS) + Chemistry or Physics	30 25 25 25 25

International admissions for the Bachelor of Engineering at Clayton and Malaysia

Qualification	Requirements *see prerequisite subjects	Calculation of scores
Australian Year 12	ATAR 86.20	Equivalent ATAR.
Monash University Foundation Year (MUFY)	305	Based on the best eight units made up from Part A & B of the same subject sequence for 3 areas of study plus two from the same subject sequence or different subject sequence. English requirement met by successful completion of English A and English B with an average of at least 65%.
University of Melbourne Trinity (FY)	80%	Based on the average of the best four subjects. English met by minimum of 65% in English or English for Academic Purposes.
RMIT & La Trobe (FY)	85%	Average of percentage grades for all subjects completed, including fails. English entry requirement met by minimum of 65% in English.
South Australian Certificate of Education (SACE)	ATAR 86.20	Equivalent ATAR.
South Australian Matriculation (SAM)	ATAR 86.20	Equivalent ATAR.
International Baccalaureate (IB) Diploma	30	Based on total score achieved for all subjects as reflected on transcript. Evidence of successful completion of the diploma is required. English met by minimum of 4 in English (SL) or 3 in English (HL).
GCE A Level	10 points*	Based on the score of a maximum of three A Level subjects taken in one academic year. (An AS level subject is considered half an A level). Scores calculated as follows for A Levels: A = 5, B = 4, C = 3, D = 2, E = 1. Scores calculated for AS levels: A = 2.5, B = 2, C = 1.5, D = 1, E = 0.5. AS subjects continued to A levels cannot be included in the calculation. English met by a minimum of C in the GSCE (O levels).
Hong Kong Diploma of Secondary Education	21#	Based on total of best five subjects (Category A and C only - Category B not to be used in 1, **Level 2** = 2, **Level 3** = 3, Level 4 = 4, Level 5 = 5. A = 5, B = 4, C = 3, D = 2, E = 1. English met by minimum of **Level 4** in Senior Secondary 3 English.
Sri Lanka A Level	12 points*	Total score of a maximum of three A Level subjects taken in one year. A = 5, B = 4, C = 3, D = 2, E = S=1. English entry requirement needs to be satisfied in addition – eg, by providing IELTS or TOEFL result.
STPM Malaysia	9.33 points*	Based on the total of three Subject Grade Point (SGP) scores of three academic subjects (excluding the local language). English must be met in addition, e.g. by providing an IELTS or TOEFL result, or by a minimum of C in O Level English.
UEC (Malaysia)	3.00#	Average of the best five subjects excluding English, Chinese and Bahasa Malaysia. If average ends in decimal point, the score should be rounded down, eg. an average of 4.9 should be rounded down to 4.Scores calculated as follows: A1 =1, A2 = 2, B3 = 3, B4 = 4, B5 = 5, B6 = 6, C7 = 7, C8 = 8. English must be met in addition, e.g. by providing IELTS or TOEFL result.
UNIPREP Indonesia/UNSW Foundation Year (FY)	8	Based on the final Grade Point Average as reflected on the English met by a minimum of 6.5 (65%) in English.
All Indian Senior Secondary School Certificate	80%	Based on the average of the best four academic subjects, excluding the local language. English met by a pass in English subject.
Indian School Certificate (ISC)	75%	Based on the average of the best four academic subjects, excluding the local language. English met by a pass in English subject.
SAT (Scholastic Aptitude Test)	Diploma	Based on the total of the Critical Reading score, Mathematics plus total score of 1925 in SAT score and Writing score. A completed Grade 12 Diploma must also be submitted. English met by a pass in Grade 12 English.
Ontario Grade 12	80%	Based on the average score of the six best Grade 12 academic subjects, excluding workplace preparation and open courses. English met by a pass in English subject.
South African National Senior Certificate	35	Based on the number of points totalled in the best six subjects, excluding Life Orientation. Bonus points to a maximum of four, are awarded for achieving Level 5 or higher in English or mathematics (bonus points =+ 2), or Level 6 or higher in mathematical literacy (bonus points =+ 2). English met by successful completion of '**Level 4** English'.

*Based on best three academic subjects, including pre-requisite subjects. # Based on best five academic subjects, including pre-requisite subjects. FY = Foundation Year.

How to apply

Domestic and Onshore International students

Apply through VTAC

If you are an Australian or New Zealand citizen or a permanent Australian resident, or you are an international student who has completed VCE or IB in Victoria, you must apply though the Victorian Tertiary Admission Centre (VTAC) for your first or future year entry to Monash University.

Visit www.vtac.edu.au for more information.

Prerequisites

Please check that you meet the prerequisites for your chosen course before submitting your application.

Prerequisite details can be found in the Admissions Table (Pages 42 and 43).

Fees

Australian and New Zealand citizens, Australian permanent residents and holders of humanitarian visas are eligible to apply for a Commonwealth Supported Place (CSP).

Visit www.monash.edu.au/fees for more information.

International students

To enter the engineering program as an international student, you must have completed an equivalent qualification to the Victorian Certificate of Education (VCE), in addition to the required pre requisites subjects or equivalent.

International prerequisite subjects for the Bachelor of Engineering

English, Mathematics and at least one of Physics or Chemistry (Year 12 equivalent).

If you intend to study the Bachelor of Engineering in Malaysia and wish to branch into Chemical Engineering, you must also complete Year 12 Chemistry (or equivalent).

Prerequisites and English language requirements

If you are studying another qualification and wish to enter an engineering program at Monash, please check your prerequisites, English language requirements and instructions on how to apply at www.monash.edu/international/prospectivestudents.

If you meet the academic requirements but not the English language requirements, you can take an English language bridging program offered by the Monash University English Language Centre.

Visit www.monash.edu/englishcentre for more information.

Overall requirements

For full details on admission requirements for all engineering degrees including double degrees and for specific requirements and qualifications which are not listed above, visit www.monash.edu/international/prospectivestudents

Fees

Please visit www.monash.edu/international/fees for information on fees for international students.

Please note: 2012 tuition fees will be set in September 2011

Credit transfer

If you have studied at post-secondary level in or outside of Australia, you may be eligible for some credit towards your degree. The amount of credit awarded will depend on your completed qualification and the specific subjects you studied.

To apply for credit, please include a certified copy of your results and full details of the syllabus with your application.

Alternative entry pathway - Monash College

If you do not meet the entry requirements for Monash engineering programs, then we encourage you to consider Monash College.

Monash College offers fee paying programs for local and international students who need to bridge the gap between their highest qualification and the academic requirements accepted by Monash University.

The College is also suited to students who narrowly miss the academic requirements for direct entry and do not wish to lose time repeating Year 12 or transferring from another institution.

Monash College offers entry into second year of the Bachelor of Engineering degree via the Diploma in Engineering Studies. The diploma is equivalent to the first year of study in the Bachelor of Engineering - and once complete, you can move directly into second year studies at Monash University (subject to a minimum average of 60%).

Visit www.monash.edu/monashcollege or phone + 61 3 9627 4852 for more information.

Notes

Artist's impression of the New Horizons building.

The Monash Wind Tunnel

MONASH University

Faculty of Engineering

PO Box 72
Monash University
Wellington Road
Clayton VIC 3800
Australia

www.eng.monash.edu

Telephone: + 61 3 9905 3404
Fax: + 61 3 9905 3409
Email: engineering.enquiries@monash.edu

At Monash - Engineering

Seminars provide a broad overview of courses available and are an ideal career research tool for VCE students.

Date: Thursday 19 May

Time: 6.30pm

Venue: Lecture Theatre South 1, Building 64, Clayton campus

Bookings and more information visit:
www.monash.edu.au/study/events/atmonash.

Open Day

Open Day gives you the chance to talk to academic staff, meet students and tour the faculty and campus.

Date: Clayton campus: Sunday 7 August

Gippsland campus: Saturday 6 August

Time: 10.00am - 4.00pm

More information visit: www.monash.edu closer to the date.

Information Evening

Each year the Faculty of Engineering holds an information evening for senior secondary school students and their parents.

Current students and academic staff give talks on courses and careers in engineering followed by an expo where you can talk to presenters, students and faculty staff.

Date: Thursday 8 September

Time: 6.30pm

Venue: Lecture Theatre C1, Building 63, Clayton campus

Booking and more information: visit www.eng.monash.edu closer to the date.

CRICOS provider: Monash University 00008C

April 2011