



The University of Sydney

Faculty of Engineering Handbook 2000

The University's homepage tells you all about courses at Sydney, some careers they can lead to, and what university life is like. The interactive website, with video and sound clips, has links to the University's faculties and departments.

You can explore the University of Sydney on the web at www.usyd.edu.au.

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University semester and vacation dates 2000

Academic year information (*Academic Board policy and dates 1998-2002*) is available at:

http://www.usyd.edu.au/su/planning/policy/acad/3_0aca.html

	Day	Date (2000)
First Semester lectures begin	Monday	28 February
Easter recess		
Last day of lectures	Thursday	20 April
Lectures resume	Monday	1 May
Study vacation: 1 week beginning	Monday	5 June
Examinations commence	Monday	12 June
First Semester ends	Saturday	24 June
Second Semester lectures begin	Monday	10 July
Mid-semester recess		
Last day of lectures	Friday	8 September
Lectures resume	Monday	9 October
Study vacation: 1 week beginning	Monday	6 November
Examinations commence	Monday	13 November
Second Semester ends	Saturday	2 December

Last dates for withdrawal or discontinuation 2000

	Day	Date
<i>Semester 1 units of study</i>		
Last day to add a unit	Friday	10 March
Last day for withdrawal	Friday	31 March
Last day to discontinue with permission	Friday	14 April
Last day to discontinue	Friday	2 June
<i>Semester 2 units of study</i>		
Last day to add a unit	Friday	28 July
Last day for withdrawal	Thursday	31 August
Last day to discontinue with permission		Not applicable in 2000 <i>(there are 7 weeks to withdraw until 31 August)</i>
Last day to discontinue	Friday	3 November
<i>Full Year units of study</i>		
Last day for withdrawal	Friday	31 March
Last day to discontinue with permission	Friday	14 July
Last day to discontinue	Friday	3 November

The University of Sydney Faculty of Engineering Handbook 2000
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The information in this handbook is subject to approval and/or change by the appropriate faculty or the University. Students should always check the accuracy of the information with faculty staff.

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Contents

Message from the Dean	iv	General University information	133
Letter from the SUEUA President	v	Glossary	137
1. Guide to the Faculty	1	Index	141
The branches of Engineering	1	Map of main campus	146
2. Undergraduate units of study	5		
Aeronautical Engineering	5		
Chemical Engineering	14		
Civil Engineering	25		
Computer Science	35		
Electrical Engineering	38		
Mechanical Engineering	46		
Interdisciplinary units of study	58		
3. Tables of undergraduate units of study	61		
Table 1: Aeronautical Engineering	61		
Table 2: Chemical Engineering	65		
Table 3: Civil Engineering	71		
Table 4: Computer Engineering	76		
Table 5: Electrical Engineering	79		
Table 5A: Electrical Engineering (Information Systems)	84		
Table 6: Mechanical Engineering	88		
Table 7: Mechanical Engineering (Mechatronics)	93		
Table 8: Project Engineering and Management (Civil)	97		
Table 9: Telecommunications Engineering	101		
Table 10: Software Engineering	104		
Table 11: Mechanical Engineering (Biomedical)	108		
Table 12: Aeronautical Engineering (Space Engineering)	112		
Table 13: Advanced Engineering and Faculty-wide elective subjects	115		
4. Regulations	117		
Undergraduate degree requirements	117		
Bachelor of Engineering Resolutions of the Senate	117		
Combined Degrees of Bachelor of Engineering with Bachelor of Science, Commerce or Arts: Resolutions of the Faculty	118		
5. Postgraduate study	125		
Doctor of Engineering	125		
Doctor of Philosophy	125		
Master of Engineering	125		
Master of Engineering (Research)	125		
Master of Engineering Studies	125		
Master of Project Management	126		
Diplomas and certificates	126		
Further information	126		
6. Other Faculty information	127		
The Faculty	127		
Staff	127		
Aeronautical Engineering	128		
Chemical Engineering	128		
Civil Engineering	128		
Electrical and Information Engineering	129		
Mechanical and Mechatronic Engineering	129		
Scholarships and prizes	130		
Student facilities and societies	130		
A short history of the Faculty	131		
Foundations	131		

Message from the Dean

Welcome to the Faculty of Engineering of the University of Sydney, which is also known as the P.N. Russell Faculty of Engineering in commemoration of its industrialist benefactor, Sir Peter Russell. Over the past one hundred and ten years about ten thousand students have preceded you along the path you have chosen to follow towards professional engineering.

An aim of this faculty is to provide the best possible education for its students, both undergraduate and postgraduate. Undergraduate teaching is one of the highest expressions of education; for us, undergraduate teaching is a great social responsibility as well as an opportunity to produce engineers of the future who are both technically competent and socially aware. We produce engineers who will be Australia's future industrial leaders.

In whichever of the engineering branches you may choose to enrol, you will find that the engineer is concerned with applying scientific knowledge and exercising social skills. To do so with competence and assurance, we believe he or she should have a strong basis in science. Consequently, during the first two years of your course this scientific basis is laid down. This vital foundation, the soundness of which is the hallmark of the Peter Nicol Russell Faculty, provides you with the ability you will depend on during your future professional career to appreciate the significance of new and developing technologies, and to work with them. At the same time we teach you the responsibility you have as an engineer.

The engineer must operate in the real world of economic forces and social priorities. Engineering is a creative occupation: based on science applied with art and skill, and with the economic and social dimensions added. Our graduates develop the skills to thrive in the real world, with concern for and the knowledge required to deal with the important environmental issues of today.

You may have chosen to take engineering because you enjoy proficiency at mathematics and in the sciences, disciplines you probably find interesting and challenging. You perhaps have a liking for solving problems and making things. These are all characteristics of the engineer. Engineering is about meeting people too, and managing. Many engineers travel extensively; they tend to have high starting salaries and high career mobility; and they are greatly needed by the nation.

If you are one of the growing number of students who have opted to take a combined degree, you will already be aware of the value and flexibility that these additional studies in quite different areas can add not only to your career prospects but also to your enjoyment of your university time and appreciation of life in general. You will be gaining a breadth of experiences and knowledge that can only benefit your career as an engineer.



The course in engineering includes more classes and laboratory hours than most. It calls for steady and concentrated effort. Above all it is stimulating and exciting. Engineering students are a cohesive group who work and play hard, win more than their share of sporting trophies, and have a reputation for flair and initiative. This too, is the essence of engineering. I congratulate you for joining us and I wish you well in your university life and professional career.

A handwritten signature in black ink that reads "J.A. Raper". The signature is written in a cursive, flowing style.

Judy Raper, Dean.

Letter from the SUEUA President

As the president of the Sydney University Engineering Undergraduate Association (SUEUA), I am writing this letter to inform you of the outstanding attributes that the Faculty of Engineering has to offer, in both the academic and non-academic aspects of university life.

I chose to study engineering at the University of Sydney, due to its reputation for academic excellence and the Faculty's ability to cater for all needs of the whole student body. The Dean's passionate support for SUEUA gives us as a student association the ability, and the enjoyment, to fulfil the social needs of the faculty.

This will be my fourth year of study at Sydney. I can gladly say that as a result of the last three years in engineering, being so involved with SUEUA has brought to light some of my hidden skills in communication, leadership and fun. My involvement with SUEUA has also given me the chance to make new and exciting friendships with students from all over the faculty. It's these friendships which will last a lifetime!

Prospective students

What exactly does SUEUA do? Well I'm glad you asked. SUEUA's role as the student faculty society is to organise and run all social events on the engineering calendar, liaise with academic and administrative staff and provide seminars and workshops with industry to help prepare students for their eventual departure into the ever-advancing world of engineering.

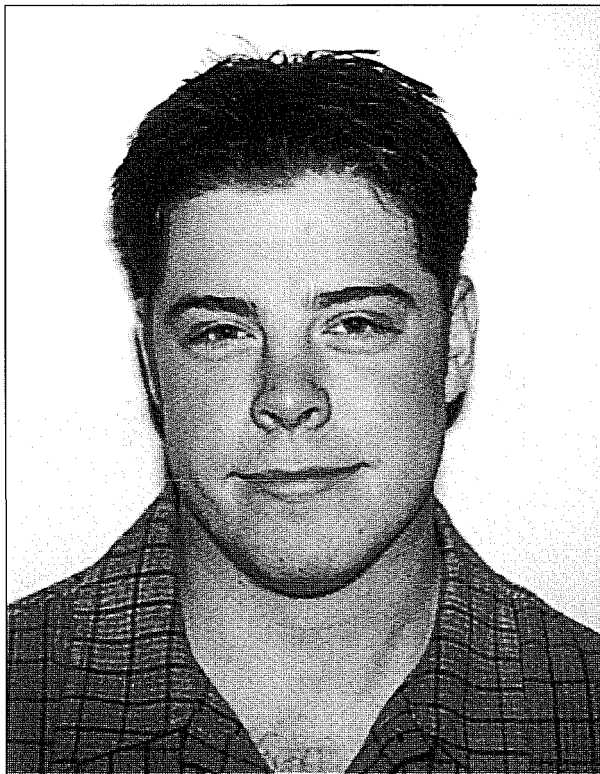
Compared with your high school, the University of Sydney is quite vast and may seem a little intimidating at first. However, if you get involved early, instead of seeing thousands of unknown faces each day on your way to class, you will see friends whom you would have met at SUEUA functions such as 'First Year Camp', 'Beer'n'Bangers' or a lazy Friday afternoon SUEUA barbecue.

Engineering can be quite a challenging degree, so why not come to the University of Sydney and enjoy all the benefits the Faculty of Engineering has to offer.

Fellow students

So you've been at this University for one, two or maybe even five years working hard to get your degree. If I could offer you some advice: don't forget to have fun! Think of yourself and experience everything that university life has to offer. If you get involved now, you too will be able to meet exciting new friends, future business contacts and develop your own interpersonal skills.

Last year in seeking a summer placement for my vocational employment, I was involved in many job interviews with some of the largest engineering firms in Sydney. It was during these interviews that the importance of my involvement with SUEUA, and also the Engineering Revue, became very apparent. In the modern world of engineering employers are



no longer only looking for the students with HD averages, skills in management, leadership and teamwork are of increasing importance. As a student with no, or very little, industry experience, how did my potential employers compare me with my competition? They looked into the extent of my extra-curriculum experience and involvement, and what skills I had gained as a result.

Without a doubt, the last three years have been the most rewarding and exciting of my life. It was not until I arrived at the University of Sydney and the Faculty of Engineering, that I really saw the potential of what university life had to offer. I've learnt so much, developed in so many different ways and had an amazing, unforgettable time in between. Hopefully you too can see this transformation within yourself and are using the experiences gained to lead you into the future.

Have a great year. I know I will.

Peter Beazley, SUEUA President 2000



Guide to the Faculty

The Faculty of Engineering
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Dean

Professor Judy A Raper, BE PhD CPEng, FICChemE FTEAust
ProDean

Professor Yiu-Wing Mai, BSc(Eng) PhD H.K., D Eng,
 FTSE, FASME, FHKTE, FWAust

Associate Dean (Postgraduate and Research)

Associate Professor John C Small, BSc(Eng) Lond.PhD,
 MTEAust, MASCE

Associate Dean (Undergraduate)

Associate Professor Geoff W Barton BE PhD

Secretary to the Faculty and Finance Officer

Mr Michael Whitley, BA(Hons) EastAnglia MCom U.N.S.W.

ASA CJAFCS FICD Dip

Student Administration Staff

Postgraduate Adviser - Ms Josephine Hatty, BA Macq.

Undergraduate Adviser - Mrs Annamaria Brancato

Office Manager - Mrs Annamaria Brancato

Executive Assistant to the Dean

Ms Kylie Williams, BSc

Manager Development and Marketing

Mr Eric van Wijk BSc (ANU) GradDipEd GradDipAppEcon
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Chancellor's Scholarships in Engineering Program

Executive Officer: Ms Lee Glasson BA DipEd (Flinders)

Administrative Assistant

Ms Kay Fielding

Professional Officer

Didier Debuf, BE M.EngSc U.N.S.W.

Industry Liaison

Dr Maurice Barton, BSc Hons Brighton C.O.T. MSc OxonPhd

Aston FAIM

Faculty Librarian

Irene Rossendell BA (Qld), Dip Lib UNSW, ALIA

The branches of Engineering

Aeronautical Engineering (including Space Engineering)

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<http://www.aero.usyd.edu.au/>

Head: Professor Grant P. Steven

Administrative Officer: Ms Yvonne Witting

Aeronautical Engineering is the study of the mathematics, physics, computer science, material science and design philosophy that go into the analysis, design, manufacture and operation of aerospace vehicles.

Aeronautical engineers find a use for their skills in research, airline maintenance and operations, aerospace design and manufacturing, in both civil and military environments. There is also good demand for graduates with aeronautical skills outside the aerospace sector.

The department offers a four-year undergraduate program leading to a Bachelor of Engineering (Aeronautical) degree. There is also the offer of a five-year combined degree with Science, Commerce or Arts.

The Department's teaching policy is to use a combination of lectures, tutorials, laboratory, projects and industrial work experience to provide a broad range of stimuli that will impart the knowledge and art of Aeronautical Engineering.

In *the first* year, students study basic mathematics and all of the basic sciences including computer and aerospace science.

The *second* year sees the strengthening of these concepts and also the introduction of aeronautical engineering courses such as flight mechanics and dynamics.

The third year is the most important year of the program, as the fundamentals of flight mechanics and dynamics, aircraft materials and structures, aerodynamics and aircraft design are presented.

In the fourth year, more advanced study is undertaken in flight dynamics and control, aerodynamics, aircraft structures, aircraft design and propulsion. A significant proportion of the year is devoted to a thesis project where each student undertakes in-depth research into a theoretical or practical project in aeronautics with the aid of a supervisor.

The four-year program is regularly reviewed and is accredited by the Institution of Engineers, Australia. Our honours graduates who are interested in research take positions at recognised international universities, such as MIT, Oxford, Stanford and Imperial College.

Space Engineering is the study of the design, testing and implementation of engineering components in one of the most demanding of environments - space.

The relative small class sizes in the final two years make for an informal and friendly atmosphere. A student branch of the American Institute of Aeronautics and Astronautics (AIAA) operates in the Department, which together with the Royal Aeronautical Society, caters to the professional needs of the students. Our student society WINDSOC operates a varied social program.

Chemical Engineering (including Bioprocess, Environmental and Energy, Process and Computer Systems)

Phone: +61 2 9351 2470

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Email: hod@chem.eng.usyd.edu.au

Head: Professor James G. Petrie

Administrative Assistant: Ms Linda McGill

Chemical engineering is concerned with industrial processes in which material in bulk undergoes changes in its physical or chemical nature. Chemical engineers design, construct, operate and manage these processes and in this they are guided by economic and environmental considerations.

Industries employing chemical engineers are generally referred to as the process industries: examples of these are the large complexes at Botany in New South Wales and Altona in Victoria, and the petroleum refineries in all mainland States; other examples are the minerals processing industries that refine Australian ores such as bauxite, nickel sulphides and rutile to produce aluminium, nickel and titanium. In addition there are the traditional metallurgical industries, steel, copper, zinc, lead, etc, as well as general processing industries producing paper, cement, plastics, paints, glass, pharmaceuticals, alcohol and foodstuffs. Allied process operations are those involving waste disposal, pollution abatement, power production and nuclear technology.

Chemical engineering studies are based on chemistry, mathematics and physics and the first two are taken to some depth. The chemical engineer must learn something of the language and principles of mechanical, electrical, and civil engineering, and of administration, and industrial relations.

Each student completes a common core of units of study, fundamental to the study of chemical engineering, and also takes a number of elective courses, chosen according to his or her particular field of interest from course options listed later.

Three of these introduce students to some important industries in the process field.

Minerals Engineering. For students who are interested in gaining some familiarity with the minerals processing industries.

Biochemical Engineering. For those interested in biochemical methods of pollution control or in any of the biochemical industries such as pharmaceuticals, fermentation or food and dairy processing.

Reservoir Engineering. These courses deal with the properties and behaviour of petroleum and natural gas reservoirs, and the strategies used in their development.

Regardless of the option chosen, the graduate will be a fully qualified chemical engineer, well prepared for a career in any of the process industries.

The Department has a number of active exchange programs with leading Departments overseas. The exchanges, with the Royal Institute of Technology, Stockholm, and the Ecole Nationale Supérieure D'Ingenieurs de Genie Chimique in Toulouse, see five or six of our final year students completing their degrees at one of these Institutions each year, with similar numbers of their students finishing their courses in Sydney. There is also an exchange program with Iowa State University which allows one or two of our students to spend their third year there. Each of these exchange schemes includes Industrial Experience in the host country. Some financial assistance is available to approved students.

The majority of chemical engineering graduates enter industry, taking up positions in plant operation, supervision, and eventually management. Others will be engaged in plant design, construction, and commissioning work either for a large process company or one of the specialist construction firms.

There is also scope for research and development work with industry or government organisations.

Chemical engineers are also recruited by many of the larger companies for technical service and sales. Graduates may also be able to obtain positions overseas either directly or through Australian companies with overseas associations.

Civil Engineering and Project Engineering and Management (including Environmental, Geotechnical, Structural and Construction)

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Email: office@civil.usyd.edu.au

Head: Associate Professor Robert J. When

Executive Assistant to Head of School: Ms Tmne Blair

The title Civil Engineer is given to one who invents, contrives, designs and constructs for the benefit of the community. Civil engineering covers a wide range including the conception, design, construction and maintenance of those more permanent structures and services such as roads, railways, bridges, buildings, tunnels, airfields, water supply and sewerage systems, dams, pipelines, river improvements, harbours and irrigation systems. In the broader sense civil engineers are charged with the task of producing structures and systems that give the greatest amenity for the funds expended. They have therefore to optimise their schemes in terms of technological performance, impact upon the environment and the financial resources available.

Civil engineers find employment: in government authorities whose concern is the design, construction and maintenance of public services; with consultants whose main interest is the design of civil engineering works; with contractors who carry out the construction work; and in civil engineering industries which manufacture and supply materials, plant and equipment.

Graduates in construction engineering and management will find themselves particularly well placed for project management and leadership roles in the following organisations; construction companies, project management organisations (major management, consulting and planning firms), government organisations, large corporations including

mining and industrial companies, and part of multidiscipline teams of professionals in charge of large infrastructure projects - eg, the Olympics

In the first and second years of the course, the student is given a grounding in mathematics and the sciences with an introduction to structural theory, design, construction, and the properties of materials.

In the third year, basic courses are given in structures, soil mechanics, surveying, hydraulics, structural design, construction, materials and practice of civil engineering.

In the fourth year, the basic courses of the third year are continued with an additional course which requires the preparation of a thesis. At honours level a more extensive thesis is required. A major segment of final year studies comprises options in structures, fluid mechanics, engineering management, soil mechanics and geomechanics.

As civil engineering is a practical profession, attention is given to this aspect throughout the course. Full use is made of the laboratories with students carrying out experiments to obtain a better understanding of behaviour under practical conditions. There is extensive use of computers in design and other exercises. During the vacation between the senior and senior advanced years, every student must obtain practical experience in a civil engineering field and must submit a satisfactory report on this experience. During the final year, students attend a two-week camp for practical surveying experience and to apply surveying methods to a project. Seminars are also held and visits to works in progress are made as opportunities arise. Students are encouraged to take a close interest in current research and *investigations*.

Quality Assurance: For most subjects originating in the Department of Civil Engineering, independent Quality Assurance Auditors have been appointed. These auditors have no direct teaching involvement with the subjects for which they act and are responsible for maintaining an overview of each of these subjects through to the monitoring of results. As the auditors are changed more frequently than subject content, the names of current auditors, together with those of staff responsible for coordinating and running the subjects, are available from the Department's Office.

Electrical, Telecommunications, Software and Computer Engineering

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<http://www.ee.usyd.edu.au/>

Head: Associate Professor Stephen W. Simpson

Administrative Officer: Peter Finneran

The Department of Electrical Engineering offers students the opportunity to study engineering in an exciting, innovative and relevant environment. The field of Electrical, Telecommunications and Computer Engineering is one in which there has been a history of constant improvements, developments and innovations in existing technologies, coupled with the evolution of new technologies. The Department is closely linked to the engineering industry and the units of study are of a quality to ensure that our graduates are prepared for a changing profession as we approach and pass the year 2000.

The degree courses offered by the Department of Electrical Engineering - Electrical Engineering, Software, Telecommunications and Computer Engineering - are four year programs (for both Pass and Honours). They can, however, be taken as five year double degree programs with Arts, Science or Commerce. Students are also able to participate in exchange programs with universities in Sweden and the USA as part of their degree program.

The degree courses include emphasis on practical problem solving, the basic theory necessary to underpin the profession through the rapid changes being made, and professional practice. There are opportunities to make contacts in industry, including a three months practical training in industry at the end of third year.

The Electrical Engineering degree is designed to be general and allows a student to concentrate in the later years on a variety of fields such as biomedical engineering, energy engineering and automatic control as well as telecommunications and computers or take a broad selection in several areas.

The Telecommunications Engineering degree offers specialisation in the third and fourth years in the subjects electronics and optics, computer systems, electromagnetics, signal and communication systems and telecommunications software. Extensive problem-solving computer based projects, and aspects of modern workplace management, are features of the program.

The Computer Engineering degree has a greater emphasis on computer science but the core program in the first two years is almost the same as the other two degrees. This degree specialises in the third and fourth years in advanced computer systems, computer networking and software engineering. A wide range of computer oriented electives including artificial intelligence and integrated circuit design are available. Features of the program include computer based tutorials, aspects of modern workplace management principles and the development of communication skills.

The Software Engineering degree has a common first year with Electrical, Telecommunication and Computer Engineering programs. The second year is mostly in common with a core emphasising science and technology, computer science and microcomputer programming. A feature of the program is that students can start specialising in the second year by selecting software engineering electives in business software, electronics and circuits, for CAD software, commerce and biology. Specialisations in software engineering databases, signal processing, information systems, telecommunication software systems, CAD, operating systems and compilers, real time systems and high performance computing.

Electrical, Telecommunications, Software and Computer engineers have a wide choice of career opportunities. Prospective employers include consulting engineering firms, state and local government, computer companies, financial companies, manufacturers, builders, and research institutions such as the CSIRO or universities. Like engineering itself, the possibilities are almost limitless.

Mechanical, Mechatronic and Biomedical Engineering

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<http://www.mech.eng.usyd.edu.au/>

Head: Associate Professor John Kent

Administrative Officer: Craig Symes

Mechanical Engineering is a very broad branch of professional engineering and mechanical engineers are found in almost every type of engineering activity. They are involved in power generation, transportation systems for land, sea and air, pollution control, environmental protection and, biomedical engineering. They are found in a wide range of industries which manufacture machinery and consumer goods and offer research and technical services.

Mechanical engineers design machinery, engines, vehicles, agricultural and mining equipment, ships and household appliances. They are managers who run production lines, power stations and steel mills. They design and maintain coal conveyer systems, building services, oil and gas pipelines and port loading facilities. The great diversity of applications for mechanical engineers means they are much sought after in both commercial and industrial fields.

Students have the opportunity to complete the Bachelor of Mechanical Engineering in one of three different degrees - Mechanical, Mechatronics or Biomedical.

Mechatronics combines mechanical engineering, electronics and computing. It is the enabling technology of computer-automated manufacturing through the use of robots and

automated machine tools. Mechatronics may be concerned with individual machines such as robots, or manufacturing systems automated in their entirety.

Mechatronic engineers use computers and other digital systems to control industrial processes. They bring electronic, materials and mechanical sciences together to create a diverse range of products. These range from everyday products such as cameras, washing machines, photocopiers and anti-lock car brakes, to miniaturised substitutes for human organs and to powerful and precise computer-controlled machine tools used in manufacturing.

Biomedical engineers apply engineering principles to understand, modify or control biological systems, and develop technology to monitor physiological functions and to assist in diagnosis and treatment of patients. Biomedical engineering is an interdisciplinary branch of engineering, encompassing areas of electrical, mechanical and chemical engineering. Subjects in biomedical and orthopaedic engineering as well as research opportunities in Electrical, Mechanical and Mechatronic Engineering are available. This degree meets the tertiary study entry requirements for the Graduate Medical Program.

The first two years of undergraduate study in mechanical, mechatronic or biomedical engineering provide students with an introduction to engineering science, design and manufacturing methods, management, computing and electronics, so that by the end of the second year, a broad field has been covered.

In third year, mechanical engineering students study in more depth the hardware, materials and manufacturing processes which are at the heart of mechanical engineering. In addition to this, mechatronics students study topics such as control, digital systems and computer technology, electronics and electrical machines. Three months' practical training in industry follows third year for all students.

The final year of mechanical, mechatronic and biomedical engineering allows students to develop the professional skills that they will need after graduation. Emphasis is placed on using engineering science, up-to-date technologies and professional tools to solve practical problems. Specialisation in the final year is encouraged. Areas of specialisation include: management, thermofluids, environmental engineering, computational fluid dynamics, design, rheology, advanced materials, orthopaedic/biomedical engineering and mechatronics.

Undergraduate units of study

Units of study are subject to alteration

Arrangements for units of study, and the units themselves, including staff allocated as stated in this or any other publication, announcement or advice of the University are an expression of intent only and are not to be taken as a firm offer or undertaking. The University reserves the right to discontinue or vary such units of study, arrangements or staff allocations at any time without notice.

On the following pages details of the units of study are provided in a form which is convenient for reference. Every care has been taken to ensure that the information given is complete and accurate. However, updates are constantly ongoing and therefore variations may be made from time to time. These will be announced by the lecturer or posted on the relevant noticeboards. It is the responsibility of students, by attendance at lectures and frequent inspection of the noticeboards, to ensure that they have the latest information on any unit of study.

Textbooks

Changes sometimes occur in the selection of prescribed textbooks, or reference books, owing to supply difficulties, or the publication of new and more suitable works. Such changes will be announced by lecturers and it is prudent to check with the relevant lecturer before buying the books you expect to need.

Elective units of study in other faculties

There is provision for students to apply to the Faculty of Engineering for special permission to take any other units of study which are available in other degree programs towards their BE degrees (eg, Computer Science 3, Economics 2). Any unit of study which is not listed in the Tables of Units of Study or in the list of recommended elective units of study in this handbook is referred to as a 'non-listed' unit of study by the Faculty.

If you have a strong interest in taking a particular 'non-listed' unit of study, you should consult the relevant faculty handbook for details about it. You will also need to check whether or not there is a quota for this unit of study or any special assumed knowledge/prerequisite. You will also need to ensure that the unit of study creates no timetable clash with Engineering requirements.

If you decide that you wish to enrol in a 'non-listed' unit of study, you will need to apply for special permission to do so. Please ask to see the Chair of the Committee for Undergraduate Studies or the Faculty's Undergraduate Coordinator at enrolment time for application procedure.

Unit of study numbering system

The units of study available for the degree are designated Junior (First Year), Intermediate (Second Year), Senior (Third Year), Senior Advanced or Honours (Fourth Year). These names indicate the year of attendance in which the unit of study becomes available to you if you are making normal progress.

Each unit of study has a unique code and number, comprising 4 letters followed by 4 numbers (eg, MECH 2200). Each unit of study also has a unique and much longer numerical code allocated to it by the University for administrative purposes, however for the majority of student requirements (eg, enrolment) this will not be necessary.

The first 4 letters (eg, MECH, AERO) indicate the Department which teaches the unit of study. The first number of the set of 4 numbers following indicates the year of study. Example 'MECH 2200': This is a unit of study taught by the

Department of Mechanical and Mechatronic Engineering and is normally offered to Second Year (Intermediate) students.

Aeronautical Engineering

AERO1 4 0 0 Introduction to Aircraft Construction and Design

6 credit points

Offered: July. **Classes:** 1 lec/week per semester. 1 x 3hr practical/workshop/presentation session per semester. **Assessment:** In-course involvement, practical assignments and quizzes. First Year Elective unit of study for the degree in Aeronautical Engineering.

Syllabus Summary

Introduction to aircraft design and construction methods; fibre-glass molding of complex components; bonding and glueing; structural reinforcement; manufacture of metal components; wooden components; aircraft grade materials; welding; riveting; bolting and other fasteners.

Investigation of a typical aircraft configuration; component layout; alternate configurations; weight penalties or gains.

Requirements for ancillary equipment; aircraft instruments; accuracy of instruments; engine and propeller selection; fuel system; navigation and communication systems.

Aviation regulation; process of aircraft certification; aircraft categories; performance measurement and requirements; weight and balance; centre of gravity requirements.

Objectives/Outcomes

The objective of this unit of study is to introduce and foster practical engineering skills in students newly enrolled in the degree of Bachelor of Engineering (Aeronautical).

Students will actively participate in the construction and design of a light aircraft. The aircraft is to be constructed under current Civil Aviation Regulations so that students will gain an insight into all aspects of the process. By being a part of the construction team students will also experience the organisational requirements necessary to successfully complete a complex engineering project.

The final outcome will be that students gain an understanding of:

- Light aircraft design methods
- Innovative methods of construction
- Techniques for selecting, sizing and stressing components
- Regulatory requirements for certification
- Off-Design requirements
- Construction tolerances
- Team-work requirements in undertaking complex engineering projects.

AERO1 6 0 0 Workshop Technology

4 credit points

Prohibition: MECH 1600. **Offered:** February. **Classes:** (1 lec, one 3hr lab)/wk. **Assessment:** Assignments, practical work. First year core unit of study for the degree in Aeronautical Engineering.

Objectives/Outcomes

To develop an understanding of the fundamentals of vehicle manufacture, construction, servicing and repair. Students will develop skills working with machine tools and hand tools.

Syllabus Summary

Fitting - measurement, measuring tools, marking tools, holding tools, hammers, cutting tool materials, cutting tool shapes, the machine tools: lathe, mill, grinder, drill, shaper, deburring and finishing operations.

Welding - Welding processes, distortions, flame cutting, resistance welding. Problems of welding aircraft materials.

Heat treatment - Definition and importance of heat treatment, forging, normalising, hardening, case hardening, stress relief.

Fasteners - Types of fasteners for aircraft, riveted, bolted, bonded, locking of fasteners.

Maintenance - Requirements for various aircraft components, engine overhaul, component life, lubrication, patches and repairs, serviceability of components.

Textbooks

Library classification: 671

Reference book: Cutler Understanding Aircraft Structures (BSP Professional, 1988)

AERO1700 Introduction to Space Engineering
3 credit points

Prohibition: Mutually exclusive with AERO 1900 Introduction to Aeronautics. **Offered:** February. **Classes:** 1 lec, one 2hr tut/lab per week. **Assessment:** exam (50%), assignments(50%).

First Year core unit for the degree in Aeronautical Engineering (Space Engineering)

Objectives/Outcomes

To develop an understanding of the role of aerospace engineers within industry along with the overlying fundamentals of aerospace vehicle design, analysis performance and operation. Students will develop skills in working in groups, communication and presentation of information, solving engineering based problems

Syllabus Summary

Glossary of terms for aerospace vehicles and their components. Brief introduction to astronautics, spacecraft performance, mechanics of flight, aerospace structures, materials and propulsion systems. The operating characteristics of modern vehicles, their uses and limitations. Modern developments in space. Future trends, aerospace planes, orbital vehicles. The limitations of the space environment.

Textbooks

Jane's All the World's Spacecraft (Annual)

Stinton The Anatomy of the Aeroplane (Collins, 1985)

AERO1800 Computational Engineering 1D

3 credit points

Offered: July. **Classes:** 1 lec, one 2hr lab per week. **Assessment:** exam (50%), assignments(50%).

First year core course for the degree in Aeronautical Engineering and Mechanical Engineering

Objectives/Outcomes

To provide basic computational skills for engineering problem solving using personal computers. Students will develop familiarity with the use of standard PC's in an Engineering context. Students will become aware of the details and structure of programming in a wide variety of environments including PC networks.

Syllabus

Programming in an engineering environment: use of compilers; debugging; object-oriented coding; code optimisation; code documentation; flow charts; program design and philosophy. Specialised functions for personal computers: network operation; communication via Intranet and Internet; network standards, software and hardware.

Introduction to spreadsheets: data structures; graphing; recursion.

Computer language components: Program structures, variables and data types, statements, keywords, intrinsic functions, arithmetic operations, program control, logical operations, input/output, formatting, functions and procedures. The use of toolboxes and engineering software libraries.

Engineering applications

Problems in engineering mechanics; graph plotting, curve fitting and solution interpolation.

Solution of simultaneous linear equations; applications in structural analysis. Solution of ordinary differential equations; applications in fluid statics. Iterative solutions for non-linear problems; trajectory simulation; particle dynamics.

Search and retrieval of engineering data; use of online information systems and the Australian Standards.

Reference Books

The Student Edition of MATLAB (Prentice Hall, 1995)

Press et al Numerical Recipes, the Art of Scientific Computing (Cambridge Press, 1986)

Etter Engineering Problem Solving with MATLAB (Prentice Hall, 1993)

AERO1900 Introductory Aeronautics

4 credit points

Offered: February. **Classes:** (1 lec, one 3hr lab)/wk. **Assessment:** assignments, practical work.

First year core unit of study for the degree in Aeronautical Engineering.

Objectives/Outcomes

To develop an understanding of the role of aeronautical engineers within industry along with the overlying fundamentals of aerospace vehicle design, analysis performance and operation. Students will develop skills in working in groups, communication and presentation of information, solving aeronautical based problems

Syllabus Summary

Classification of aircraft, fixed wing, rotary wing, aerostats, surface effect vehicles, rockets. Glossary of terms for aircraft and their components. Brief introduction to aerodynamics, aircraft performance, dynamics of flight, airframe structures, materials and propulsion systems. The operating characteristics of modern aircraft, their uses and limitations. Modern developments in aviation. Future trends, aerospace planes, super-widebody aircraft, orbital vehicles.

Reference books

Jane's All the World's Aircraft (Annual)

Stinton The Anatomy of the Aeroplane (Collins, 1985)

AERO2201 Fluid Mechanics

4 credit points

Prohibition: Mutually exclusive with AERO 2200 Introductory Aerodynamics, AERO 2700 Space Engineering 1. **Offered:** July.

Classes: two lec, one 2hr lab/tut per week. **Assessment:** assignments, practical work, 2hr examination.

Second year core course for the degree in Aeronautical Engineering

Objectives/Outcomes

To develop an understanding of the fundamentals of fluid dynamics and its application to aircraft and related components. Students will develop a competency in tackling fluid flow problems and producing solutions for engineering applications.

Syllabus Summary

Properties of fluids and gases; measurement and prediction of gas properties and behaviour; temperature, density, pressure, viscosity, speed of sound. Perfect gas laws. Definition of Newtonian fluid, non-Newtonian fluid, continuum and rarefied flows.

Fluid behaviour, governing equations, controlling non-dimensional parameters, Reynolds number, Mach number, Froude number, Weber number, Knudsen number.

Fluid statics. Governing hydrostatic equation; buoyancy; stability of floating bodies. Pressure measuring devices; barometers; manometers. Properties of the Earth's atmosphere.

Fluid dynamics. Governing conservation of mass, momentum and energy equations; continuity, Bernoulli and Euler equations. Applications in flow rate and velocity measuring devices; venturi; pitot-static tube; orifice plate. Velocity potential equation for flow modelling; internal and external flows; prediction of surface pressure distribution; production of forces by fluid; vorticity and circulation. Definition of non-dimensional force coefficients; lift, drag and pitching moment coefficients.

Introduction to viscosity and compressibility effects. Boundary layer flows; laminar and turbulent layers; skin friction coefficient; flow separation; pressure and friction drag. Supersonic flow; production of shock waves; normal and oblique shocks; shock wave tables.

Reference books

Streeter and Wylie Fluid Mechanics (McGraw-Hill 1981)

Houghton and Brock Aerodynamics for Engineering Students (Edward Arnold, 1988)

Ower and Pankhurst The Measurement of Airflow (Pergamon, 1977)

AERO 2300 Mechanics of Solids 1

4 credit points

Prerequisite: 12 credit points of first year Maths (i.e Maths 1001,1002,1003,1005). **Offered:** February. **Classes:** (1 lec, one3hr lab)/wk. **Assessment:** 2hr exam and course assignments. Second year core unit of study for the degree in Aeronautical and Mechanical Engineering.

Intermediate elective course for the degree in Mechatronic and Chemical Engineering.

Objectives/Outcomes

To develop an understanding of the fundamentals of structural analysis and its application to the general field of engineering. Students will develop the ability to tackle typical structural problems and produce solutions for applications in aeronautical, mechanical and mining engineering.

Syllabus Summary

Concepts of equilibrium, compatibility, stress and strain; study of internal stress systems due to tension, bending, torsion and shear; statically determinate and indeterminate structural elements; concepts of energy methods, displacement analysis; simple buckling. Problem based applications in aerospace, mechanical, mining engineering.

Textbooks

Fenner Mechanics of Solids (Blackwell Scientific Publication, 1989)

Library classification: 620.11

AERO 2500 Introductory Flight Mechanics and Performance

4 credit points

Prerequisite: MATH 1001,1002,1003,1005. **Offered:** February. **Classes:** (3 lec, one 1hr tut/lab)/wk. **Assessment:** 2hrexam, assignments.

Second year core unit of study for the degree in Aeronautical Engineering.

Objectives/Outcomes

To develop an understanding of the concepts of the mechanics of flight including fundamentals of aircraft performance, stability and control. Students will learn the basic concepts and be introduced to the mathematical tools used for prediction of aircraft flight mechanics.

Syllabus Summary

Introduction to aircraft performance. General performance; steady level flight; balance of forces; take-off; climb; cruise; landing performance. Range calculations. Manoeuvre performance.

Origin of symmetric forces and moments. Static and manoeuvring longitudinal stability, equilibrium and control of rigid aircraft. Aerodynamic load effects of wings, stabilisers, fuselages and powerplants. Trailing edge aerodynamic controls.

Trimmed equilibrium condition; effects on performance and static stability of trim. Static margin. Effect on static stability of free and reversible controls.

Reference books

McCormick Aerodynamics, Aeronautics and Flight Mechanics (Wiley, 1979)

Hale Aircraft Performance, Selection and Design (Wiley, 1987)

Etkin Dynamics of Atmospheric Flight (Wiley, 1972)

Roskam Airplane Flight Dynamics and Automatic Flight Controls (RoskamA&EC, 1979)

Nelson Flight Stability and Automatic Control (McGraw-Hill, 1989)

AERO 2700 Space Engineering 1

6 credit points

Prohibition: Mutually exclusive with AERO 2200 Introductory Aerodynamics, AERO 2201 Fluid Mechanics, AERO 2500 Intro. Flight Mech. and Performance. **Offered:** July. **Classes:** 4 lec, one 2hr tut/lab per week. **Assessment:** exam (50%), assignments(50%). Second year core unit for the degree in Aeronautical Engineering (Space Engineering).

Objectives/Outcomes

To develop an understanding of the environment of space, including the effects due to relevant physical phenomenon. To gain

an understanding of the initial component steps to be undertaken in the design of an aerospace vehicle.

Syllabus Summary

Introduction to instrumentation for the physical sciences, optics for communications and sensing. Electromagnetic properties of matter; Maxwell equation.

Launch system basics; introduction to fluid mechanics; basic flight mechanics and orbital mechanics. Vehicle stability and control.

Introduction to spacecraft subsystems; attitude control, structures, thermal loading, mechanisms, power generation and storage, propulsion; liquid and solid rockets. Telemetry tracking and command (TT&C), useful payloads. Space application concepts; communications, earth observation, astronomy, microgravity, exploration.

Textbooks

To be advised

AERO 2800 Aeronautical Engineering Computing

4 credit points

Offered: February. **Classes:** (1 lec, one 3hr lab)/wk. **Assessment:** 2hr exam (50%), assignments(50%).

Second year core unit of study for the degree in Aeronautical Engineering.

Objectives/Outcomes

To develop an understanding of the use of the computer as a tool for solution of problems in the field of aeronautical engineering. Students will develop skills in applying computer software algorithms to problems in this field. Students will learn the usefulness and applicability of many currently available software packages.

Syllabus Summary

Application of numerical solution techniques to solve problems in engineering. Matrix formats; sparsity; bandwidth; symmetry. Matrix manipulation; multiplication; inversion; reduction. Solution of linear simultaneous equations. Calculation of Eigenvalues and Eigenvectors. Discrete Fourier transforms. Procedures for iteration; numerical integration and differentiation.

The storage of data in efficient file or memory structures. Data retrieval; sorting; collation; statistical analysis. The generation and use of random numbers.

Use and evaluation of software packages. Wordprocessors; databases; spreadsheets; mathematical symbolic manipulation; CAD/CAM; graph plotting; engineering analysis. Definitions for user-friendly interfaces; GUI's; data format requirements.

Use of the Internet as an aeronautical research tool; email; WWW; network etiquette.

Reference books

Press et al Numerical Recipes, the Art of Scientific Computing (Cambridge Press, 1986)

The Student Edition of MATLAB (Prentice-Hall, 1992)

AERO 3200 Aerodynamics 1

4 credit points

Prerequisite: AERO 2200. **Offered:** February. **Classes:** (3 lec, one 1 hr tut/lab)/wk. **Assessment:** 2hr exam(75%), assignments/lab reports(25%).

Third year core unit of study for the degree in Aeronautical Engineering.

Objectives/Outcomes

To develop an understanding of the fundamental equations governing aerodynamics and their application to aeronautical problems. Students will gain skills in problem solving in area of fluid mechanics.

Syllabus Summary

Basic equations governing aerodynamics; continuity; conservation of mass and momentum; Bernoulli, Euler and Navier-Stokes equations. Application to fluid mechanics; forces on objects in a moving fluid; pressure distribution; effects of Reynolds and Mach number. Vorticity, circulation and the production of lift; Kutta-Joukowski Law. Modelling of solid bodies in potential flow; solutions for two and three dimensional shapes; Biot-Savart Law.

Aerodynamic loading on aerofoil sections, wings, fuselages and other aircraft components. Effects on aircraft performance. Performance optimisation using energy methods; excess power and specific energy calculations.

Reference books

McCormick Aerodynamics, Aeronautics and Flight Mechanics (Wiley, 1979)
 Streeter and Wylie Fluid Mechanics (McGraw-Hill 1981)
 Bertin and Smith Aerodynamics for Engineers (Prentice Hall 1979)
 Dommasch Airplane Aerodynamics (Pitman)
 Houghton and Brock Aerodynamics for Engineering Students (Edward Arnold)
 Abbott and Von Doenhoff Theory of Wing Sections (Dover 1959)

AERO 3250 Aerodynamics 2

4 credit points

Prerequisite: AERO 2200. **Offered:** July. **Classes:** (3 lec, one 1 hr tut/lab)/wk. **Assessment:** 2hr exam (75%), assignments/lab reports (25%).

Third year core unit of study for the degree in Aeronautical Engineering.

Objectives/Outcomes

To develop an understanding of the fundamental equations governing aerodynamics and their application to aeronautical problems. Students will gain skills in problem solving in area of wing theory, boundary layers and gas dynamics.

Syllabus Summary

Basic gas dynamics; steady one-dimensional flow including friction and heat transfer; shock waves. Introduction to steady two-dimensional supersonic flow.

Viscous effects; introduction to boundary layer theory; heat transfer and skin friction. Prediction of aerodynamic drag.

Classical two-dimensional aerofoil theories; Joukowski mapping; thin aerofoil theory. Classical three-dimensional wing theory; lifting-line; lifting surface theory. Calculation and use of aerodynamic derivatives; aerodynamics of control surfaces.

Reference books

McCormick Aerodynamics, Aeronautics and Flight Mechanics (Wiley, 1979)
 Bertin and Smith Aerodynamics for Engineers (Prentice Hall 1979)
 Dommasch Airplane Aerodynamics (Pitman)
 Houghton and Brock Aerodynamics for Engineering Students (Edward Arnold)
 Liepmann and Roshko Elements of Gas Dynamics (Wiley 1957)
 Schlichting Boundary Layer Theory (McGraw Hill, 1960)

AERO 3300 Aircraft Structures 1

4 credit points

Prerequisite: AERO 2300. **Offered:** February. **Classes:** (3 lec, one 1hr/tut/lab)/wk. **Assessment:** 2hr exam, assignments/lab reports.

Third year core unit of study for the degree in Aeronautical Engineering.

Objectives/Outcomes

To develop an understanding of the fundamentals of structural strength estimation. Students will gain skills in problem solving in the area of aircraft structural analysis.

Syllabus Summary

Solid mechanics; stress and strain; linear elasticity; strain energy. Plane stress systems. Elastic vibration and buckling.

Structural analysis; airframe structures. Loads and reactions in airframes. Analysis of multi-cell box beams and tubes. Analysis of rings.

Reference books

Timoshenko Strength of Materials, Part I and II (Van Nostrand)
 Langtjaar Energy methods in Applied Mechanics (Wiley)
 Bruhn Analysis and Design of Flight Vehicle Structures (Tri-State Offset)
 Megson Aircraft Structures for Engineering Students (Edward Arnold, 1972)

Library Classification:

620.11,628.13,629.13,630.1

AERO 3301 Aerospace Structures 1

4 credit points

Prerequisite: AERO 2300 Mechanics of Solids 1. **Prohibition:** Mutually exclusive with AERO 3300 Aircraft Structures 1. **Offered:** February. **Classes:** 3 lecture, one hr tutorial/lab per week.

Assessment: 2hr exam, assignments/lab reports.

Third year core unit for the degree in Aeronautical Engineering (Space Engineering)

Objectives/Outcomes

To develop an understanding of the fundamentals of structural strength estimation. Students will gain skills in problem solving in the area of aerospace structural analysis.

Syllabus Summary

Solid mechanics; stress and strain; linear elasticity; strain energy. Plane stress systems. Elastic vibration and buckling.

Structural analysis; airframe structures. Loads and reactions in airframes. Analysis of multi-cell box beams and tubes. Analysis of rings.

Reference books

Timoshenko Strength of Materials, Part I and II (Van Nostrand)
 Langtjaar Energy methods in Applied Mechanics (Wiley)
 Bruhn Analysis and Design of Flight Vehicle Structures (Tri-State Offset)
 Megson Aircraft Structures for Engineering Students (Edward Arnold, 1972)

AERO 3350 Aircraft Structures 2

4 credit points

Prerequisite: AERO 2300. **Offered:** July. **Classes:** (3 lec, one 1 hr tut/lab)/wk. **Assessment:** 2hr exam, assignments/lab reports.

Third year core unit of study for the degree in Aeronautical Engineering.

Objectives/Outcomes

To develop an understanding of the fundamentals of structural strength estimation. Students will gain skills in problem solving in the area of aircraft structural analysis.

Syllabus Summary

Solid mechanics; thermal stresses and plasticity; applications in plane stress systems.

Structural analysis; elementary analysis of plates and stiffened panels and shells. Analysis of complex frameworks; introduction to displacement methods of analysis.

Reference books

Drucker Introduction to the Mechanics of Deformable Bodies (McGraw-Hill)
 Bruhn Analysis and Design of Flight Vehicle Structures (Tri-State Offset)

Library Classification:

620.11,629.13,630.1

AERO 3351 Aerospace Structures 2

4 credit points

Prerequisite: AERO 2300 Mechanics of Solids 1. **Prohibition:** Mutually exclusive with AERO 3350 Aircraft Structures 2. **Offered:** July. **Classes:** 3 lec, one 1 hr tut/lab per week. **Assessment:** 2hr exam, assignments/lab reports.

Third year core unit for the degree in Aeronautical Engineering (Space Engineering)

Objectives/Outcomes

To develop an understanding of the fundamentals of structural strength estimation. Students will gain skills in problem solving in the area of aerospace structural analysis.

Syllabus Summary

Solid mechanics; thermal stresses and plasticity; applications in plane stress systems.

Structural analysis; elementary analysis of plates and stiffened panels and shells. Analysis of complex frameworks; introduction to displacement methods of analysis.

Reference books

Drucker Introduction to the Mechanics of Deformable Bodies (McGraw-Hill)

Bruhn Analysis and Design of Flight Vehicle Structures (Tri-State Offset)

AERO 3400 Aircraft Design 1

3 credit points

Prerequisite: MECH 2400. **Offered:** February. Classes: (1 lec, one 3hr/tut)/wk. Assessment: Exam, tutorial assignments, major and minor design projects.

Third year core unit of study for the degree in Aeronautical Engineering

Objectives/Outcomes

To develop an understanding of the procedures for design. Students will gain skills in designing aircraft components.

Syllabus Summary

Introduction to design; the process of aircraft design; safety and its implications; component design; structural analysis.

Reference books

Svensson Introduction to Engineering Design (UNSW Press, 1981)

Bruhn Analysis and Design of Flight Vehicle Structures (Tri-State Offset)

AERO 3401 Aerospace Design 1

4 credit points

Prerequisite: MECH 2400 Mechanical Design 1. **Prohibition:**Mutually exclusive with AERO 3400 Aircraft Design 1. **Offered:**

February. Classes: 1 lec, one 3hr tut per week. Assessment: exam, tut assignments, major and minor design projects.

Third year core unit for the degree in Aeronautical Engineering (Space Engineering)

Objectives/Outcomes

To develop an understanding of the procedures for design. Students will gain skills in designing aerospace vehicle components.

Syllabus Summary

Introduction to design; the process of aerospace design; safety and its implications; component design; structural analysis.

Reference books

Svensson Introduction to Engineering Design (UNSW Press, 1981)

Bruhn Analysis and Design of Flight Vehicle Structures (Tri-State Offset)

AERO 3450 Aircraft Design 2

3 credit points

Prerequisite: MECH 2400. **Offered:** July. Classes: (1 lec, one 3hr tut)/wk. Assessment: Exam, tut assignments, major and minor design projects.

Third year core unit of study for the degree in Aeronautical Engineering

Objectives/Outcomes

To develop an understanding of the procedures for design. Students will gain skills in designing aircraft components.

Syllabus Summary

Optimisation; design for manufacture; joints and fasteners; vibration; fatigue; human factors, the art of design; social responsibilities.

Reference books

Svensson Introduction to Engineering Design (UNSW Press, 1981)

Bruhn Analysis and Design of Flight Vehicle Structures (Tri-State Offset)

AERO 3500 Flight Mechanics 1

4 credit points

Prerequisite: AERO 2500. **Offered:** July. Classes: (3 lec, one 1hr tut/lab)/wk. Assessment: exam, assignments.

Third year core unit of study for the degree in Aeronautical Engineering

Objectives/Outcomes

To develop an understanding of dynamic behaviour of aircraft in flight. Students will gain skills in problem solving in the area of flight vehicle motion.

Syllabus Summary

Axis systems for the description of aircraft motion. Axis transformations. The general equations of flight vehicle motion.

State-Space forms of the longitudinal and lateral-directional equations of aircraft motion. Nonlinear differential equations.

Trim and perturbation equations. Linearisation about trim conditions. Linearised equations of longitudinal and lateral-directional motion.

Laplace transforms and their application to aeronautical dynamic system analysis. Eigenvalues and eigenvectors and their relation to the stability and behaviour of aeronautical systems.

Static lateral-directional equilibrium and stability. Introduction to lateral-directional control.

Linear approximation of aerodynamic derivatives and the influence of aircraft components on stability derivatives.

Longitudinal and lateral-directional dynamic stability. Frequency domain dynamic stability analysis. Time domain analysis and solutions for the flight path of a rigid body aircraft; response to control inputs.

Reference books

Etkin Dynamics of Atmospheric Flight (Wiley, 1972)

Roskam Airplane Flight Dynamics and Automatic Flight Controls (RoskamA&EC, 1979)

Nelson Flight Stability and Automatic Control (McGraw-Hill, 1989)

AERO 3501 Flying Operations

2 credit points

Prerequisite: AERO 2500, AERO 2201 or AERO 2200. Classes:

Part-week course held mid-semester vacation.

Third year elective unit of study for the degree in Aeronautical Engineering.

Objectives/Outcomes

To develop a hands on feel of the dynamic behaviour of aircraft in flight. Students will gain skills in flying, navigation and aircraft operating procedures.

Syllabus Summary

Flying instruction covering: level flight; turns; stall; take-off; landing; circuits; night flying; navigation, both visual and using instruments; emergency procedures and safety.

AERO 3600 Aviation Technology

4 credit points

Offered: July. Classes: (one 2hr lec, one 2hr/tut/lab)/wk.

Assessment: exam(50%), assignments(50%).

Third year elective unit of study for the degree in Aeronautical Engineering.

Objectives/Outcomes

To develop an understanding of the background processes that are required for the design, manufacture and operation of aircraft. Students will gain skills in aerospace component manufacture, design, testing and operation.

Syllabus Summary

Survey of current practice in aviation measurement and instrumentation. Introduction to pressure, force, velocity and displacement transducers; accelerometers; anemometers; temperature sensors and strain gauges. Use of computer data acquisition systems; signal processing; filtering; A/D conversion. Digital data formats; storage requirements and accuracy limitations. Signal postprocessing; mean; standard deviation; analysis using FFT's; random decrement. Calibration of sensors.

Manufacturing processes; automated machining; techniques for manufacture of non-metal components; manufacture using composite materials; properties of sealants and adhesives. Fasteners. Introduction to CAD and NC machining.

Aeronautical material and hardware standards. Civil aviation regulations and airworthiness directives. Aircraft weight and balance control. In-service structural integrity checking. Systems standards.

Reference books

CASA Civil Aviation Orders, parts 100 to 103.

Cutler Understanding Aircraft Structures (PSP professional, 1988)

AERO 3601 Aviation Operation and Management

3 credit points

Offered: July. Classes: (one 3hr lec/tut)/wk. This course is given by visiting lecturers who are currently associated with the aerospace industry. The availability of the course is not guaranteed each year. Assessment: assignments.

Third year elective unit of study for the degree in Aeronautical Engineering

Objectives/Outcomes

To develop an understanding of the current state of aerospace manufacturing for the Australian aviation industry. Students will gain skills in aerospace engineering management.

Syllabus Summary

Principles and practice of aviation and airline management. Discussion and analysis of airline operations. Flight safety and air-worthiness standards.

Reference books

To be advised by the Lecturer.

AERO 3700 Space Engineering 2

8 credit points

Prerequisite: AERO 2700 Space Engineering 1. **Offered:** July.

Classes: 4 lec, one 2hr tut/lab per week; site visits. **Assessment:** exam (50%), assignments(50%).

Third year core unit for the degree in Aeronautical Engineering (Space Engineering).

Objectives/ Outcomes

Students will gain skills in solving problems typically encountered in Space Engineering. An appreciation of the complexity of space vehicle design and component integration will be gained. Methods of program management to ensure absolute quality control will be shown to have paramount importance.

Syllabus Summary

Advanced spacecraft subsystems; propellant budgets, attitude control, thermal view factor calculations, nuclear generation of power, surface tension propellant tanks, sensor and actuator sizing.

Introduction to Quality Assurance; Product Assurance.

Launch vehicle design; systems and trajectory analysis. Launch site design and operation; including environmental considerations. Earth station design, staff functions, TT&C ground segment implementation. Human spaceflight; design & operational implications. Spacecraft operation and control. Space vehicle testing; theory and practice; acoustic, vibration, thermal, thermal vacuum tests.

Introduction to supersonic and hypersonic flows. Fundamentals of Gas Dynamics. Advanced orbit mechanics. Interplanetary, Molniya type orbits.

Textbooks

To be advised

AERO 4200 Aerodynamics 3

3 credit points

Prerequisite: AERO 3250. **Offered:** February. **Classes:** (2 lec, one 1 hr tut/lab)/wk. **Assessment:** 2hr exam(50%), assignments/lab reports(50%).

Fourth year core unit of study for the degree in Aeronautical Engineering

Objectives/Outcomes

To develop an understanding of modern applications of aerodynamic theory. Students will gain skills in problem solving using state of the art methods for air and fluid flows.

Syllabus Summary

Panel method techniques for the solution of inviscid two and three dimensional flows. Vortex lattice; doublet/vortex panel methods. Linearised compressibility corrections. Modelling of complete aircraft configuration.

Aerofoil section boundary layer theory; pressure gradient effects; transition from laminar to turbulent flow; laminar separation bubbles; stalled flow. Calculation of aerofoil drag using viscous/inviscid flow interaction.

Investigation of aerofoil and wing behaviour in the wind tunnel. Application of wind tunnel corrections. The effect of aspect ratio and wing sweep. Effect on wing loading of control surfaces; fuselage; tailplane. Estimate of downwash effects.

Steady two-dimensional supersonic flow; shock waves; normal and oblique; method of characteristics. Two-dimensional supersonic aerofoils. Introduction to three-dimensional effects.

Reference books

McCormick Aerodynamics,,Aeronautics and Flight Mechanics (Wiley, 1979)

Pankhurst and Holder Wind Tunnel Technique (Wiley)

Bertin and Smith Aerodynamics for Engineers (Prentice Hall 1979)

Abbott and Von Doenhoff Theory of Wing Sections (Dover 1959)

Houghton and Brock Aerodynamics for Engineering Students (Edward Arnold)

Anderson Fundamentals of Aerodynamics (McGraw-Hill, 1986)

Thompson Compressible Fluid Dynamics (McGraw-Hill)

AERO 4201 Propulsion

4 credit points

Prerequisite: MECH 3201. **Offered:** July. **Classes:** (3 lec, one 1hr tut/lab)/wk. **Assessment:** 2hr exam(50%), assignments/lab reports(50%).

Fourth year coreunit of study for the degree in Aeronautical Engineering

Objectives/Outcomes

To develop an understanding of the modern techniques used for aircraft propulsion. Students will gain skills in problem solving for aircraft propulsion systems ranging from propellers, gas-turbine engines to rockets.

Syllabus Summary

Propulsion unit requirements subsonic and supersonic flight; thrust components, efficiencies, additive drag of intakes. Piston engine components and operation. Propeller theory. Operation, components and cycle analysis of gas turbine engines; turbojets; turbofans; turboprops; ramjets. Components: compressor; fan; burner; turbine; nozzle. Efficiency of components; off-design considerations. Operation, components and thermodynamics of rocket motors. Dynamics of rocket flight; orbital velocity; staging. Future directions; minimisation of noise and pollution; sub-orbital propulsion systems; scram-jets; hybrid engines.

Reference books

McCormick Aerodynamics,,Aeronautics and Flight Mechanics (Wiley, 1979)

Glauert The Elements of Aerofoil and Airscrew Theory (C.U.P.)

Kerrebrock Aircraft Engines and Gas Turbines (MIT Press, 1977)

Archer and Salazsy Introduction to Propulsion (Prentice-Hall 1996)

AERO 4250 Aerodynamics 4

3 credit points

Prerequisite: AERO 3250. **Offered:** July. **Classes:** (2 lec, one 1hr tut/lab)/wk. **Assessment:** 2hr exam(25%), assignments/lab reports(75%).

Fourth year elective unit of study for the degree in Aeronautical Engineering

Objectives/Outcomes

To develop an understanding of modern applications of aerodynamic theory. Students will gain skills in problem solving using state of the art methods for air and fluid flows.

Syllabus Summary

Unsteady supersonic one-dimensional flow. Hypersonic flow; real gas effects.

Introduction to the use of CFD for transonic flow.

Solution of internal and external problems in aerodynamics using finite element methods. Direct simulation method (DSMC); rarefied flow; near-continuum solutions.

Reference books

Bertin and Smith Aerodynamics for Engineers (Prentice Hall 1979)

Anderson Fundamentals of Aerodynamics (McGraw-Hill, 1986)

Thompson Compressible Fluid Dynamics (McGraw-Hill)

John Gas Dynamics (Allyn and Bacon, 1984)

Bird Rarefied Gas Dynamics 2nd Ed (Oxford UP, 1995)

AERO 4290 Rotary Wing Aircraft

4 credit points

Prerequisite: AERO 3250. **Offered:** February. **Classes:** (3 lec, one 1hrut/lab)/wk. **Assessment:** course assignments and a written examination.

Fourth year elective unit of study for the degree in Aeronautical Engineering

Objectives/Outcomes

To develop an understanding of the theory of flight, design and analysis of helicopters, autogyros and other rotary wing aircraft. Students will gain an appreciation of the extra difficulties involved when the vehicle flow is cyclic in nature.

Syllabus Summary

Introduction to rotary wing aircraft; vertical flight performance; forward flight performance; blade motion and control; dynamics of rotors; rotorcraft stability; rotor blade design.

Reference books

Bramwell Helicopter Dynamics (Arnold)
Gessow and Myers Aerodynamics of the Helicopter (McMillan)

AERO 4291 Advanced Computational Aerodynamics 3 credit points

Prerequisite: AERO 3250. Offered: July. Classes: (2 lec, one 1 hr tut/lab)/wk. Assessment: course assignments.

Fourth year elective unit of study for the degree in Aeronautical Engineering

Objectives/Outcomes

To develop a specialist knowledge in the field of Computational Fluid Dynamics including an appreciation of the coding of Aerodynamics problems using these computer analysis systems.

Syllabus Summary

Explicit methods; implicit finite difference and finite volume methods. Extensions to the basic method to capture shock wave effects. Computation of one and two dimensional flows. Benchmarking of computational results against known flow solutions.

Reference books

CAJ Fletcher Computational Techniques for Fluid Dynamics Vol 1 and 2 (Springer-Verlag, 1992)

AERO 4292 Aeroelasticity

3 credit points

Prerequisite: AERO 3250. Offered: July. Classes: (2 lec, one 1 hr tut/lab)/wk. Assessment: course assignments.

Fourth year elective unit of study for the degree in Aeronautical Engineering

Objectives/Outcomes

To develop a specialist knowledge in the field of unsteady aerodynamics. The develop familiarity with the techniques for predicting airflow/structure interactions for high speed vehicles.

Syllabus Summary

Advanced two and three dimensional panel method techniques; calculation of oscillatory flow results; prediction of aerodynamic derivatives. Pressure distributions for complete aircraft configuration. Unsteady subsonic flow analysis of aircraft; calculation of structural modes. Structural response to gusts; aeroelasticity; flutter and divergence.

Reference books

Abbott and Von Doenhoff Theory of Wing Sections. (Dover, 1959)
Bertin and Smith Aerodynamics for Engineers (Prentice Hall, 1979)

Fung An Introduction to Theory of Elasticity (Dover, 1969)

AERO 4300 Aircraft Structures 3

5 credit points

Prerequisite: AERO 3350. Prohibition: AERO 4301 Applied Numerical Stress Analysis. Offered: February. Classes: (3 lec, one 1 hr tut/lab)/wk. Assessment: 2hr exam, assignments/lab reports. Fourth year core unit of study for the degree in Aeronautical Engineering.

Objectives/Outcomes

To develop an understanding of modern techniques for the estimation of structural strength. Students will gain skills in problem solving using state of the art methods in aircraft structural analysis.

Syllabus Summary

Finite element method analysis of problems in structural behaviour; elastic; static; dynamic; thermal effects; transient; non-linear. Modelling structures using one, two and three dimensional elements.

Reference books

Brush and Ahnroth Buckling of Bars, Plates and Shells (McGraw-Hill)

Cook Concepts and Applications of Finite Element Analysis (Wiley, 1981)

Cox Design of Structures of Least Weight (Pergamon, 1965)

Heubner The Finite Element Method for Engineers (Wiley Interscience)

Madag Metal Fatigue: Theory and Design (Wiley)

Roark Formulae for Stress and Strain (McGraw-Hill-Kogakusha)

Stanley Strength Analysis of Aircraft Structures (Dover)

Timoshenko and Woinowsky-Kreiger Theory of Plates and Shells (McGraw-Hill-Kogakusha)

Washizu Variational Methods in Elasticity and Plasticity (Pergamon)

ZienMewicz The Finite Element Method in Engineering (McGraw-Hill)

Library Classification: 620, 620.11, 624.17

AERO 4301 Applied Numerical Stress Analysis

6 credit points

Prerequisite: WIECH 3310 Mechanics of Solids 2. **Prohibition:**

AERO 4300 Aircraft Structures 3. **Offered:** February. **Classes:** 2 lec/wk plus prac classes. **Assessment:** one 2hr exam. Class work is assessed.

Fourth year elective unit of study.

The finite element method. Philosophy. Matrix algebra. Matrix analysis of structures. Generalisation of the finite element method in elasticity for static, dynamic and thermal analysis. Rod elements. Beams. Triangular elements for plane stress. Natural coordinate systems. Introduction to plate and shell theory. Theories and analysis in structural stability. Three dimensional elements. Modelling strategies. Isoparametric elements, accuracy and convergence. Applications of finite element modelling in solid mechanics. Practical modelling of real structures will be done; a 'hands-on' approach will be taken.

Reference book

Cook Concepts and Applications of Finite Element Analysis (Wiley, 1989)

AERO 4302 Aerospace Structures 3

5 credit points

Prerequisite: AERO 3351 Aerospace Structures 1. **Prohibition:**

Mutually Exclusive with AERO 4301 Applied Numerical Stress Analysis; AERO 4300 Aircraft Structures 3. **Offered:** February. **Classes:** 3 lec, one 1 hr tut/lab per week. **Assessment:** 2hr exam, assignments/lab reports.

Fourth year core unit for the degree in Aeronautical Engineering (Space Engineering).

Objectives/Outcomes

To develop an understanding of modern techniques for the estimation of structural strength. Students will gain skills in problem solving using state of the art methods in aerospace structural analysis.

Syllabus Summary

Finite element method analysis of problems in structural behaviour; elastic; static; dynamic; thermal effects; transient; non-linear. Modelling structures using one, two and three dimensional elements.

Reference books

Brush and Almroth Buckling of Bars, Plates and Shells (McGraw-Hill)

Cook Concepts and Applications of Finite Element Analysis (Wiley, 1981)

Cox Design of Structures of Least Weight (Pergamon, 1965)

Heubner The Finite Element Method for Engineers (Wiley Interscience)

Madag Metal Fatigue: Theory and Design (Wiley)

Roark Formulae for Stress and Strain (McGraw-Hill-Kogakusha)

Stanley Strength Analysis of Aircraft Structures (Dover)

Timoshenko and Woinowsky-Kreiger Theory of Plates and Shells (McGraw-Hill-Kogakusha)

Washizu Variational Methods in Elasticity and Plasticity (Pergamon)

ZienMewicz The Finite Element Method in Engineering (McGraw-Hill)

AERO 4350 Aircraft Structures 4

3 credit points

Prerequisite: AERO 3350. **Prohibition:** AERO 4301 Applied Numerical Stress Analysis. **Offered:** July. **Classes:** (3 lec, one 1hr tut/lab)/wk. **Assessment:** 2hr exam, assignments/lab reports. Fourth year elective unit of study for the degree in Aeronautical Engineering

Objectives/Outcomes

To develop an understanding of modern techniques for the estimation of structural strength. Students will gain skills in problem solving using state of the art methods in aircraft structural analysis.

Syllabus Summary

Plates and shells. Optimum structures. Buckling of Bars, plates and shells; imperfection sensitivity. Structural dynamics. Structural fatigue; principles and practice.

Reference books

Brush and Almroth Buckling of Bars, Plates and Shells (McGraw-Hill)

Cook Concepts and Applications of Finite Element Analysis (Wiley, 1981)

Cox Design of Structures of Least Weight (Pergamon, 1965)

Heubner The Finite Element Method for Engineers (Wiley Interscience)

Madag Metal Fatigue: Theory and Design (Wiley)

Roark Formulae for Stress and Strain (McGraw-Hill-Kogakusha)

Stanley Strength Analysis of Aircraft Structures (Dover)

Timoshenko and Woinowsky-Kreiger Theory of Plates and Shells (McGraw-Hill-Kogakusha)

Washizu Variational Methods in Elasticity and Plasticity (Pergamon)

Zienkiewicz The Finite Element Method in Engineering (McGraw-Hill)

Library Classification:
620,620.11,624.17

AERO 4351 Aerospace Structures 4

3 credit points

Prerequisite: AERO 3351 Aerospace Structures 2. **Prohibition:** Mutually Exclusive with AERO 4350 Aircraft Structures 4. **Offered:** July. **Classes:** 2 lec, one 1 hr tut/lab)/wk. **Assessment:** 2hrexam, assignments/lab reports.

Fourth year core unit for the degree in Aeronautical Engineering (Space Engineering).

Objectives/Outcomes

To develop an understanding of modern techniques for the estimation of structural strength. Students will gain skills in problem solving using state of the art methods in aerospace structural analysis.

Syllabus Summary

Plates and shells. Optimum structures. Buckling of Bars, plates and shells; imperfection sensitivity. Structural dynamics. Structural fatigue; principles and practice.

Reference books

Brush and Almroth Buckling of Bars, Plates and Shells (McGraw-Hill)

Cook Concepts and Applications of Finite Element Analysis (Wiley, 1981)

Cox Design of Structures of Least Weight (Pergamon, 1965)

Heubner The Finite Element Method for Engineers (Wiley Interscience)

Madag Metal Fatigue: Theory and Design (Wiley)

Roark Formulae for Stress and Strain (McGraw-Hill-Kogakusha)

Stanley Strength Analysis of Aircraft Structures (Dover)

Timoshenko and Woinowsky-Kreiger Theory of Plates and Shells (McGraw-Hill-Kogakusha)

Washizu Variational Methods in Elasticity and Plasticity (Pergamon)

Zienkiewicz The Finite Element Method in Engineering (McGraw-Hill)

AERO 4390 Smart Materials and Structures

3 credit points

Prerequisite: AERO 3350 Aircraft Structures 2 or AERO 3351 Aerospace Structures 2. **Offered:** July. **Classes:** 2 lec, 1 hr tut/lab per week. **Assessment:** 2 hr exam, assignments/lab reports.

Fourth year elective unit for the degree in Aeronautical Engineering.

Objectives/Outcomes

To develop an understanding of the modern smart materials and structures technologies. Students will gain an appreciation of the advanced technology components: sensors, actuators, and central process unit, in the implementation of Smart Structures System.

Syllabus Summary

Smart materials (Piezoelectricity, SMA, ER/MR Fluids, Magnetostriction, Electrostriction, MEMS), Modeling single/dual piezoelectric actuation of beams and plates (Surface bonded or embedded actuators; Block force/Uniform strain/Bernoulli-Euler models; Bending/torsion models with skewed actuators); Vibration Control; Contra Schemes (single channel feedback/feed-forward control, digital filters, adaptive controllers); MEMS; Fiber Optics; Composite structures; Structural health monitoring/damage detection (Damage detection methods, vibration signature analysis for fault detection, damage classification, case study).

AERO 4400 Aircraft Design 3

6 credit points

Prerequisite: AERO 3450. **Offered:** February. **Classes:** (1 lec, one 3hr design class)/wk. **Assessment:** Design projects.

Fourth year core unit of study for the degree in Aeronautical Engineering

Objectives/Outcomes

To develop an understanding of the application of design to the modern aerospace industry. Students will gain an overview of how to manage a design team and will also gain skills in carrying out detailed design problems.

Syllabus Summary

Design requirements. Sources of information for aircraft design. Configuration design: performance, weight and balance, propulsion. Aerodynamic design: lift, drag and control. Structural design: loads, materials. Philosophies of design and analysis.

System design: requirements and specification. System design procedures, systems integration.

Reference books

Torenbeek Synthesis of Subsonic Airplane Design (Delft UP)

Roskam Airplane Design (Roskam A&EC)

AERO 4490 Advanced Aircraft Design

4 credit points

Prerequisite: AERO 3450. **Offered:** July. **Classes:** (one 3hr design class)/wk. **Assessment:** Design projects.

Fourth year elective unit of study for the degree in Aeronautical Engineering

Objectives/Outcomes

To develop an understanding of the application of design to the modern aerospace industry. Students will gain an overview of how to manage a design team and will also gain skills in carrying out detailed design problems.

Syllabus Summary

Advanced design methods. Methods of processing information for aircraft design. Detailed configuration design: performance, weight and balance, propulsion. Aerodynamic design: lift, drag and control. Advanced structural design: loads, materials. Weight estimation and fulfilling of regulatory requirements.

Advanced system design: modern aircraft requirements and specification. Glass cockpit design, systems integration and validation.

Reference books

Torenbeek Synthesis of Subsonic Airplane Design (Delft UP)

Roskam Airplane Design (Roskam A&EC)

AERO 4500 Flight Mechanics 2

6 credit points

Prerequisite: AERO 3500. **Offered:** February. **Classes:** (4 lec, 1 tut)/wk.

Fourth year Core unit of study for the degree in Aeronautical Engineering.

Objectives/Outcomes

To develop an understanding of the application of flight mechanics to modern aircraft systems. Students will gain skills in problem solving in the areas of dynamic aircraft behaviour, control systems and aircraft handling.

Syllabus Summary

Sources of flight dynamic modelling data.

Dynamic systems analysis techniques. Modelling and analysis of aircraft dynamic motions. Effects of inertial coupling between longitudinal and lateral-directional degrees of freedom. Gyroscopic motion.

Aircraft response to deterministic and stochastic inputs. Extended aircraft models. Sources of stochastic inputs and their characteristics.

Mechanics and models of aircraft control systems, sensors, components and devices. Motion measurement, signal analysis and conditioning.

Applications of closed loop control; modification of aircraft dynamic characteristics, stability and handling; guidance, manoeuvre control and navigation. Reference input signal characteristics and design. Transient response to control inputs.

Transfer functions for complete aircraft and control systems; stability and response characteristics of the closed loop system. Aircraft handling qualities description, specification and modification.

Reference Books

Etkin Dynamics of Atmospheric Flight (Wiley, 1972)

Roskam Airplane Flight Dynamics and Automatic Flight Controls (RoskamA&EC, 1979)

D'Azzo and Houpis Linear Control System Analysis and Design: Conventional and Modern (McGraw-Hill, 1995)

AERO 4590 Advanced Flight Mechanics

3 credit points

Prerequisite: AERO 3500. Offered: July. Classes: (2 lec, 1 tut)/wk. Fourth year elective unit of study.

Objectives/Outcomes

To develop an understanding of the application of flight mechanics and control systems to modern aircraft. Students will gain skills in problem solving in the areas of dynamic aircraft behaviour, control systems and aircraft handling.

Syllabus Summary

Overview of aircraft dynamic system modelling.

Identification of dynamic systems. Model structure. Introduction to parameter estimation techniques. Application to estimation of aircraft static, dynamic and control derivatives.

Aircraft state estimation. State estimation in the presence of noise and modelling errors. Introduction to Kalman filtering.

Overview of applications of digital flight control systems. Review of classical continuous system controller characteristics and control system design. Discretised dynamic system characteristics. Controllability and observability. Modern control techniques and their application to guidance, control, navigation and structural-dynamic control problems. Common control system design software.

Reference Books

Stevens and Lewis Aircraft Control and Simulation (Wiley, 1992)

Roskam Airplane Flight Dynamics and Automatic Flight Controls (RoskamA&EC, 1979)

D'Azzo and Houpis Linear Control System Analysis and Design: Conventional and Modern (McGraw-Hill, 1995)

AERO 4600 Practical Experience

0 credit points

Offered: July. **Classes:** 12 weeks of prac work experience.

Fourth year core unit of study for the degree in Aeronautical Engineering.

Objectives/Outcomes

To develop skills in the application of engineering theory to real industry situations. To gain experience in the actual practice of engineering.

Syllabus Summary

Each student is required to work as an employee of an approved engineering organisation and to submit a satisfactory written

report of his or her work. Normally 12 weeks of practical work experience (375 hours minimum) is required and this is undertaken after the completion of some or all of the prescribed Senior core courses and before enrolment in the final year of study. The University Careers and Appointments Service is available to assist students to obtain suitable employment.

AERO 4620 Aeronautical International Exchange Program

24 credit points

Prerequisite: Completion of all first, second and third year core units of study in Aeronautical Engineering. Approval by Head of Department of Aeronautical Engineering. **Assessment:** Individual units of study at an overseas university participating in an aeronautical exchange program are assessed and a weighted average mark will be calculated from this to obtain an assessment. Fourth year alternative core course for the degree in Aeronautical Engineering.

Objectives/Outcomes

The object of this exchange program is to give students the opportunity to study in a different cultural environment for one semester. Students will gain an understanding of the differences in technique applied in the aeronautical industry in other parts of the world. Many aerospace developments are being initiated by groups in North America or Europe and this exchange program will allow Australian students to be involved in these new areas.

Exchange Program Summary

Students spend one semester at an overseas university that is part of the approved exchange program in aerospace engineering. The course work completed at the exchange university is to be equivalent to one semester at University of Sydney. Units of study must be at the advanced undergraduate level commensurate with core units of study in the fourth year aeronautical engineering program. The specific units of study must be approved by heads of department at both institutions. A recommended subject is Thesis or Design Project and students are encouraged to undertake work experience within the overseas industry where this is possible.

For details of overseas universities participating in this exchange program, contact the head of department of aeronautical engineering.

AERO 4700 Space Engineering 3

4 credit points

Prerequisite: AERO 3700 Space Engineering 2. **Offered:** February.

Classes: 3 lec, one 1 hr tut/lab per week. **Assessment:** exam (50%), assignments(50%).

Fourth year core unit for the degree in Aeronautical Engineering (Space Engineering).

Objectives/ Outcomes

Students will gain an appreciation of the advanced technology components required in the implementation of Aerospace Engineering. They will gain an understanding of the possibilities and future directions of these emerging technologies.

Syllabus Summary

Advanced spacecraft subsystems and design; redundancy philosophies; flight computers; magnetic torquing; star tracking. Advanced launch systems; Reuseable, Single Stage To Orbit, nuclear propulsion, mass drivers. Advanced orbit mechanics; gravity assist trajectories and other interplanetary strategies, Lagrange points, Halo orbits, gravitational models etc.

Launch vehicle selection and payload integration; coupled analysis.

Re-entry vehicle design, including application of super/hypersonic flow. An introduction to rarefied gas dynamics.

Advanced space propulsion systems; solar sailing, electric propulsion, pulsed nuclear, antimatter. Space navigation systems; GPS; GLONASS. Space based communications system architecture (GEO, LEO, MEO systems)

Project Management; Schedule, cost control, proposals, bid structure, personnel management, systems engineering, ISO 900X and other relevant standards.

Basic Space Law and legislative issues; The Outer Space Treaty, The Space Activities Act.

Textbooks

To be advised

AERO 4900 Thesis or Design Project

10 credit points

Prerequisite: 40 credit points of Senior Subjects. **Offered:** Full Year (starts Feb). **Classes:** Literature survey, design, expt and/or analysis work over whole year. **Assessment:** A bound thesis document is to be submitted for assessment.

Fourth year core unit of study for the degree in Aeronautical Engineering.

Objectives/Outcomes

To develop an understanding of the practice of aeronautical engineering. Students will gain skills in design, analysis and management by undertaking a significant research project.

Each student is required to conduct one piece of experimental, theoretical or design work in greater detail than is possible in ordinary classes and to write a thesis presenting the results of these investigations.

The student is expected to design and construct (where possible) any special piece of apparatus or model that may be necessary.

AERO 4920 Seminar

2 credit points

Prerequisite: 40 credit points of Senior Subjects. **Offered:** July. **Classes:** A mini-conference held at the end of a week midway through the semester. **Assessment:** Oral presentation evaluated by peers and staff.

Fourth year core unit of study for the degree in Aeronautical Engineering.

Objectives/Outcomes

To develop skills in the presentation of engineering ideas. To gain skills in communication.

Each student is required to present a seminar on a selected topic. Students are also expected to take part in the discussion sessions following each presentation.

Chemical Engineering

CHNG 1001 Chemical Engineering Applications

4 credit points

Offered: February. **Classes:** One (2 hr) lecture/tutorial per week plus one (3 hr) laboratory or plant visit per week for one semester.

Assessment: Laboratory reports (30%), industrial visits (10%), lecture reports (15%), final examination (45%).

First year core unit of study for the degree in Chemical Engineering.

What Is Chemical Engineering? Obtain some overview of Chemical Engineering; of the process industries in Australia; of what chemical engineers do and the challenges they face. Meet some Chemical Engineers.

Laboratory

Find out about the construction, methods of fabrication, selection of materials of construction, and the operation of common chemical process plant hardware; giving attention to the importance of costs, safety, operability and reliability. Learn about the key steps in engineering communication.

Industrial Practice

Understand how chemical engineering works in practice by seeing what real plants and their equipment look like, what these plants do, and why. Student will develop skills in equipment handling; in communication, written and oral; in individual and group working; in peer assessment.

Syllabus Summary

(a) What is chemical engineering? A survey of the nature of chemical engineering, of the nature of the Australian process industries, and of the main professional activities of chemical engineers. Lectures are given by invited speakers from government, industry and academia. Visits to works in the Sydney region are undertaken with tutorial exercises based on these visits.

(b) Chemical engineering applications laboratory. An appreciation of (i) the methods and materials of construction of items of process equipment, (ii) the role of this equipment in building

up an entire chemical processing plant, (iii) its operation and maintenance and (iv) safety requirements and procedures. Students will dismantle, reassemble and operate items of process equipment. They will present written answers to questions, supplemented by drawings of process flowsheets, diagrams of dismantled equipment, and discussions of heat and mass balances and of process parameter values.

CHNG 1101 Chemical Engineering 1A

4 credit points

Offered: February. **Classes:** Two (1hr) lectures; plus one (2 hr) tutorial per week for one semester. **Assessment:** One 3hr exam at end of semester plus continuous assessment of assignments.

First year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

This is a first unit in chemical engineering calculations. It aims to teach students how they should formulate and solve mass balances on chemical process systems. It also introduces students to introductory flowsheet analysis.

Syllabus

The unit consists of a series of tutorial exercises by which students are exposed to a range of typical problems on process systems; and then some larger projects which allow students to apply the approaches and procedures that they have learned to more realistic and complex applications.

The lectures introduce and complement the tutorials. Topics covered in the lectures include: unit systems and unit conversion; properties of fluids; mass balance calculations on flow systems; combustion processes; calculation of equilibrium compositions of reacting systems; vapour pressure and humidity.

CHNG 1102 Chemical Engineering 1B

4 credit points

Prerequisite: CHNG 1101 Chemical Engineering 1A. **Offered:** July. **Classes:** 2 hours of lectures, 3 hours of tutorials per week.

Assessment: Assignments; final examination.

First year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

This is a first unit in chemical engineering calculations. It aims to teach students how they should formulate and solve energy balances on chemical process systems.

It completes the analysis of typical industrial flowsheets by including both mass and energy balances.

Syllabus

The unit consists of a series of tutorial exercises by which students are exposed to a range of typical problems on process systems; and then some larger projects which allow students to apply the approaches and procedures that they have learned to more realistic and complex applications.

The lectures introduce and complement the tutorials. In addition, the lectures cover the following topics: the First Law of Thermodynamics applied to flow systems; thermodynamic properties: enthalpy, internal energy, heat capacities; calculations for ideal gas and liquid systems; thermochemistry; adiabatic flame temperature; equilibrium in adiabatic reactors; heats of solution and mixing.

CHNG 1201 Chemical Process Case Studies

4 credit points

Offered: July. **Classes:** 4 hours of lectures / tutorials per week for one semester. **Assessment:** Tutorials, assignments, final examination.

First year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop an understanding of:

- The chemistry of industrial processes.
- The economic aspects of the industry.
- Process flowsheets.
- Modern environmental concerns.

Syllabus Summary

An introduction to the major processes of the modern chemical industry. An overview of the process chemistry involved, the

process flowsheet, together with design, control and optimisation needs. The economic and environmental constraints that shape the industry. The case study format will be used to develop a number of professional skills in the student - team work, use of library and computer resources and presentation skills.

CHNG 1301 Computing for Chemical Engineers

4 credit points

Offered: February. **Classes:** One (1 hr) lecture and one (2 hr) tutorial per week for one semester. **Assessment:** Tutorial assessment and a final examination.

First year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop a basic understanding of personal computers and their use in solving engineering problems.

Syllabus Summary

Introduction to personal computers. Use of spreadsheet packages for carrying out data manipulation, numerical calculations and graphing. Application to chemical engineering problems.

CHNG 2101 Chemical Engineering 2A

4 credit points

Offered: February. **Classes:** Two lectures and one tutorial per week; three laboratory sessions in total. **Assessment:** Laboratory reports; project reports; final examination.

Second year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

This unit seeks to introduce students to basic concepts of fluids handling relevant to the process industries. Students will meet simple equipment design problems in this area and will apply their understanding to measurements and analysis of laboratory plant. Satisfactory completion of the course will prepare students for more advanced courses in fluids and in the integration of fluid flow with heat and mass transfer.

Students will develop generic skills in:

- technical problem solving
- scaling and thinking non-dimensionally
- operating and analysing process plant.

Syllabus Summary

Fluid statics - applications to pressure measurement; forces on storage vessels. Inviscid flow theory - Bernoulli's equation; flow friction; flow measurement. Laminar flow - force balance; analytical solutions for velocity profile. Turbulent flow - dimensional analysis, friction factor. Pumping - ideal pumps; pump selection; net positive suction head. Pipe networks.

CHNG 2102 Chemical Engineering 2B

4 credit points

Offered: July. **Classes:** Two lectures and one tutorial per week; three laboratory sessions in total. **Assessment:** Laboratory reports; project reports; design competition; final written examination.

Second year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

This unit seeks to introduce students to basic concepts of how heat energy is transferred, especially to and from fluids; similarly the concept of mass transfer and its conceptual relationship to heat transfer is introduced. This unit introduces the concept of chemical engineering rate processes and their importance in selecting and designing process equipment; students will meet simple equipment design problems in this area and will develop their understanding through measurements and analysis of laboratory plant. Satisfactory completion of the course will prepare students for more advanced courses in fluids and in the integration of fluid flow with heat and mass transfer. A light-hearted design exercise brings the student body together, encouraging them to apply their understanding to unusual problems and to think laterally.

Students will develop generic skills in:

- technical problem solving
- scaling and thinking non-dimensionally
- operating and analysing process plant
- working in small groups on unusual problems.

Syllabus Summary

Heat transfer: Conduction; convection - the heat transfer coefficient, dimensional analysis. Correlations for pipe flow, external flows, natural convection. The overall heat transfer coefficient. Simple heat exchangers.

Mass Transfer: Diffusion; convection - the mass transfer coefficient, dimensional analysis, analogy with heat transfer. Correlations. The overall mass transfer coefficient. Mass transfer in dilute absorbers. Simultaneous heat and mass transfer.

CHNG 2301 Chemical Engineering Computations

4 credit points

Prerequisite: Maths 1001,1002,1003,1005 CHNG 1301. **Offered:** July. **Classes:** 4hrs lec & tut/wk. **Assessment:** Tutorials, assignments and one final examination.

Second year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop an understanding of:

- Chemical engineering problem analysis.
 - Computational techniques in problem solving.
 - Software applications.
- Students will develop skills in:
- Using computers.
 - Solving engineering problems.
 - Developing and using computer software.

Syllabus Summary

The need and role of numerical computations in chemical engineering. Solving linear and nonlinear algebraic equations. Curve-fitting and interpolation of data. Numerical differentiation and integration. Solution of ordinary differential equations. Principles of optimisation. Use of software packages. Review and extension of first-year statistics and computing with an emphasis on chemical engineering applications.

CHNG 2302 Process Data Management

4 credit points

Offered: February. **Classes:** 4 hrs/week of lectures and tutorials for one semester. **Assessment:** Tutorial assignments and a final examination.

Year 2 elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

It is expected that students will understand the basic principles of statistical data analysis and usage.

Syllabus Summary

Data gathering and uses; data quality; data filtering; frequency distributions; averages and measures of dispersion; statistical inference; hypothesis testing; analysis of variance; least-squares fitting; linear regression; data reconciliation; control charts; statistical software packages.

CHNG 2501 Sustainable Development

4 credit points

Offered: February. **Classes:** Two (1 hr) lectures and one (1 hr) tutorial per week for one semester. **Assessment:** Tutorial assignments (both individually and in small groups) and two projects.

Second year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

- To develop an awareness of the various concepts which underpin sustainable development;
- To explore the role of chemical and process engineers in promoting sustainable development;
- To explore tools and approaches for quantifying industry's environmental performance.

Syllabus Summary

- Sustainability - its biophysical, economic and social dimensions;
- A thermodynamic analysis of the industrial economy;
- Industry's "triple bottom line" accountability;
- Environmental resource management - air, water, and land pollution;
- Australian industry and sustainability;

- Industry case studies - successes and failures.

CHNG 2502 Clean Products and Processes

4 credit points

Prerequisite: CHNG 2501. **Offered:** July. **Classes:** Two (1 hr) lectures and one (1 hr) tutorial per week for one semester.

Assessment: Tutorial assignments (both individually and in small groups) and two projects.

Year 2 core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

- To develop a systems analysis view of industry's environmental performance;
- To distinguish between "cleaner technology" and "clean-up" technology;
- To develop tools and approaches for the design of cleaner processes.

Syllabus Summary

- Limitations of clean-up technologies;
- From products to processes to services;
- Cleaner technology, Life Cycle Assessment and industrial ecology;
- Waste minimisation hierarchy;
- Process synthesis with environmental objectives;
- Design for sustainability - micro and macro dimensions;
- Case studies: (a) resource industries; (b) chemical and process industries; (c) small and medium scale industries.

CHNG 2601 Materials and Corrosion

4 credit points

Offered: July. **Classes:** 2hr of lec & tut/wk. **Assessment:** One 2hr exam.

Third year core unit for the degree in Chemical Engineering.

Syllabus summary

The major forms of corrosion and the mechanisms by which they occur. Aqueous corrosion. Chemical and electrochemical thermo-dynamics of corrosion, stability diagrams. Electrode kinetics. Polarisation. Application to corrosion kinetics. Passivation. Corrosion types protection and case studies. Materials selection and design. High temperature corrosion and oxidation.

Textbooks

Fontana Corrosion Engineering 3rd edn (McGraw-Hill, 1986)

Reference books

Uhlig and Revie Corrosion and Common Control 3rd edn (Wiley, 1985)

Pourbaix Atlas of Electrochemical Equilibria in Aqueous Solutions (NACE, 1974)

CHNG 2701 Fundamentals of Bioprocess Engineering 1

4 credit points

Prerequisite: CHEM 1101 CHEM 1201. **Offered:** February. **Classes:** one lecture per week and two tutorial/project/lab sessions per week for one semester. **Assessment:** Tutorials 35% projects 35% and final examination 30%.

Objectives

To understand the major metabolic pathways of the cell.

- To understand the role of biochemistry in Biochemical Engineering.
- To understand how chemical engineering fundamentals are relevant to the study of biochemistry.

Syllabus

Major macromolecules of the cell: carbohydrates, proteins, lipids, nucleic acids.

- Enzymes: structure and function, enzyme kinetics, enzyme recovery and purification.
- Major metabolic pathways: carbohydrate metabolism, citric acid cycle, lipid metabolism, oxidative phosphorylation, nitrogen metabolism.

Textbooks

Biochemistry, L. Stryer 4th edition, WH Freeman and Co. NY

CHNG 2702 Fundamentals of Bioprocess Engineering 2

4 credit points

Prerequisite: CHEM 1101 CHEM 1201. **Offered:** July. **Classes:** one lecture and two tutorial/project/labs per week for one semester. **Assessment:** Laboratory 35% projects 35% and final examination 30%.

Second year elective unit of study for the degree in Chemical Engineering.

Objectives

To study practical aspects of the application of biochemistry to industrial processes.

Syllabus

Molecular biology basic concepts; Introduction to Immunology; Biochemistry and medicine.

Laboratory projects

Enzyme reactions, Protein separation, Electrophoresis, Chromatography.

Textbooks

Biochemistry L. Stryer 4th Ed- WH. Freeman and Co, NY.

CHNG 3001 Chemical Engineering Laboratory

4 credit points

Prerequisite: CHNG 2101 Chemical Engineering 2A; CHNG 2102 Chemical Engineering 2B. **Offered:** February. **Classes:** Laboratory sessions as scheduled. **Assessment:** Written laboratory reports (including skills assessment in planning and executing experiments) and oral presentation of work.

Third year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop skills in the following:

- the planning and conducting of laboratory-scale experiments.
- report writing and oral presentations.

Syllabus Summary

This laboratory course complements the various "Unit Operations" courses in 3rd Year.

As part of the preparation for any experiment, a student will be expected to undertake the following:

- become familiar with the background theory
- understand the operation of the experimental apparatus
- define the experimental aim, the range of measurements to be made and how these measurements will be processed.

Considerable importance is attached to the analysis and interpretation of the experimental data and to the writing of a clear, logical and concise technical report.

CHNG 3041 Year 3 Exchange Program A

24 credit points

Prerequisite: Completion of all Year 1 and 2 core units of study in Chemical Engineering, and at least 96 credit points towards the degree. Approval of the Heads of Department of Chemical Engineering at the University of Sydney and the host institution.

Offered: February. **Assessment:** Individual approved subjects at the host institution are assessed according to their standard procedures and a composite mark is derived from the weighted average of those assessments.

Year 3 elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

The objective of this (single semester) Exchange Program is to provide students with the opportunity to live and learn in a foreign culture while completing the academic and professional requirements of the University of Sydney degree program.

Upon completion of the full year-long exchange (ie both CHNG 3041 and 3042), students will have completed work at least equivalent to Year 3 in the Chemical Engineering degree, including in particular all Year 3 units of study.

CHNG 3042 Year 3 Exchange Program B

24 credit points

Prerequisite: Completion of all Year 1 and 2 core units of study in Chemical Engineering, and at least 96 credit points towards the degree. Approval of the Heads of Department of Chemical Engineering at the University of Sydney and the host institution.

Offered: July. **Assessment:** Individual approved subjects at the host institution are assessed according to their standard procedures and a composite mark is derived from the weighted average of those assessments.

Year 3 elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

The objective of this (single semester) Exchange Program is to provide students with the opportunity to live and learn in a foreign culture while completing the academic and professional requirements of the University of Sydney degree program.

Upon completion of the full year-long exchange (ie both CHNG 3041 and 3042), students will have completed work at least equivalent to Year 3 in the Chemical Engineering degree, including in particular all Year 3 units of study.

CHNG 3101 Unit Operations (Heat Transfer)

4 credit points

Prerequisite: CHNG 2101 Chemical Engineering 2A; CHNG 2102 Chemical Engineering 2B. **Offered:** February. **Classes:** One (1 hr) lecture and one (2 hr) tutorial per week for one semester.

Assessment: Tutorial work, project report, and a final examination. Third year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop an understanding of how basic heat-transfer theory is applied to the performance analysis and design of heat-transfer equipment.

Syllabus Summary

Revision of overall heat-transfer coefficient. Fouling factors. Heat exchanger performance analysis and effectiveness - NTU approach. Design and rating problems. Plate and frame heat exchangers. Shell-and-tube heat exchangers: 1-2, 2-¹- contacting schemes. Thermal analysis. Estimation of heat-transfer rates and pressure drop. Practical considerations in design and selection. Condensation heat-transfer mechanisms. Nusselt analysis. Correlations. Design and practical applications. Boiling heat-transfer mechanisms. Nucleate and flow boiling. Evaporators and reboilers. Radiation fundamentals. Black and non-black radiation and absorption. Radiation interchange between black and grey bodies. Electrical analogies. Reradiating surfaces. Gas radiation. Furnace calculations.

CHNG 3102 Unit Operations (Mass Transfer)

4 credit points

Prerequisite: CHNG 2101 Chemical Engineering 2A; CHNG 2102 Chemical Engineering 2B. **Offered:** February. **Classes:** Two (1 hr) lectures and one (1 hr) tutorial per week for one semester.

Assessment: Tutorial assignments (both individually and in small groups) and a final examination.

Third year core unit of study for the degree in Chemical Engineering.

Objectives

To develop an appreciation of several industrially important mass transfer operations (such as drying, distillation, gas absorption and extraction).

To be able to analyse and design equipment used for such mass transfer operations.

Syllabus Summary

The industrial importance of mass transfer operations. Mass transfer as an equilibrium stage process. Vapour-liquid equilibrium (ideal and non-ideal), x-y and T-x-y diagrams. Flash distillation. Analysis and design of binary distillation columns as equilibrium stage processes. McCabe-Thiele diagrams. Analysis and design of other mass transfer operations (such as gas absorption) as equilibrium stage processes. Computer-based physical property packages and mass transfer calculations.

CHNG 3103 Unit Operations (Particle Mechanics)

4 credit points

Prerequisite: CHNG 2101 Chemical Engineering 2A; CHNG 2102 Chemical Engineering 2B. **Offered:** July. **Classes:** Three (1 hr) lectures/tutorials per week for one semester. **Assessment:** Assignments, and a final examination.

Third year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop an understanding of the following:

- The characteristics of particles.
- The processing of particulate systems.

Syllabus Summary

Introduction to particulate systems, particle size and shape parameters, size distributions and statistical properties, test sieve analysis. Screening, particle-screen mechanics, efficiency of screening. Size reduction, energy requirements, classical laws, product size distribution. Motion of a particle in a fluid, terminal velocity, hindered settling. Phase separations, classification, elutriation, thickening, cyclones, centrifuging. Motion of fluids in particle beds, filtration, filters.

CHNG 3104 Unit Operations (Fluid Mechanics)

4 credit points

Prerequisite: CHNG 2101 Chemical Engineering 2A; CHNG 2102 Chemical Engineering 2B. **Offered:** July. **Classes:** Four hours of lectures and tutorials per week for one semester. **Assessment:** Tutorial assignments and final examination.

Third year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop an understanding of:

- non-Newtonian flows
 - compressible fluid flow
 - other fluid flows.
- Students will develop skills in:
- solving problems in non-Newtonian flow
 - solving problems in compressible fluid flow
 - understanding the unusual phenomena in some non-Newtonian and compressible flow situations
 - designing power inputs to agitated vessels.

Syllabus Summary

Non-Newtonian fluids. Models of non-Newtonian fluids; power law fluids, Bingham plastics, "velocity distribution and pressure drop in pipes. Compressible flow in nozzles and pipes. Isothermal and adiabatic flow; critical pressure conditions. Maximum flow through nozzles and pipes. Maximum entropy and Mach number, shock waves. Two-phase flow, flow regimes, calculation of pressure drop in pipes. Mixing in agitated vessels. Turbine power characteristics in tanks.

CHNG 3105 Thermodynamics 1

4 credit points

Prerequisite: CHNG 2101 Chemical Engineering 2A; CHNG 2102 Chemical Engineering 2B. **Offered:** February. **Classes:** Two (1hr) lectures plus one (1 hr) tutorial per week for one semester.

Assessment: Assignments; final examination.

Third year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

The major objectives are:

- (i) To perform energy analyses of process flowsheets.
- (ii) To estimate the thermodynamic properties of fluids.

Specifically, this involves solving the energy equation for equipment items such as: valves, pumps, compressors, turbines, heaters and coolers, reactors and burners; and for flowsheets and cycles made up of those equipment items.

Syllabus

First and second laws of Thermodynamics; thermodynamic properties: enthalpy, internal energy, entropy, exergy. Applications in the analysis of typical energy intensive processes: heat engines; refrigeration cycles; liquefaction processes; compressible flow.

Estimation of thermodynamic properties of pure components, using (i) first-order fluid models, (ii) charts and tables, and (iii) equations of state. P-V-T relationships for real gases; methods based on the principle of corresponding states; 2- and 3-parameter equations of state; the fundamental property relationships; calculation of residual enthalpies and entropies using volume-explicit equations of state (e.g. the virial equation in volume-

explicit form); application of pressure-explicit equations of state in computer methods for property prediction.

CHNG 3106 Thermodynamics 2

4 credit points

Prerequisite: CHNG 3105 Thermodynamics 1. **Offered:** July.

Classes: Two (1 hr) lectures plus one (1 hr) tutorial per week for one semester. **Assessment:** Assignments; final examination.

Third year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

The major objectives are:

(i) To understand the theoretical basis for equilibrium in multiphase systems and reacting systems.

(ii) To introduce the thermodynamic concepts: chemical potential, fugacity, activity, and excess properties.

(iii) To predict the behaviour and compositions of liquids and vapours in equilibrium.

(iv) To predict the composition of systems in chemical equilibrium.

Syllabus

Criteria for equilibrium. Extension of the fundamental property relationship to multicomponent systems. Thermodynamic properties: Gibbs Free Energy, chemical potential, fugacity; calculation of fugacities of pure components from equations of state. Clausius-Clapeyron equation.

Phase equilibrium: Equilibrium diagrams for low pressure ideal and non-ideal solutions; equilibrium diagrams for high pressure systems; calculation of dew points, bubble points; isothermal and adiabatic flash. Estimation of K-values using: ideal solution fugacities, activity coefficients, chart data. Basis of computer methods for calculating K-values.

Solution properties: Liquid models; partial molal properties; excess properties; activity coefficients. Stability of liquid solutions.

Chemical equilibrium: Calculation of chemical equilibrium constants from thermodynamic data (enthalpies and free energies of formation). Calculation of equilibrium compositions and conversion for homogeneous and heterogeneous systems.

CHNG 3107 Reaction Engineering 1

4 credit points

Offered: July. **Classes:** Three hours per week of scheduled group work; occasional lectures. **Assessment:** Two projects and interviews; final written examination.

Third year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

The technical objective in this course is to develop students' understanding in basic design considerations for chemical reactor design, and in carrying out the necessary design calculations.

Students will develop generic skills in:

- tackling open-ended problems requiring a synthesis of material learned previously with new learning;
- working cooperatively in self-managed groups;
- application of computational techniques to unfamiliar problems.

Syllabus Summary

Homogeneous and heterogeneous reaction kinetics; development of rate laws. Methods for analysis and interpretation of reaction rate data. Volume change effects. Steady-state behaviour of isothermal ideal reactors: batch; plug flow; continuous stirred tank; packed-bed reactors for catalysed reactions.

CHNG 3301 Process Modelling

4 credit points

Prerequisite: CHNG 2301 Chemical Engineering Computations.

Offered: February. **Classes:** Two (1 hr) lectures and one (1 hr) tutorial per week for one semester. **Assessment:** Tutorial assignments (individually and in small groups) and a final examination.

Third year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop an appreciation for the following:

- The different techniques used to develop and solve process models.
- The way process models are used in industry.
- The role of modern computer software in process modelling.

Syllabus Summary

Uses for process modelling (such as process optimisation). Physical modelling and the role of dimensionless correlations. Empirical modelling (line of best-fit; variable transformations; multilinear regression). Linear programming. Steady-state and dynamic mechanistic (heat and mass balance based) modelling. Numerical methods relevant to model solution. Use of software packages in process modelling.

CHNG 3302 Process Control 1

4 credit points

Offered: July. **Classes:** 4 hrs/week of lectures and tutorials for one semester. **Assessment:** Tutorial assignments and a final examination.

Third year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

It is expected that students will understand the principles of dynamic modelling and the basics of process control.

Syllabus Summary

The role of control in chemical processes. Development of dynamic models. Analytical and numerical solution of dynamic models. Laplace transforms. Transfer functions. Dynamic analysis of first-order, second-order and higher order systems. Introduction to feedback control. Types of controllers. Closed-loop characteristic equation. Stability analysis. Controller design. Process reaction curve method. Use of MATLAB.

CHNG 3303 Flowsheeting and Optimisation

4 credit points

Offered: July. **Classes:** 4 hrs/week of lectures, tutorials and project work for one semester. **Assessment:** Tutorial assignments and project work.

Year 3 elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

It is expected that students will understand the basic principles and usage of process flowsheeting technology.

Syllabus Summary

Need and uses of process flowsheeting; alternative approaches to flowsheeting; key unit operations; performance and design calculations; consideration of process dynamics; aspects of process optimisation; commercial flowsheeting and design software.

CHNG 3401 Project Economics

4 credit points

Offered: February. **Classes:** Two (1 hr) lectures and one (1 hr) tutorial per week for one semester. **Assessment:** Tutorial assignments plus a final examination.

Third year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop a basic understanding of the role that economic considerations have in industrial projects.

Syllabus Summary

The assessment of projects using economic criteria: taxation, capital and depreciation; manufacturing costs and capital cost determination. Comparison of alternatives, allowing for risk and uncertainty, project finance.

CHNG 3501 Waste Management and Treatment Technologies

4 credit points

Prerequisite: CHNG 2501, CHNG 2502. **Offered:** July. **Classes:**

Two (1 hr) lectures and one (1 hr) tutorial per week for one semester. **Assessment:** Tutorial assignments (both individually and in small groups), one project, and a final examination.

Year 3 elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

- To develop an awareness and comprehensive understanding of physical, chemical and biological technologies for effective treatment of gaseous, liquid and solid wastes, based on process principles.
- To explore issues pertaining to management of environmental hazards in the process industries, with a focus on eco- and human toxicology.
- To develop an understanding of landfill management as a process technology.

Syllabus Summary

- Properties of gaseous, liquid and solid wastes;
- Physical treatment technologies;
- Chemical treatment technologies;
- Biological treatment technologies;
- Hazard rating of process wastes;
- Eco- and human toxicity of process wastes;
- Waste containment practices;
- Case Studies: (a) Integrated waste treatment in industrial processes; (b) Waste conditioning for landfill disposal.

CHNG 4001 Practical Experience

0 credit points

Prerequisite: 28 credit points of 3rd Year units. **Offered:** July. **Classes:** There are no formal classes. Students are required to obtain 10 weeks of practical work experience before entering their 4th Year. **Assessment:** By submission of a report of approximately 2500 words on the industrial experience undertaken. The report will cover the nature of the industry, the company's organisational relationships both internally and externally and a technical section devoted to the work performed by the student. The report is to be submitted before the end of the first week of the 4th academic year. Fourth year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To obtain first-hand experience of the way chemical engineering skills are employed in an industrial context.

Syllabus Summary

Each student is required to work as an employee of an approved organisation and to submit a report on that work. The employment undertaken must be relevant to Chemical Engineering and should be discussed before acceptance with a member of the Department of Chemical Engineering. While the responsibility for obtaining satisfactory employment rests with the student, the Department, through the Chemical Engineering Foundation, and the Careers and Appointments Service will assist wherever possible.

CHNG 4002 Thesis

8 credit points

Prerequisite: Students should have completed (or be enrolled in) all other 4th Year core units. **Offered:** February. **Classes:** No formal classes. The thesis supervisor will be available for discussion at agreed times but the student is expected to work on his/her own initiative. **Assessment:** Written thesis and seminar. Fourth year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To obtain an understanding of how to define, undertake and report on an open-ended piece of supervised research work.

Syllabus Summary

Students are asked to write a thesis based on a modest (but significant) research project, which is very often some aspect of a staff member's research interests. Some projects will be experimental in nature, others may involve computer-based simulation, feasibility studies, or the design, construction, and testing of equipment.

In undertaking the project, the student will learn how to examine published and experimental data, set objectives, organise a program of work, and analyse results and evaluate these in relation to existing knowledge. The thesis will be judged on the extent and quality of the student's original work and particularly on how critical, perceptive, and constructive he or she has been, in assessing his/her own work and that of others.

Students are required to give a seminar, explaining the aims and achievements of their thesis.

CHNG 4003 Advances in Chemical Engineering A

4 credit points

Offered: February. **Classes:** Two (1hr) lectures plus one (1 hr) tutorial per week for one semester. **Assessment:** Assignments; final examination.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

The objective of this unit is to provide students with exposure to the latest developments in research and technology.

Syllabus

This unit will discuss the impact of current research and new technology on the profession of chemical engineering. It will address the changes that are taking place in industrial processes as a result of these new technologies. The syllabus details will change from time as time as specialist lecturers become available.

CHNG 4004 Advances in Chemical Engineering B

4 credit points

Offered: July. **Classes:** Two (1hr) lectures plus one (1 hr) tutorial per week for one semester. **Assessment:** Assignments; final examination.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

The objective of this unit is to provide students with exposure to the latest developments in research and technology.

Syllabus

This unit will discuss the impact of current research and new technology on the profession of chemical engineering. It will address the changes that are taking place in industrial processes as a result of these new technologies. The syllabus details will change from time as time as specialist lecturers become available.

CHNG 4005 Laboratory Projects in Unit Operations

4 credit points

Prerequisite: CHNG 3001 Chemical Engineering Laboratory. **Offered:** July. **Classes:** Five hours per fortnight of laboratory classes for one semester. **Assessment:** Project reports, oral presentation and general skill shown in planning and executing laboratory experiments.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop skills in executing appropriate experimental testing procedures and the presentation of results in oral and written form, together with teamwork skills.

Syllabus Summary

This laboratory unit extends the range of experiments illustrating the principles and application of heat and mass transfer, particle mechanics and reaction engineering. Two laboratory experiments will be undertaken by students during the semester, and two written reports and two oral presentations will be required from each student. The same level of preparation is required for this course as for CHNG 3001 Chemical Engineering Laboratory. Specifically, students are required to: (1) familiarise themselves with the background theory; (2) understand the operation of the experimental apparatus and the correspondence between the apparatus and that described in the background theory; and (3) define the experimental aim, range of measurements to be made and how these measurements will be processed in the light of the background theory and the aim of the experiment.

CHNG 4006 Professional Option

2 credit points

Prerequisite: Passed at least 144 credit points. **Offered:** July. **Classes:** There are no formal classes for this course. **Assessment:** See Syllabus description.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

The objective of this course is to provide students with experience in how to prepare and present a technical report.

Syllabus

This course requires a student to carry out an assignment related to the profession of chemical engineering - this will normally consist of a discussion of the design or operation of an industrial process. The discussion will be presented in the form of a written report, as a seminar, or both.

CHNG 4041 Year 4 Exchange Program A

24 credit points

Prerequisite: Completion of all Year 1, 2 and 3 core units of study in Chemical Engineering, and at least 144 credit points towards the degree. Approval of the Heads of Department of Chemical Engineering at the University of Sydney and at the participating exchange institution. **Offered:** February. **Assessment:** Students spend one academic year at the host institution where they take a normal load. Their specific course choices are approved by the Heads of Department of the two institutions. Individual approved subjects at the host institution are assessed according to their standard procedures and a composite mark is derived from the weighted average of these assessments.

Year 4 elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

The objective of this (single semester) Exchange Program is to provide students with the opportunity to live and learn in a foreign culture while completing the academic and professional requirements of the University of Sydney degree program.

Upon completion of the full year-long exchange (ie both CHNG 4041 and 4042), students will have completed work at least equivalent to Year 4 in the Chemical Engineering degree, including in particular the Year 4 core units of study, and will have fulfilled all the requirements of their degree from the University of Sydney.

CHNG 4042 Year 4 Exchange Program B

24 credit points

Prerequisite: Completion of all Year 1, 2 and 3 core units of study in Chemical Engineering, and at least 144 credit points towards the degree. Approval of the Heads of Department of Chemical Engineering at the University of Sydney and at the participating exchange institution. **Offered:** July. **Assessment:** Students spend one academic year at the host institution where they take a normal load. Their specific course choices are approved by the Heads of Department of the two institutions. Individual approved subjects at the host institution are assessed according to their standard procedures and a composite mark is derived from the weighted average of these assessments.

Year 4 elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

The objective of this (single semester) Exchange Program is to provide students with the opportunity to live and learn in a foreign culture while completing the academic and professional requirements of the University of Sydney degree program.

Upon completion of the full year-long exchange (ie both CHNG 4041 and 4042), students will have completed work at least equivalent to Year 4 in the Chemical Engineering degree, including in particular the Year 4 core units of study, and will have fulfilled all the requirements of their degree from the University of Sydney.

CHNG 4101 Separation Processes

4 credit points

Prerequisite: Unit Operations (all four components). **Offered:** July. **Classes:** Four hours of lectures and tutorials per week for one semester. **Assessment:** Tutorial assignments and final written examination.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop an understanding of:

- multicomponent distillation;
 - separation in non-ideal liquid systems;
 - membranes and treatment of waste water.
- Students will develop skills in:
- solving multicomponent distillation problems;
 - investigating azeotropes;
 - developing process flowsheets for difficult separation systems;
 - solving wastewater cleanup problems.

Syllabus Summary

Multicomponent distillation: history and introduction. Phase equilibria in multicomponent systems. K values for ideal and non-ideal systems, batch distillation. Computer methods of solution including Naphtali-Sandholm method. Flowsheeting packages for multicomponent distillation. Overall column efficiencies. Tray layout. Optimal column design. Membrane separation: introduction, types of membranes, separating ability and equipment. Packed distillation columns: capacity and HETP. Environmental applications; steam stripping of volatile organic components from aqueous waste liquids. Flowsheeting packages and phase equilibria in environmental systems. Practical distillation for tray and packed columns following the Kister methods.

CHNG 4102 Transport Phenomena

4 credit points

Offered: July. **Classes:** 4 hrs/week consisting of a mixture of lectures and practical sessions. **Assessment:** In-class assessments, assignments and project work.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop an understanding of the equations which govern momentum, heat and mass transfer and ways of solving them.

Students will develop skills in:

- model formulation
- solving ordinary and partial differential equations
- unifying heat, mass and momentum transfer concepts

Syllabus Summary

Constitutive equations for momentum, heat and mass transfer. Analogies between momentum, heat and mass transfer. Diffusion, forced convection, and natural convection laminar and turbulent flow. Solution of flow problems using a computational package.

CHNG 4103 Advances in Polymer Engineering

4 credit points

Offered: July. **Classes:** 3 hrs of lectures/tutorials per week for one semester. **Assessment:** Tutorials, assignments, final examination.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop an understanding of:

- How polymeric resins are manufactured.
 - Polymer properties in engineering application.
 - Polymer processing in manufacturing.
 - How polymers are recycled.
- Students will develop skills in:
- Laboratory and conceptual work.
 - Verbal and written communication (project work).
 - Solving engineering problems involving polymers.

Syllabus Summary

Basic structure and properties of polymers. Application of chemical engineering fundamentals including reaction engineering and kinetics to produce polymer resins from monomers. Engineering principles of polymer processing and shaping by extrusion, injection moulding, blow moulding, calendaring and film blowing to obtain value-added products such as sheets, tubes, car parts, bottles, fibres for clothes, etc. Case studies with nylon, polyester, polyethylene will be treated in detail. Selecting polymers for engineering applications based on chemical, mechanical, thermal and flow behaviour. Recycle and reuse of polymers.

CHNG 4104 Reaction Engineering 2

4 credit points

Prerequisite: CHNG 3107 Reaction Engineering 1. **Offered:** July.**Classes:** Two (1 hr) lectures and one (2 hr) tutorial per week.**Assessment:** Tutorials (20%), assignment (20%) and a final examination (60%).

Fourth year unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

Extend knowledge of homogeneous, isothermal, ideal reactors undertaking single reactions to non-isothermal reactions, multiple reactions, heterogeneous reactions and non-ideal reactors.

Further develop problem solving skills by a tutorial based course where the problem solving requires the student to:

- Refine the problem statement.
- Set up the equations which define the system.
- Select the appropriate numerical method / computer package to solve the equations.
- Present and discuss the results obtained and their implications with respect to the problem statement.

Syllabus Summary

Temperature effects; multiple reaction(s); non-ideal reactor(s); heterogeneous reactions; non-catalytic, catalytic, multiphase reactions.

CHNG 4105 Thermodynamics of Natural Gas Engineering

4 credit points

Prerequisite: CHNG 3105 and CHNG 3106. **Offered:** February.**Classes:** Three hours of lectures and tutorials per week for one semester. **Assessment:** Class assignments, project work and a final examination.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

This course examines the application of thermodynamics to a range of design and operating problems in the natural gas industry. By focusing on a specific industry, it is hoped to demonstrate both the versatility and the relevance of thermodynamics. Students who take this course should develop a more mature understanding of thermodynamics, as well as gaining some insights into a major process industry. Specifically, students will:

- examine the methods used to predict the volumetric and thermodynamic properties of natural gases, including retrograde condensation phenomena;
- discuss the properties of gas hydrates, and the methods used for predicting conditions for hydrate formation;
- make design calculations for natural gas compressors and pipelines, both vertical (ie wells) and horizontal;
- calculate limiting flow rates through valves, chokes and pipelines;
- understand the methods used in the design of LNG processes.

Syllabus Summary: Review of thermodynamic fundamentals for pure component fluids. Equations of state: general cubic equations, specific high accuracy equations.

Use of real fluid data in gas compression and compressible flow calculations. Compressor power requirements; isothermal, isentropic and polytropic efficiencies. Compressor flow-versus-head characteristics. Fundamental equations of flow: continuity, momentum, energy equations. Flow through valves, nozzles, sharp edged orifices. Choking in valves and nozzles. Isothermal and adiabatic flow in pipes. Static and flowing bottom-hole pressures in wells.

Review of thermodynamic fundamentals for fluid mixtures. Modifications to cubic equations of state. Properties of natural gases: typical compositions. Calculation of equilibrium conditions using cubic equations of state for high pressure phase equilibrium; calculation of equilibrium water content in reservoir gas. Gas hydrates; prediction methods for hydrate formation from mixed gases.

Process analysis: cascade and mixed refrigerant processes for LNG production. Thermodynamic efficiencies of LNG processes.

CHNG 4201 Chemical Engineering Design 1

4 credit points

Prerequisite: CHNG 3101,3102,3103,3104. **Offered:** February.**Classes:** 4 hours of lectures and tutorials per week for one semester. **Assessment:** Tutorial assignments and a final examination.

Fourth year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop an understanding of:

- concepts in process flowsheeting
 - use of computer packages
 - optimisation of the process; heat exchanger networks.
- Students will develop skills in:
- development of the process flowsheet
 - solving flowsheet problems using computer packages
 - designing heat exchanger networks
 - awareness of cost optimisation.

Syllabus Summary

Introduction to process design. Process flowsheet development. Unit operation library models. Equations of state and thermodynamic models. Design philosophy. Use of computer flowsheeting packages. Optimisation of a flowsheet. Steady-state and dynamic process simulations. Heat exchanger networks. Energy integration within the process. Distillation trains, process synthesis and cost optimisation.

CHNG 4202 Chemical Engineering Design 2

8 credit points

Prerequisite: CHNG 3101, 3102,3103,3104; CHNG 3105

Thermodynamics 1; CHNG 3106 Thermodynamics 2; CHNG 3401

Project Economics. **Offered:** July. **Classes:** Approximately 8 hours of informal classes, design and library work per week for one semester. **Assessment:** Design report and contribution to design group.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop an understanding of:

- full chemical engineering design study;
 - preparation of a full design report.
- Students will develop skills in:
- designing a complete chemical plant;
 - working in a design group;
 - interacting with a consultant;
 - writing a design report.

Syllabus Summary

The preparation of a detailed design project: flowsheet selection, heat and mass balances, detailed equipment design and costing, hazard assessment and hazard operability studies, environmental impact and project financial analysis.

CHNG 4203 Major Industrial Project

24 credit points

Prerequisite: Passed at least 144 credit points. Students wishing to do this unit of study are required to discuss the matter with the Head of Department prior to enrolment. **Offered:** February.

Fourth year elective unit of study for the degree in Chemical Engineering.

The objective of this unit of study is to provide students with experience in carrying out a major project within an industrial environment, and in preparing and presenting detailed technical reports (both oral and written) on their work.

Syllabus

The major component of this unit of study is the conduct of a project in industry under joint University /industry supervision. The project will encompass many of the features of CHNG 4002 Thesis, but will be larger in scope. The student will be required to submit a bound report to both the University and any company involved.

In addition, students will be required to incorporate in their work industry case studies in core curriculum areas of their degree program, as determined by the Head of Department. Students are expected to show a proficiency in each of these case studies comparable with that which would be achieved in the

units of study they are replacing. The Major Industrial Project may not then be counted with the units of study corresponding to the selected case study areas. Case studies which may be required are:

- (1) Case Studies in Process Design and Simulation
(in lieu of CHNG 4201 Chemical Engineering Design 1)
- (2) Case Studies in Project Management
(in lieu of CHNG 4401 Project Engineering)
- (3) Case Studies in Hazard and Environmental Impact Analysis (in lieu of CHNG 4402 Process Plant Risk Management)

CHNG 4301 Advanced Fluid Dynamics Modelling

4 credit points

Offered: July. **Classes:** Four hours per week consisting of a mixture of lectures and practical sessions. **Assessment:** Assignments and project work.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop an understanding of current computational models of fluid flow and its associated physics.

Students will develop skills in:

- using a CFD package;
- breaking a complex problem into simpler pieces;
- solving real problems.

Syllabus Summary

This course will familiarise students with modern developments in computational fluid dynamics (CFD) modelling. It will contain a review of the basic equations and introductions to mesh generation, solution methods, graphical analysis of results, turbulence modelling, multiphase flows, combustion, non-Newtonian flow and chemical reactions. The course will comprise a mixture of theory and practical use of a CFD package.

CHNG 4302 Reservoir Engineering

4 credit points

Prerequisite: CHNG 3103 Unit Operations (Particle Mechanics); CHNG 3104 Unit Operations (Fluid Mechanics). **Offered:** February. **Classes:** Two (1 hr) lectures plus one (1 hr) tutorial per week for one semester. **Assessment:** Assignments; final examination.

Fourth year elective unit of study for the degree in Chemical Engineering.

Introducing chemical engineering students to methods used in predicting and managing the behaviour of oil and gas reservoirs.

Reservoir engineering analysis applies also to other important areas such as: the migration and treatment of pollutants in soils and sediments; the recovery of methane from coal seams and landfill; heap leaching of low-grade ores; and in-situ leach mining.

Syllabus

Properties of porous media: porosity, permeability. Physics of single and two-phase flow through porous media. Single-phase flow: steady-state flow in one and two dimensions; area sweep efficiencies in regular arrays of wells; flow through parallel layers: communicating and non-communicating layers; miscible displacement processes; the convective-dispersion equation. Unsteady-state flow: well testing.

Two phase systems: saturation, capillary pressure, relative permeability, fractional flow. Multiphase flow: Buckley-Leverett solution to the two-phase convection equation; simulation methods; partially miscible displacement processes. Application of the method of characteristics to partially miscible multicomponent displacement processes (specifically: three-component, two-phase systems).

Introduction to enhanced oil recovery.

CHNG 4303 Optimisation Techniques

4 credit points

Prohibition: CHNG 4305 Process Systems Engineering. **Offered:** February. **Classes:** Two (1 hr) lectures and one (1 hr) tutorial per week for one semester. **Assessment:** Tutorial work, project reports and a final examination.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop skills in formulating and solving optimisation problems relevant to chemical engineering.

Syllabus Summary

Problem, objective function and constraint formulation. Analytical and numerical search methods for single variable and multivariable systems. Linear systems and linear programming. Hoesheet optimisation. Multi-objective function systems.

CHNG 4304 Process Control 2

4 credit points

Prerequisite: CHNG 3302 Process Control 1. **Offered:** February.

Classes: Four hours of lectures, tutorial and laboratory work per week for one semester. **Assessment:** Tutorial assignments, laboratory reports and a whole semester project.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

It is expected that students will become familiar with a variety of advanced control strategies, their experimental application, as well as receiving training in Distributed Control System configuration and use.

Syllabus Summary

Frequency response analysis and design. Advanced process control strategies: Cascade control. Model-based control strategies: Delay compensation, Feedforward control, Multivariable control, IMC control design and model predictive control strategy. Benefits of process control. New trends in process control. Laboratory experiments and PC laboratory in Process Control.

CHNG 4305 Process Systems Engineering

4 credit points

Prohibition: CHNG 4303 Optimisation Techniques. **Offered:** July. **Classes:** Two (1 hr) lectures and one (1 hr) tutorial per week for one semester. **Assessment:** Tutorial work, project reports and a final examination.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop skills in integrating process modelling, simulation, design, optimisation and control concepts.

Syllabus Summary

Introduction to process systems engineering. Cost-benefit analysis. Process modelling (steady-state and dynamic) and simulation. An introduction to the techniques of systematic process design. Process optimisation (theory and applications) and advanced control concepts. Available computer packages for these various applications.

CHNG 4401 Project Engineering

4 credit points

Offered: February. **Classes:** 4 hours of lectures, seminars and discussions per week for one semester. **Assessment:** Tutorial assignments, seminar presentations and a final examination.

Fourth year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To obtain an appreciation of the techniques employed in the successful management of an industrial project.

Syllabus Summary

Principles of project management. Management of large projects or a portfolio of small projects - including planning techniques, organisation and control. Management of commissioning and start-up of process plant, and of plant maintenance. Preparation and delivery of oral presentations on technical subjects. Introduction to occupational safety, safety management systems, management of environmental performance, safety during shut-downs, quality assurance and principles of Total Quality Management. The concept of 'completed staff work'. Introduction to process plant production management. Individual and team approaches to solving standard and open-ended problems.

CHNG 4402 Process Plant Risk Management

4 credit points

Offered: February. Classes: Two (1 hr) lectures and one (1 hr) tutorial per week for one semester. **Assessment:** Tutorial work, project reports and a final examination.

Fourth year core unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop an understanding of the central concepts underlying risk management, and the quantification and reduction of such risks in the engineering field.

Syllabus Summary

Inevitability of risk. Types of hazards to people, the environment and property. Risk criteria or targets. Systematic hazard identification. Dimensions of risk. Quantification of consequences and frequency of hazardous incidents. Assessment of risks, risk contours. Role of the human factor. Inherent safety and risk reduction by engineering and management approaches. Insurance, community and legal relationships. Case studies.

CHNG 4403 Engineering Business Skills

4 credit points

Offered: July. **Classes:** Three hours per week of group work with a (nominated) company for one semester. **Assessment:** Group report and a final examination.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

This course is built around the Young Achievement Australia course "Business Skills for Tertiary Students" which aims to give students an insight into modern management concerns and resolution skills.

Syllabus Summary

Participants in this program will be exposed to a range of business issues including the following:

- the factors affecting business outcomes;
- the importance of cash flow management;
- the core requirements of any enterprise team (whatever its size);
- leadership and management skills;
- how specialist areas of expertise can combine to reach a common goal;
- the advantages and disadvantages of risk-taking, and ways of coping with both;
- strategies for achieving (and communicating) clear expectations, objectives and requirements in business and the community.

CHNG 4501 Biochemical Engineering

8 credit points

Prerequisite: CHNG 2701 & CHNG 2702 Fundamentals of Bioprocess Engineering 1 & 2; MICR 2007 Microbiology for Engineers A; MICR 2008 Microbiology for Engineers B. **Offered:** July. Classes: 2 x 2 hr/week Lectures, 4 x 12 hr/semester Laboratories, 6 x 1 hr Tutorials. **Assessment:** Assignments (15%), laboratory work (15%), design study (15%) and final examination (55%).

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

1. Understand the history and scope of the biotechnology industry.
2. Identify the role of biochemical engineering in the industrial application of biotechnology and its development.
3. Provide an understanding of the major fundamental aspects of biochemical engineering.
4. Use this fundamental understanding to study some selected industrial applications.

Syllabus Summary

Fundamentals: History of biochemical engineering; review of metabolism; quantification of cell growth and metabolism; modelling of microbial growth; fermenter design, sterilisation, aeration; bioseparations.

Applications: Industrial yeast production and brewing; amino acid production; cheese manufacture; computer applications;

animal/plant cell technology; genetic engineering; wastewater treatment; biotechnology regulation.

CHNG 4502 Advanced Topics in Environmental Engineering A

4 credit points

Prerequisite: All four components of Unit Operations; CHNG 3106 Thermodynamics 2. **Offered:** February. Classes: Two (1 hr) lectures plus one (1 hr) tutorial per week for one semester. **Assessment:** Assignments; final examination.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

The application of chemical engineering methods and principles to the problems of pollution prevention and control.

Syllabus

Both courses (A and B) are aimed at developing quantitative descriptions of environmental rate and transport processes. These processes include chemical partitioning, reactions, and convective/dispersive transport in air, water and soil. The specific syllabus for each course will be redefined from time to time. Course topics will be drawn from:

Air pollution: Sources and types of air pollution; atmospheric chemistry and ozone depletion; control and removal of sulphur and nitrogen oxides; transport, dispersion and reaction in the atmosphere; vapour emissions from landfills and surface impoundments.

Water pollution: Sources and types of water pollution; equilibria in aqueous phases; interactions between aqueous phase and sediments in lakes and estuaries; dispersion of contaminants in rivers and lakes; physio-chemical and biological treatment processes; pollution from leaching processes in tailings dumps and landfills.

Soils and Sediments: Sources and types of pollution in soils and sediments; physics of movement of groundwater and contaminants in porous media; oily phase migration in soils; in-situ remediation of contaminated soils and sediments.

CHNG 4503 Advanced Topics in Environmental Engineering B

4 credit points

Prerequisite: All four components of Unit Operations; CHNG 3106 Thermodynamics 2. **Offered:** July. Classes: Two (1 hr) lectures plus one (1 hr) tutorial per week for one semester. **Assessment:** Assignments; final examination.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

An appreciation of the application of chemical engineering methods and principles to the problems of pollution prevention and control.

Syllabus

Both courses (Advanced Topics in Environmental Engineering A and B) are aimed at developing quantitative descriptions of environmental rate and transport processes. These processes include chemical partitioning, reactions, and convective and/or dispersive transport in air, water and soil. The specific syllabus for each course will be adjusted from time to time with topics drawn from the areas described under CHNG 4502 Advanced Topics in Environmental Engineering A.

CHNG 4504 Environmental Decision Making

4 credit points

Offered: July. Classes: One 2 hour lecture and one (1 hr) tutorial per week for one semester. **Assessment:** Tutorial assignments, projects and a final examination.

Fourth year unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

- To acquaint students with the issues to be considered in environmental decision making, the wide range of stakeholders involved, and uncertainties in the information available to support the decision.

- To bring all this together in a structured manner, ensuring the clear identification of decision objectives, and the criteria by which the value of possible decision outcomes will be assessed.
- To explore decision making in Impact Assessment.

Syllabus Summary

This course will consider, from a "Systems" perspective, the practice of environmental decision making, the tools and approaches used in problem structuring and decision analysis, and the evaluation of decision outcomes. A specific focus will be where there are multiple objectives to be satisfied, including the exploration of trade-offs between environmental, economic, and social objectives. The course will explore the use of "Life Cycle Thinking" to guide the scope of decision analysis, providing the spatial and temporal boundaries which define the decision space. Students will be exposed to the theory and practice of Environmental Impact Assessment, as well as product and process Life Cycle Assessment. Decision making in the context of project life cycle considerations will also be explored, focusing on identification and management of risk and uncertainty.

CHNG 4505 Bioremediation

4 credit points

Offered: February. **Classes:** Two (2 hr) lectures / tutorials per week for one semester. **Assessment:** Assignments (20%), project work (40%) and a final examination (40%).

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

1. Understand the role of microorganisms in the treatment of solid, liquid and gaseous wastes.
2. Understand the range of bioremediation techniques available and the practical benefits and limitations of bioremediation.
3. Apply the above knowledge to address a series of environmental problems by supervised project work.

Syllabus Summary

Bioremediation techniques (economics, legislation, computer-based design); Waste characteristics; Bioavailability / bioactivity; Metabolism (major metabolic pathways); Metabolism (degradation of aliphatic, aromatic, halogenated compounds, genetic manipulation); Reactor systems; Anaerobic digestion; Aerobic treatment processes; Biological nutrient removal; Bioremediation technologies (composting, landfill, sludge disposal). Monitoring efficacy of bioremediation; Biofiltration; Artificial wetlands; Bioleaching/sulfate-reducing bacteria.

CHNG 4601 Advanced Particle Mechanics

4 credit points

Prerequisite: All four components of Unit Operations. **Offered:** July. **Classes:** 3hrs lec & tut/wk for one semester. **Assessment:** Assignments and final examination.

Fourth Year elective unit for the degree in Chemical Engineering.

Syllabus summary

Bulk solids flow: properties of bulk granular material; stress analysis of solids; testing of granular material; flow properties; design of bunkers; flow rate predictions; calculation of flow parameters of hoppers.

Fluidisation: Applications; types of fluidisation; incipient fluidisation; theory of bubble rise; bubble formation; fluid-bed reactors.

Conveying: Pneumatic and hydraulic conveying of solids: regimes, models and equipment (including blowers and pumps).

CHNG 4602 Mineral Processing (Extractive Metallurgy)

4 credit points

Prerequisite: Unit Operations (all four components). **Offered:** February. **Classes:** Three hours of lectures/tutorials per week for one semester; field trips as arranged. **Assessment:** Class assignments, tutorials and a final examination.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop an understanding of the fundamental principles of metal extraction from naturally occurring compounds (minerals) and/or recycled materials, and the technology to yield a commercial end-product, with due regard for the environment.

Students will develop skills in:

- devising strategies to achieve extraction process objectives, within the constraints imposed by social, economic and physical environments;
- working in groups;
- verbal and written communication.

Syllabus Summary

Mineral beneficiation and its relationship to smelting practice. Rationale in the metallurgical processing of complex ores and waste products. Principles of extraction and recovery in pyrometallurgy, hydrometallurgy and electrometallurgy. Alternatives in mining and minerals beneficiation - in situ leaching, dump and heap leaching. Mineral stability. Thermodynamics of reduction. Ellingham diagrams. Roasting of sulphides. Matte smelting and converting. Refining techniques. Hydrometallurgical processing of low-grade ores and electrowinning.

CHNG 4603 Mineral Processing (Mineral Dressing)

4 credit points

Prerequisite: Unit Operations (all four components). **Offered:** July.

Classes: Three hours of lectures, tutorial and laboratory classes per week for one semester. Field trips as arranged. **Assessment:** Tutorial work, laboratory reports and a final examination.

Fourth year elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop an understanding of the various techniques used in mineral dressing.

Syllabus Summary

Mineralogy and its relationship to mineral liberation and beneficiation. Metallurgical balances. Data reconciliation. Mineral processing unit operations, principles - comminution, concentration, heavy media separation, jigging, magnetic separation, electrodynamic and electrostatic separation, tabling and film concentrators. Flotation - surface chemistry. Collector and modifier action. Electrokinetic phenomena. Oxide and sulphide ore flotation. Depressants and selective flotation. Flotation kinetics. Ore sorting. Tailings dams.

CHNG 4604 Chemical Modelling of Aqueous Systems

4 credit points

Prerequisite: CHNG 3101, CHNG 3102, CHNG 3103, CHNG 3104 and CHNG 3106. **Offered:** February. **Classes:** Three hours of lectures/tutorials per week for one semester. **Assessment:** Class assignments, tutorials and a final examination.

Year 4 elective unit of study for the degree in Chemical Engineering.

Objectives/Outcomes

To develop an understanding of the current state-of-the-art in chemical modelling of aqueous systems and its application to environmental problems, water pollution and wastewater treatment, chemical manufacturing, mineral processing and extractive metallurgy.

Students will develop skills in the following:

- Making critical decisions in characterising aqueous systems;
- Developing appropriate models for solving realistic problems involving aqueous processes;
- Critically assessing and evaluating available computer packages for modelling;
- Developing treatment strategies for process streams, wastewaters and the aquatic environment.

Syllabus Summary

Basic concepts of chemical modelling of aqueous systems. Identification, selection and assessment of key input data for a chemical model. Chemical speciation in an aqueous environment. Aqueous systems at elevated temperature and high concentrations of dissolved species. Interaction of atmospheric carbon dioxide on waste residue disposal and aqueous processing.

Chemical modelling techniques, and review and evaluation of computer software for aqueous processes.

Case studies and applications include: the removal/recovery of heavy metals (eg Cd, Cu, Cr, Zn) from wastewaters; lime as a reagent; effect of atmospheric CO₂ on metal precipitation and disposal; gypsum solubility; gas solubility, absorption and "sour" water treatment; mineral processing (leaching, solvent extraction, flotation); complexing ligands (S₀₄₂-, Cl⁻, NH₃, CO₂, S₀₂); aluminium in the environment; aqueous corrosion.

Civil Engineering

CIVL1001 Civil Engineering 1

4 credit points

Prerequisite: Assumed standard of knowledge. Mathematics 3 unit course and a satisfactory knowledge of 2 unit Chemistry or the Chemistry component of the 3 or 4 unit Science HSC course and of the 2 unit Physics course or the Physics component of the 3 or 4 unit Science HSC course. **Offered:** February. **Classes:** (lec: 13hrs, lec/tut-13hrs and lab/drawing office: 26hrs) for one sem.

Assessment: Specified assignments and one 3hr exam at end of unit.

First year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil). Elective unit of study for the other branches.

Objectives: To provide a basic introduction to Civil Engineering.

Outcomes: A basic understanding of some aspects of Civil Engineering including Structural Engineering, Engineering Construction, Geomechanics, Hydraulics and Engineering Communications.

Syllabus summary

(a) Engineering Projects - Introduction to the planning, design, construction and operation of engineering projects. Economic and non-economic evaluation of projects.

(b) Elements of Engineering Science - Structures, geomechanics, materials, hydraulics and water resources, environment, systems, management.

(c) Communications -Freehand and scale drawing, engineering plans, shop drawings, techniques for producing drawings. Preparation of reports, verbal and written.

Reference books

Krick An Introduction to Engineering - Concept, Methods and Issues (John Wiley and Sons).

Morris Engineering -A Decision Making Process (Houghton Mifflin Company).

Hogan and Firkins Economical Structural Steelwork (Australian Institute of Steel Construction).

Brown Getting Across (Edward Arnold).

Institution of Engineers, Australia The Australian Engineering Handbook, Part 1 -Basic Principles and Techniques (I.E. Aust.).

Thompson Organization and Economics of Construction (McGraw-Hill).

Strank and White The Elements of Style (Macmillan).

Concrete Institute of Australia Recommended Practice - Reinforced Concrete Detailing Manual (CIA).

Dandy and Warner Planning and Design of Engineering Systems (Unwin Hyman).

Eagleson Writing in Plain English (Aust. Govt. Publishing Service).

CIVL 1004 Computational Engineering

4 credit points

Prohibition: COMP 1001 Introductory Programming or COMP 1002 Introductory Computer Science. **Offered:** July. **Classes:** (2 lectures and one 2 hour computer lab session) / week. **Assessment:** One 2 hr examination at end of semester plus assessment of computer exercises during semester. Engineering 1B are acceptable alternatives.

First year core subject in Civil Engineering and Project Engineering and Management (Civil).

COMP 1001 Introductory Programming and COMP 1002 Introductory Computer Science or MECH 1800 Computational Engineering 1A or MECH 1801 Computational Engineering 1C

or MECH 1810 Computational Engineering 1B are acceptable alternatives.

Objectives

To provide an introduction to a programming language and to the logic of programming. To introduce computer graphics and to highlight the application of graphics to the solution of engineering problems.

Outcomes

Students should obtain an understanding of the logic of computer programming and be able to write computer programs to solve engineering problems. They should also be able to present visual images and graphics and to apply computer graphics to the solution of engineering problems.

Syllabus summary

Introduction to the matrix and graphics functions of MATLAB: Matrix manipulation, input/output, flow control, function and script files, object hierarchies including high and low level graphics functions, object properties, plotting functions and colour maps. Introduction to fundamentals of computer graphics: Viewing objects in two and three dimensions, theory of transformations, data structures, perspective and parallel projections, hidden surfaces and colour theory.

Textbooks

D. Hanselman and B. Littlefield Mastering Matlab Prentice-Hall 1996.

D.M. Etter Engineering Problem Solving with Matlab 2nd Ed., 1997

F.S. Hill MacMillan Computer Graphics 1990

V.B. Anand Computer Graphics and Geometric Modelling for Engineering John Wiley & Sons, 1993

CIVL 1051 Dynamics

5 credit points

Corequisite: MATH 1001,1002,1003,1005. **Assumed knowledge:** Assumed standard of knowledge: Mathematics 3 unit course and Science 4 unit course (or the Physics core of 3-4 unit Science) at the HSC. **Prohibition:** MECH 1510. **Offered:** July. **Classes:** 2 hours lectures and 2 hours tutorials per week.

Assessment: One 3 hr exam at the end of the semester plus assessment of assignments.

First year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Syllabus summary: Newton's Laws, Kinematics including rectilinear motion, angular motion and curvilinear motion, motion of rigid bodies. Absolute and Relative Motion. Kinetics including particle motion and rigid body motion. Work and Energy. Linear and angular impulse and Momentum. Kinetics of Steady Mass Flow. Periodic Motion.

Objectives: To introduce basic concepts of motion and the calculation of both paths of motion and the forces associated with the motion.

Outcomes: It is expected that students will be able to apply the dynamics of particles and rigid bodies, mainly in two dimensions to solve engineering problems.

Textbooks

Meriam and Kraige, Mechanics -Volume 2, Dynamics, SI Version, 4th Edition, Wiley (1997).

CIVL 1052 Statics

5 credit points

Corequisite: MATH 1001,1002,1003,1005. **Assumed knowledge:** Mathematics 3 unit course at the HSC. **Prohibition:** MECH 1500 Mechanical Engineering 1, MECH 1501 Engineering Statics. **Offered:** February. **Classes:** (lec: 26hrs and tut- 26hrs) in Sem 2. **Assessment:** Assignment submissions during semester and one 3hr exam at end of semester.

First year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Syllabus summary: Basic concepts: scalars and vectors; units. Statics of the rigid body; forces and moments in two dimensions and three dimensions; system isolation; free body diagrams, and equilibrium criteria in two dimensions and three dimensions. Cable systems; beams with distributed loads, statically determinate pin-jointed structures, hydrostatics.

Objectives: To introduce basic concepts of static equilibrium and the calculation of forces and moments in statistically determinate structures.

Outcomes: It is expected that students will be able to analyse simple pin jointed structures, draw free body diagrams.

Textbooks

Meriam and Kraige Engineering Mechanics, Volume 1, Statics, SI version, 4th Edition, Wiley (1997).

GEOL1501 Engineering Geology 1

6 credit points

Prohibition: GEOL 1002. **Offered:** February. **Classes:** 39 hrs lec, 26 hrs lab. Field excursions in the Sydney region, as appropriate.

Assessment: Practical laboratory work, assignment, and a combined theory and practical exam.

First year core unit of study for the degree in Civil Engineering, unless the unit of study GEOL 1002 has been completed. Second year core unit of study for the degree in Project Engineering and Management (Civil).

Course objectives: To introduce basic geology to civil engineering students.

Expected outcomes: Students should develop an appreciation of geologic processes as they influence civil engineering works and acquire knowledge of the most important rocks and minerals and be able to identify them.

Syllabus summary: Geological concepts relevant to civil engineering and the building environment. Introduction to minerals; igneous, sedimentary and metamorphic rocks, their occurrence, formation and significance. General introduction to physical geology and geomorphology, structural geology, plate tectonics, and hydrogeology. Associated laboratory work on minerals, rocks and mapping.

Textbooks

T. West Geology Applied to Engineering; or

A. Holmes Principles of Physical Geology 4th Edition.

CIVL 2004 Engineering Communications 1

2 credit points

Offered: February. **Classes:** 12hrs lec, 14hrs discussion/oral presentation. **Assessment:** Based on three written reports and three oral presentations. Extra credit for some or all oral presentations may be given for verifiable public speaking activities with the students' section of the Institution of Engineers, Australia, the University of Sydney Debating Society or equivalent organisation. Students are encouraged to engage in these activities. Second year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Objectives: To develop effective written and oral communication skills.

Outcomes: Ability to make written and oral presentations on topics of general, technical and/or social significance to small peer groups.

Syllabus summary: 12 hours of lectures on effective report writing and oral presentation. Written reports and oral presentation on three topics of general, technical and/or social significance of 5, 10 or 15 minutes duration. Oral presentation in groups of eight students in a lecture or round-table discussion format.

CIVL 2101 Properties of Materials

4 credit points

Prerequisite: CHEM 1401 Chemistry 1E. **Offered:** February. **Classes:** lec: 40hrs and lab approx. 12hrs. **Assessment:** One 3hr exam covering the whole syllabus. Satisfactory lab work is a prerequisite for passing the exam.

Second year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Objectives: To develop an understanding of the relationship between microstructure and mechanical properties of metals and cement based materials.

Outcomes: Ability to select the materials best suited for a particular application.

Syllabus summary: Production, solidification and bonding in metals. Elastic-plastic deformation of metals. Microstructural effects relating to mechanical properties of metals. Welding.

Hydrogen embrittlement, lamellar tearing. Fatigue and brittle fracture.

Hardened cement paste, mortar, concrete, timber, masonry. Cements and their hydration, minerals and other admixtures in concrete, mix design.

Textbooks

Materials Science and Engineering an Introduction
William D. Callister Jr. 4th Edition 'Wiley' publishers
Campbell-Allen and Roper Concrete Structures: Materials Maintenance and Repair (Longman Scientific and Technical) - preferred text.

Soroka Portland Cement Paste and Concrete (Macmillan Australia, 1979)

Akroyd Concrete - Its Properties and Manufacture (Pergamon) and/or

Troxell Composition and Properties of Concrete 2nd edn (McGraw Hill).

U.S. Bureau of Reclamation Concrete Manual
Czernin Cement Chemistry and Physics for Civil Engineers (Lockwood).

Relevant SAA Specifications.

CIVL 2201 Structural Mechanics

6 credit points

Prerequisite: CIVL 1051 Dynamics and CIVL 1052 Statics. **Offered:** February. **Classes:** lec: 39hrs, tut: 26hrs. **Assessment:** Class assignments and one 3hr closed-book exam covering the whole syllabus at the end of semester.

Second year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Objectives: To provide a basic understanding of the principles of elementary stress and stiffness analyses of simple structural elements under static loading and to be able to use these principles to analyse simple structural elements using hand computation methods.

Outcomes: Proficiency in basic methods of simple structural analysis and interpretation of results.

Syllabus summary: Review of basic statics; elementary elasticity, geometric properties of plane areas, axial loading, flexure in beams, shear stresses in beams, uniform torsion, bending deflections, elementary instability, influence lines, triangulated frames and trusses, combined stresses, continuum mechanics - stresses and strains in 2D, failure theories for materials.

Textbooks

Megson Strength of Materials for Civil Engineering 2nd edn (Arnold).

Reference books

Gordon Structures (Penguin, 1978).

Shanley Mechanics of Materials student edn (McGraw-Hill, 1967).

CIVL 2203 Structural Design

4 credit points

Prerequisite: CIVL 1051 Dynamics and CIVL 1052 Statics. **Corequisite:** CIVL 2201 Structural Mechanics. **Offered:** July. **Classes:** 26hrs lec, 26hrs design classes. **Assessment:** Design class assignments and one 3hr closed book exam covering the whole syllabus on steel and concrete design at the end of semester. Second year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Objectives: To provide a basic understanding of design concepts and the design of steel and concrete elements to current code criteria.

Outcomes: Proficiency in the design of simple structural elements in steel and concrete.

Textbooks

SAA HB2.2 - Australian Standards for Civil Engineering Students: Part 2: Structural Engineering.

or

SAA AS4100 - Steel Structures Code
SAA AS3600 - Concrete Structures Code and
SAA AS 1170 - Loading Code, Parts 1 and H
Buckle The Elements of Structures 2nd edn (Pitman International)
Shodek Structures (Prentice-Hall)

Reference books

Cowan The Design of Reinforced Concrete student edn (Sydney U.P.).

Ferguson Reinforced Concrete Fundamentals student edn (Wiley).
Gordon Structures - or Why Things Don't Fall Down (Pelican).
Park and Paulay Reinforced Concrete Structures (Wiley).
Trahair and Bradford Behaviour and Design of Steel Structures to AS4100 3rd edn (E & FN Spon 1998).
Warner, Rangan and Hall Reinforced Concrete (Pitman).

CIVL 2409 Engineering Geology 2

4 credit points

Prerequisite: Either GEOL1002 or GEOL1501 Engineering Geology. **Offered:** July. **Classes:** 26hrs lec, 26hrs lab. Field Excursions in the Sydney area, as appropriate. **Assessment:** Practical lab work, assignment, plus one combined practical and theory 3hr exam at the end of the semester.

Second year core unit of study for the degree in Civil Engineering, unless the two Geology 2 units of study Plate Tectonics and Materials GEOL 2001 and Resource Exploration 2 GEOL 2002 have both been completed.

Course objectives: To introduce and emphasise the role of geology in civil engineering projects.

Expected outcomes: Students should gain an appreciation of the importance of geology in the planning and execution of civil engineering projects, and be able to apply their knowledge of geology to the solution of soil and rock engineering problems.

Syllabus summary: Application of geological principles and practices to solving problems in civil engineering. Surface and sub-surface geological, geophysical and remote sensing techniques for evaluation of ground conditions. Introductory rock mechanics, clay mineralogy and behaviour. Natural materials for construction purposes.

Textbooks

T. West Geology Applied to Engineering.

Reference books

P.J.N. Pells (ed.) Engineering Geology of the Sydney Region (Balkema).

CIVL 2610 Fluids 1

6 credit points

Prerequisite: MATH 1001, MATH 1002, MATH 1003, MATH 1005.

Offered: February. **Classes:** 26hrs lec, 39hrs lab/tut. **Assessment:** One 3hr exam covering the whole syllabus at the end of semester. Satisfactory laboratory and tutorial performance is also a requirement. Credit will be given for laboratory and tutorial submissions, as indicated at the commencement of the course.

Second year core unit of study for the degree in Civil Engineering. Third year core unit of study for the degree in Project Engineering and Management (Civil).

Objectives: To develop an understanding of: patterns of movement of fluid particles and associated force and energy relationships; applications of basic concepts to cases of fluids in containers and conduits.

Outcomes: Students should gain the ability: to determine fluid movements and forces in pipes and open channels and around bodies in fluid streams.

Syllabus summary: Fluid statics. Equations of motion. Velocity patterns. One dimensional flow principles. Flow measurements. Viscous and turbulent flow. Resistance to flow of fluids. Flow in closed conduits. Open channel flow.

Textbooks

Douglas, Gasiorek and Swatfield Fluid Mechanics (Pitman).

Hydraulics Data Sheets (Department of Civil Engineering, University of Sydney).

Robertson and Crowe Engineering Fluid Mechanics (Wiley).

Rouse Elementary Mechanics of Fluids (Dover).

Streeter and Wylie Fluid Mechanics (McGraw-Hill).

Young Munson and Okishi A Brief Introduction to Fluid Mechanics (Wiley).

Vennard and Street Elementary Fluid Mechanics (Wiley).

CIVL 2801 Engineering Construction 1

4 credit points

Offered: July. **Classes:** 26hrs lec & 26hrs tut. **Assessment:** Regular coursework as well as class tests (no final examination will be conducted).

Second year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil). Elective unit of study for other branches.

Objectives: To gain an understanding of the fundamentals of engineering construction including systems and methods in construction of excavation, embankments and other earthworks, hauling and associated operations.

Outcomes: Students should develop basic competency in earthwork engineering and economic optimisation of related construction, including proposing and analysing systems and methods, estimation of probable output, unit cost and productivity evaluation.

Syllabus summary: Introduction to the framework under which construction projects are formulated and analysed; construction engineering fundamentals; construction systems related to excavation, hauling and embankment construction, including selection and evaluation of plant and methods as well as the expected output and cost; introduction to construction operations management.

Textbooks

Lecture Notes for Engineering Construction 1 (Department of Civil Engineering, The University of Sydney).

Reference Books

Peurifoy and Ledbetter Construction Planning Equipment and Methods (McGraw-Hill).

Atlas Copco Adas Copco Manual (Atlas Copco Co.).

CAT Caterpillar Performance Handbook (CAT Publication).

Church Handbook of Excavation.

Havers, et al (editors) Handbook of Heavy Construction.

CIVL 3005 Engineering Communications 2

2 credit points

Prerequisite: CIVL 2004 Engineering Communications 1. **Offered:** July. **Classes:** 26hrs discussion/oral presentation. **Assessment:**

Based on written reports and oral presentations. Extra credit for oral presentation may be given for verifiable public speaking activities with the students' section of the Institution of Engineers, Australia, or the University of Sydney Debating Society, or equivalent organisation. Students are encouraged to engage in these activities. Third year core unit of study for the degree in Civil Engineering.

Objectives: To develop effective written and oral communication, interpersonal skills, and advocacy of civil engineering.

Outcomes: Ability to argue in writing and orally for (or against) topics of general, technical and/or social significance.

Syllabus summary: Information searches including use of electronic databases. Dealing with the media. Written reports and oral presentation on topics of general, technical and/or social significance. Effective group communication and teamwork.

CIVL 3102 Materials Aspects in Design

4 credit points

Prerequisite: CIVL 2101 Properties of Materials. **Offered:** July.

Classes: lec 40hrs, lab: 12hrs. **Assessment:** One 3hr exam covering the whole syllabus.

Third year core unit of study for the degree in Civil Engineering. Third year elective unit of study for the degree in Project Engineering and Management (Civil).

Objectives: To relate the mechanical properties of metals and cement-based materials to the design of structures made from these materials.

Outcomes: Ability to predict the influence of material properties upon the response of the structure under service conditions.

Syllabus summary: Fracture aspects in the design and use of concrete and reinforced concrete structures. Fracture, fatigue, fire and corrosion aspects in the design and use of metal structures. Durability and serviceability aspects in the design and use of concrete and reinforced concrete structures. Two laboratory sessions on failure modes of RC beams, one laboratory session on electron microscopy, one field trip.

Textbooks

Materials Science and Engineering an Introduction

William D. Callister Jr. 4th Edition 'Wiley' publishers

Campbell-Allen and Roper Concrete Structures: Materials

Maintenance and Repair (Longman Scientific and Technical) - preferred text.

Soroka Portland Cement Paste and Concrete (Macmillan Australia, 1979)

Akroyd Concrete - Its Properties and Manufacture (Pergamon)

and/or

Troxell Composition and Properties of Concrete 2nd edn (McGraw Hill).

U.S. Bureau of Reclamation Concrete Manual
Czernin Cement Chemistry and Physics for Civil Engineers (Lockwood).

Relevant SAA Specifications.

CIVL 3204 Structural Analysis

6 credit points

Prerequisite: CIVL 2201 Structural Mechanics and MATH 2002 Matrix Applications plus MATH 2005 Fourier Series and Differential Equations. **Offered:** February. **Classes:** 42hrs lec & 42hrstut.

Assessment: One 3 hr exam at end of semester plus assessment of assignments.

Third year core unit of study for the degree in Civil Engineering. Third year elective unit of study for the degree in Project Engineering and Management (Civil).

Objectives: To provide an understanding of the principles of (a) the force and displacement methods for analysing redundant trusses and beams, and (b) the lower and upper bound methods for the plastic analysis of beams and frames. To be able to apply computer methods to structural analysis and to check the validity of such solutions.

Outcomes: To be able to apply the manual methods of analysis taught in the unit of study to simple structures. To be able to apply and check computer analyses of structures.

Syllabus summary. Analysis of statically redundant trusses and frames using the force and displacement methods. Internal forces and deflections of statically redundant trusses and frames. Lack of fit. Virtual work principles: principle of virtual forces and principle of virtual displacements. Computer methods for analysing plane frames and trusses. Program PRFSA. Plastic analysis of beams and frames. Upper and lower bound theorems.

Textbooks

KJR Rasmussen, Structural Analysis 1, (Univ of Sydney)

KJR Rasmussen, GJ Hancock, M.J Clarke Structural Analysis 2, (Univ of Sydney)

Reference Books

Popov, Introduction to the Mechanics of Solids (Prentice Hall)

Parkes, Braced Frameworks (Pergamon)

Timoshenko and Young, Theory of Structures (McGraw Hill)

CIVL 3206 Steel Structures 1

6 credit points

Prerequisite: CIVL 2201 Structural Mechanics. **Corequisite:** CIVL 3102 Materials Aspects in Design, CIVL 3204 Structural Analysis.

Offered: July. **Classes:** 39hrs lec, 39hrs tut/lab/drawing office.

Assessment: One 3 hr exam at the end of the semester plus assessment of design and problem based assignments.

Third year core unit of study for the degree in Civil Engineering. Third year elective unit of study for the degree in Project Engineering and Management (Civil).

Objectives: To provide a basic understanding of the behaviour and design of steel members, connections and structures.

Outcomes: The development of some of the skills required for the design of practical steel structures.

Syllabus summary: The behaviour and design of steel members, connections and structures - design concepts, loads and load combinations, strength, stability and serviceability criteria, safety and reliability, practical steel structures, properties of cross-sections, local buckling, elastic beams, plastic beams, tension members, compression members, effective lengths and elastic in-plane frame buckling, lateral buckling of beams, in-plane bending of beam-columns, lateral buckling of beam-columns, bolted and welded connections.

Textbooks

(AISC) Economical Structural Steelwork.

G.J. Hancock & M.J. Clarke CIVL 3206 Steel Structures 1 printed lecture notes.

BHP Hot Rolled and Structural Products Handbook.

Standards Australia Specifications - current editions

AS1170 Parts 1 and 2 Loading Code, and

AS4100 Steel Structures Code; or

ASHB2.2 Structural Engineering Standards.

Reference books

AISC Design Capacity Tables for Structural Steel.

Trahair and Bradford Behaviour and Design of Steel Structures to AS4100 (3rd Edn, E & FN Spon, 1998).

CIVL 3207 Risk and Reliability Analysis

2 credit points

Prerequisite: MATH 1001, MATH 1002, MATH 1003, MATH 1005, CIVL 2201 Structural Mechanics, CIVL 2203 Structural Design.

Offered: February. **Classes:** 16hrs lec; 12hrstut. **Assessment:** One 3hr exam plus assignments.

Third year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Objectives: To provide a basic understanding of the principles of statistical decision theory, probabilistic risk assessment and structural reliability analysis; to develop an understanding of basic methods of risk and reliability analysis, including event trees, fault trees and decision trees and First Order Second Moment methods of structural reliability analysis; to develop an understanding of the principles of reliability-based design.

Outcomes: Understanding of basic methods of risk and reliability analysis and interpretation of results.

Syllabus summary: Review of basic statistical methods of analysis (including significance testing, and linear regression); probability concepts, Bayes' Theorem, statistical decision theory, preposterior analysis; probability measures, types of uncertainty, principles of probabilistic risk assessment, event trees, risk acceptance criteria; structural safety and reliability; First Order Second Moment methods of reliability analysis, the Safety Index, the design point, reliability based design, simulation methods, system effects.

Reference books

Blockley (ed.) Engineering Safety (McGraw-Hill, 1992).

Madsen, Krenk and Lind, Methods of Structural Safety (Prentice-Hall, 1986).

Melchers, Structural Reliability Analysis and Prediction (Ellis Horwood/Wiley, 1987).

CIVL 3223 Concrete Structures - Behaviour

3 credit points

Prerequisite: CIVL 2201 Structural Mechanics and CIVL 2203 Structural Design. **Prohibition:** CIVL 3205 Concrete Structures 1.

Offered: February. **Classes:** Lectures 28hrs: tut/lab/drawing office 14 hrs. **Assessment:** One 3 hour exam plus mid-semester test and report.

Third year unit of study for the degree in Civil Engineering. Third year elective unit of study for the degree in Project Engineering and Management (Civil).

Syllabus Summary: The behaviour of reinforced concrete members and structures, including: introduction, material properties, 'elastic' analysis (stresses/deformations/time-dependance), ultimate strength of beams (flexure), ultimate strength of columns (short and slender).

Objectives: To provide a basic understanding of the behaviour of reinforced concrete members and structures; to provide a basic understanding of standard methods of analysis of reinforced concrete behaviour (including an understanding of capabilities and limitations).

Expected Outcomes: Proficiency in basic methods of reinforced concrete analysis and interpretation of results.

Textbooks

Warner et al, Concrete Structures (Longman 1998)

Standards Australia Specifications - current editions:

AS3600 Concrete Structures Code

ASHB2.2 Structural Engineering Standards

Reference Book

Park and Paulay, Reinforced Concrete Structures.

CIVL 3224 Concrete Structures - Design

3 credit points

Prerequisite: CIVL 2201 Structural Mechanics and CIVL 2203 Structural Design. **Prohibition:** CIVL 3205 Concrete Structures 1.

Offered: July. **Classes:** Lectures 24 hrs: tut/lab/drawing office 18 hrs. **Assessment:** One 3 hour exam plus design project.

Third year unit of study for the degree in Civil Engineering. Third year elective unit of study for the degree in Project Engineering and Management (Civil).

Syllabus Summary: The reinforced concrete truss analogy (shear/torsion/and detailing implications). Introduction to behaviour of reinforced concrete slabs. Design of typical elements of a reinforced concrete building, structural modelling, analysis of load-effects (incl.earthquakes), design criteria (for durability, fire-resistance, serviceability and strength), design calculation procedures, reinforcement detailing, structural drawings.

Objectives: To provide a basic understanding of standard methods of analysis and design of reinforced concrete structures (including an understanding of capabilities and limitations); to provide basic design training in a simulated professional engineering environment.

Expected Outcomes: Proficiency in basic methods of reinforced concrete analysis and design.

Textbooks

Warner et al. Concrete Structures (Longman 1998)
Standards Australia Specifications - current editions:
AS1170 Loading Code - Parts 1.2 & 4
AS3600 Concrete Structures Code
ASHB2.2 Structural Engineering Standards

Reference Books

Concrete Design Handbook, Cement and Concrete Association of Australia
Reinforcement Detailing Handbook, Concrete Institute of Australia.

CIVL 3401 Soil Mechanics A

4 credit points

Prerequisite: CIVL 2201 Structural Mechanics. **Offered:** February. **Classes:** 26hrs lec, 26hrs lab/tut. **Assessment:** One 3hr exam covering the whole syllabus at the end of semester. Satisfactory laboratory performance is also a requirement. Credit will be given for laboratory and tutorial submissions, as indicated at the commencement of the course.

Third year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Objectives: To develop an understanding of: the nature of soils as engineering materials; the common soil classification systems; the importance of water in the soil and the engineering effects of water movement; the factors controlling soil settlements.

Outcomes: Students should gain the ability: to predict the engineering behaviour of soils based on soil classification; to quantify the effects of water in the soil; to predict soil settlement.

Syllabus summary: Soil structure and engineering classification of soils, compaction, effective stress concept, analysis of steady state seepage, one dimensional consolidation theory, stresses beneath loaded areas, analysis of soil settlement.

Reference books

CR. Scott An Introduction to Soil Mechanics and Foundations.
R.F. Craig Soil Mechanics.

CIVL 3402 Soil Mechanics B

4 credit points

Prerequisite: CIVL 2201 Structural Mechanics. **Corequisite:** CIVL 3401 Soil Mechanics A. **Offered:** July. **Classes:** 26hrs lec, 26hrs lab/tut. **Assessment:** One 3hr exam covering the whole syllabus at the end of semester. Satisfactory laboratory performance is also a requirement. Credit will be given for laboratory and tutorial submissions, as indicated at the commencement of the course.

Third year core unit of study for the degree in Civil Engineering. Third year elective unit of study for the degree in Project Engineering and Management (Civil).

Objectives: To develop an understanding of the concept of soil strength, and how this can be used in estimating the stability of soil constructions.

Outcomes: Students should gain an understanding of: the strength of soil masses and the factors that control the strength; the basic theories of bearing capacity and slope stability. In particular, students should gain the ability to: interpret soil strength tests; predict the strength and stability of soil.

Syllabus summary: Shear strength of soils. Earth pressure theories. Elementary bearing capacity theory. Slope stability analysis. Analysis of Retaining Walls, Pile capacity

Reference Books

CR. Scott An Introduction to Soil Mechanics and Foundations.

J.H. Atkinson An Introduction to the Mechanics of Soils and Foundations: Through Critical State Soil Mechanics.
R.F. Craig Soil Mechanics.

CIVL 3501 Surveying 1

4 credit points

Prerequisite: MATH 1001, MATH 1002, MATH 1003, MATH 1005.

Offered: February. **Classes:** lec: 28hrs, fieldwork/pract.: 24hrs.

Assessment: fieldwork, reports, tutorials, and one 3hr exam at the end of the course.

Third year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Objectives: To introduce students to basic distance, angle, and height measurement; to give students sufficient knowledge to achieve basic computational, analytical, and interpretational skills based on the measurements; to introduce students to basic electronic field equipment; to give students an insight into future trends in measurement technologies.

Outcomes: Students should gain ability to: undertake basic angle and distance measurement; undertake appropriate calculations and checks involving observed data; understand errors associated with measurement, select the correct measurement alternatives for simple measurement problems.

Syllabus summary: Introduction to engineering surveying, distance measurement, angle measurement, levelling, measurement errors, traversing, topographic surveys, optical distance measurement, error analysis, electronic surveying equipment, future surveying technologies.

Textbooks

J. Fryer, M. Elfick, R. Blinker, P. Wolf Elementary Surveying (Harper Collins Publishers).

J. Uren and W.F. Price Surveying for Engineers (MacMillan).

CIVL 3602 Fluids 2

4 credit points

Prerequisite: CIVL 2610 Fluids 1. **Offered:** July. **Classes:** 26hrs lec, 26hrs prac work/tut. **Assessment:** one 3hr exam covering the whole syllabus at the end of semester. Credit will be given for practical work and tutorial submissions, as indicated at the commencement of the course.

Third year core unit of study for the degree in Civil Engineering. Third year elective unit of study for the degree in Project Engineering and Management (Civil).

Objectives: To develop an understanding of: theory and practical aspects of analysis of fluid behaviour in pipes and open channels, and of fluid machines.

Outcomes: Students should gain the ability: to calculate heads and flows through pipe and open channel systems for steady and for unsteady conditions; and to determine machine requirements for various systems.

Syllabus summary: Dimensional analysis and similitude, open channel flow, pipe networks, hydro and aero-foils, pumps and turbines, compressible flow and unsteady flows.

Textbooks

Douglas, Gasiorek and Swatfield Fluid Mechanics (Pitman).
Hydraulics Data Sheets (Department of Civil Engineering, University of Sydney).

Robertson and Crowe Engineering Fluid Mechanics (Wiley).

Rouse Elementary Mechanics of Fluids (Dover).

Streeter and Wylie Fluid Mechanics (McGraw-Hill).

Young Munson and Okiishi A Brief Introduction to Fluid Mechanics (Wiley).

Vennard and Street Elementary Fluid Mechanics (Wiley).

CIVL 3701 Transportation Engineering and Planning

2 credit points

Offered: July. **Classes:** 26hrs lec. **Assessment:** one 2hr exam and assignment.

Third year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil). Third and fourth year elective unit of study for the degree in Mechanical Engineering.

Objectives: To introduce students to the civil engineering aspects of the main modes of transport and their effects on the environment.

Outcomes: An appreciation will be gained of the basic requirements of the main transport modes in the design of facilities, along with environmental effects and the acquisition of transport planning information.

Syllabus summary: Functions of railway track components and track properties. Rail classification yards. Airport general layout, runway and terminal design. Design of ports and port structures in relation to ships and cargo handling. Containerisation and container facilities. Data collection and presentation for transport planning; gravity models. Environmental factors and impact assessment. Geometric design of roads. Road pavement design: flexible and rigid.

Reference books

Hay Introduction to Transportation Engineering (Wiley).
Wright and Ashford Transportation Engineering - Planning and Design (Wiley, 1989).
ICAO Airport Planning Manual.
Rural Road Design (Austroads 1989).
Pavement Design (Austroads 1992).

CIVL 3802 Engineering Construction 2

4 credit points

Assumed knowledge: Completion of CIVL 2801 Engineering Construction 1 or equivalent knowledge. **Offered:** February.

Classes: 26hrs lec & 26hrs tut. **Assessment:** A number of assignments, including both oral and written presentations, will make up 90 marks, a site visit report will be assessed formally and will make the balance 10 marks (total 100 marks).

Third year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil), elective for other branches of engineering.

Objectives: To gain a working knowledge of building structures and heavy construction engineering, including planning, cost estimating and optimisation of construction operations related to building structures, underground structures, quarry operations, temporary structures and associated aspects. The objectives are to be achieved by active participation in a number of projects and preparation of plans for the same.

Outcomes: Students should develop basic competency in planning, engineering, optimisation and cost estimation of operations in civil engineering and building construction, including design of construction systems and temporary works.

Syllabus summary: Fundamentals of tunnelling in soft and hard rock, ground improvement, piling and excavation support design, construction systems for multi-storey structures, vertically-formed concrete structures, construction water supply and dewatering, production of natural and crushed rock aggregates, pavement design fundamentals and construction, safety in construction, quality management of construction works. This course will be run through a problem-based learning approach.

Textbooks

Hand-outs will be given during the currency of the course

Reference Books

Peurifoy and Ledbetter Construction Planning Equipment and Methods (McGraw-Hill).
Ratay (editor), 2nd Ed Handbook of Temporary Structures in Construction (McGraw-Hill).
Brockenbrough, et al, (editors) Highway Engineering Handbook (McGraw-Hill).
Havers, et al (editors) Handbook of Heavy Construction.
Numerous other reference books which will address specific segments of the course, such as design and engineering of temporary structures or tunnelling.

CIVL 3803 Project Appraisal

4 credit points

Coordinator A.Prof. A. Jaafari QA auditor: A.Prof. R J When

Prohibition: CIVL 4803 Engineering Management. **Offered:** February. **Assessment:** Tests and coursework (no final examination at the end of semester).

Senior core course for the Bachelor of Project Engineering & Management (Civil), elective for all other branches of engineering and faculties.

Course objectives: To develop basic competency in project appraisal, planning and strategic management, including an ap-

preciation of the total project life cycle analysis and associated decision processes.

Expected outcomes: Students should be able to carry out basic project appraisal, financial planning and life cycle costing tasks. Projects and ventures in both public and private sectors will be studied. It is expected that students will develop skills in decision making regarding analysis of alternatives, financial budgeting and project capital decisions.

Syllabus summary: Framework for conceptualisation and development of capital projects; various stages in project life cycle; importance of front-end planning and optimisation; techniques for project appraisal; economic analysis of public sector projects; depreciation, capitalisation and valuation studies, replacement of long term assets, the impact of fiscal policies on projects; value engineering/management; sensitivity and project risk analysis/management; project assignment.

Textbooks

Grant, Ireson and Leavenworth, Principles of Engineering Economy (J.Wiley & Sons).

Reference books

Thompson, Organisation and Economics of Construction (McGraw-Hill).
Turner, Handbook of Project-based Management (McGraw-Hill).

CIVL 3804 Contracts Formulation & Management

5 credit points

Coordinator A.Prof. A. Jaafari, Mr. Stephen Hibbert QA auditor: A. Prof. Ft J Wheen

Offered: July. **Assessment:** A major assignment plus normal project coursework and written examination, as generally advised at the commencement of the course.

Senior core course for the Bachelor of Project Engineering and Management (Civil), elective for all other branches of engineering and faculties.

Course objectives: To give students a fundamental knowledge of the legal system under which project procurement is conducted generally. Emphasis will be on the principles of contract formulation, administration and finalisation, including prevention and/or settlement of disputes.

Expected outcomes: This course will lead to the development of theoretical knowledge in the field of project procurement via contracts formulation and administration, covering not only the areas of contracting but also the principles behind good management of legal framework and associated issues.

Syllabus summary: Brief overview of the legal system in Australia and comparison with the legal systems in the region, fundamental principles behind good management and comparison with legal requirements; fundamentals of project procurement management, introduction to the contract law; introduction to the relevant statutes/by-law requirements and regulations made under these affecting project ownership, planning, design and implementation; review of principal forms of project procurement, implementation and administration; potential liabilities associated with project participation; review of typical project delivery systems, including standard and model contract conditions and specifications; optimisation of project team responsibilities, quality management provisions; optimum systems for project delivery/management under uncertain conditions; management of OH&S, environmental due diligence and other statutory liabilities; management of contract extensions and claims; management of documentation and records; project assignment.

Textbooks

Allan, Law of Contract in Australia (CCH Australia).

Reference books

Numerous references are specified at the commencement of the course.

CIVL 3805 Project Scope, Time & Cost Management

6 credit points

Coordinator A.Prof. A. Jaafari, Mr. Ted Tooher QA auditor: A.Prof. R J Wheen

Offered: February. **Assessment:** Tests and assignment completed and submitted by students in stages. Details will be advised at the commencement of the course.

Senior core course for the Bachelor of Project Engineering & Management (Civil), elective for all other branches of engineering and faculties.

Course objectives

- to develop underpinning knowledge of scope, time and cost management as applied to projects
- to provide practical examples and opportunities to apply scope, time and cost management to projects
- to initiate process of reflective learning and evidence development for competencies in the areas of scope, time and cost management

Expected outcomes

- demonstrate knowledge of subject area
- ability to apply tools in a project environment
- competence in learning and evidence generating to sustain competency.

Syllabus summary

Scope management including project authorisation, scope definition, control and finalisation. Cost management including project costing, resource planning budgeting and controlling financial completion. Time management including activity sequencing, duration estimating, scheduling progress, monitoring and forecasting.

Textbooks

Turner, Handbook of Project-based Management (McGraw-Hill).

Reference books

PMI, A Guide to the Project Management Body of Knowledge.
www.aipm.com.

CIVL4008 Practical Experience

0 credit points

Prerequisite: 28 credit points of Senior courses. **Offered:** February. **Classes:** 12wks practical work experience (375hrs minimum). **Assessment:** A written report.

Fourth year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Objectives: To expose students to Engineering Practice and provide working experience in the field of engineering.

Outcomes: Students will gain first hand experience of working in an Engineering environment, will see how engineering companies are organised and will be exposed to problem solving in a commercial environment.

Syllabus summary: Each student is required to work as an employee of an approved engineering organisation and to submit a satisfactory written report of his or her work. Normally 12 weeks of practical work experience (375 hours minimum) is required and this is mainly undertaken after the completion of some or all of the prescribed Senior core courses and before enrolment in the final year of study. The University Careers and Appointments Service is available to assist students to obtain suitable employment.

Reference book

Eagleson Writing in Plain English (Aust. Govt Publishing Service)

CIVL 4016 Professional Practice

5 credit points

Offered: July. **Classes:** 26hrs lec, 26hrs tut. **Assessment:** Project test and assignment work.

Fourth year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Objectives: To provide final year students with an appreciation of professional matters which will influence the way they will work as professional engineers.

Outcomes: Knowledge of occupational health and safety act; knowledge of procedures for quality assurance both in design and construction; understanding of industrial relations issues; understanding of basic civil engineering contracts; awareness of ethical issues related to the engineering profession, and the social responsibility of engineers.

Syllabus summary: The lectures will be delivered by practising engineers and other experts in the following subject areas: (a) Social responsibility in engineering, social and environmental issues and ethics of engineering practice; (b) Industrial relations, legal contracts and law; (c) Occupational health and safe-

ty, (d) quality assurance; (e) engineering contracts and documentation, (f) ecologically sustainable development.

Reference books

As advised during course, and:

Tagg et al. Civil Engineering Procedure (Thomas Telford).
Weame Civil Engineering Contracts (Thomas Telford).

CIVL 4013 Honours Thesis, Design, Project

10 credit points

Prerequisite: 40 credit points of senior subjects (WAM >65%).

Prohibition: CIVL 4014 or CIVL 4015. **Offered:** Full Year (starts Feb). **Classes:** Literature survey, design, expt and/or analysis work over whole year. **Assessment:** A bound document is to be submitted for assessment.

Fourth year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Objectives/Outcomes: To develop an understanding of the practice of civil engineering. Students will gain skills in design, analysis and management by undertaking a significant project.

Each student is required to conduct one piece of experimental, theoretical or design work in greater detail than is possible in ordinary classes and to write a thesis presenting the results of these investigations.

The level of originality for an honours thesis is greater than that required for the ordinary degree unit of study. This unit of study should be completed successfully for the award of Honours in the civil stream of Bachelor of Engineering.

CI VL 4014 Thesis/Design/Project

5 credit points

Prerequisite: 40 credit points of Senior Subjects. **Prohibition:** CIVL 4013 Honours Thesis/Design/Project or CIVL 4015. **Offered:** Full Year (starts Feb). **Classes:** Literature survey, design, expt and/or analysis work over whole year. **Assessment:** A bound document is to be submitted for assessment.

Fourth year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Objectives/Outcomes: To develop an understanding of the practice of civil engineering. Students will gain skills in design, analysis and management by undertaking a research project.

Each student is required to conduct one piece of experimental, theoretical or design work in greater detail than is possible in ordinary classes and to write a thesis presenting the results of these investigations.

CIVL 4015 Thesis/Design/Project - One Semester

5 credit points

Prerequisite: 40 credit points of Senior subjects and written approval from the Head of Civil Engineering. **Prohibition:** CIVL 4013 Honours Thesis/Design/Project or CIVL 4014. **Offered:** February. **Classes:** Literature survey, design, expt and/or analysis work over whole year. **Assessment:** A bound document is to be submitted for assessment.

NB: Availability in 2000 to be confirmed.

Fourth year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

This course is designed to allow students to complete their thesis at an accelerated pace (in one semester rather than over a full year). Students must seek written approval from the Head of Civil Engineering to enrol in this course. Approval will be granted subject to need and academic ability.

Objectives/Outcomes: To develop an understanding of the practice of civil engineering. Students will gain skills in design, analysis and management by undertaking a research project.

Each student is required to conduct one piece of experimental, theoretical or design work in greater detail than is possible in ordinary classes and to write a thesis presenting the results of these investigations.

CIVL 4105 Advanced Materials

5 credit points

Prerequisite: CIVL 3102 Materials Aspects in Design. **Offered:** July. **Classes:** 40 hrs lec & 12 hrs lab/tut. **Assessment:** One 3 hr exam plus assignments.

Fourth year elective unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Advanced cementitious materials, fibre-reinforced concrete. Modern ceramics and mechanisms for their toughening. High strength steels, stainless steels, multiaxial fatigue, impact strength of materials, stress corrosion cracking in metals. Thermal properties of mass concrete, dynamic effects on concrete properties, statistical analysis and interpretation of concrete data. Durability problems of prestressed and post-tensioned members. The laboratory sessions are held in the Microscope Unit to familiarise students with transmission and scanning microscopy, microanalysis and image analysis.

Objectives: to develop an understanding of advanced cement-based and metallic materials for new and challenging applications.

Outcomes: Ability to select advanced cement-based and metallic materials for use under demanding service conditions for which their traditional counterparts may be less suitable.

CIVL 4218 Concrete Structures 2

5 credit points

Prerequisite: CIVL 3223 Concrete Structures - Behaviour, CIVL 3224 Concrete Structures - Design. **Offered:** July. **Classes:** 28hrs lec. 28hrs tut. **Assessment:** One 3 hr exam plus assessment of selected assignments.

Fourth year elective unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Syllabus summary: Practical aspects of reinforced concrete, prestressed concrete and composite steel-concrete members and structures - non-linear behaviour, load-moment-curvature relationships, serviceability and strength for prestressed concrete beams in flexure and shear, anchorage zones, prestress losses, load balancing, strength of beams, columns and beam columns, moment redistribution, ultimate strength of concrete slabs, yield line analysis of slabs, strip equilibrium analysis of slabs, the analysis of time-dependent effects in concrete structures models of concrete creep and shrinkage, design of composite t-beams, design of composite slabs incorporating profiled steel sheeting, design of composite columns.

Objectives: To develop a depth in understanding of the fundamental behaviour and design of concrete and composite members and structures.

Outcomes: The development of design skills that will lead to reliable and economical designs of both practical and more complex structures.

Textbooks

Warner et al. Concrete Structures (Longman).
Standards Australia Specification - current editions
AS2327 Part 1 Composite Structures Code
AS 1170 Parts 1 and 2 Loading Code, and
AS3600 Concrete Structures Code, or
AS HB2.2 Structural Engineering Standards.

Reference books

Lin and Bums Design of Prestressed Concrete Structures (Wiley).
Park and Gamble Reinforced Concrete Slabs (Wiley).
Other books as indicated in classes.

CIVL 4219 Structural Dynamics

5 credit points

Prerequisite: CIVL 3204 Structural Analysis. **Offered:** February. **Classes:** 26hrs lec. 26hrs tut. **Assessment:** One 3hr exam and assignments.

Fourth year elective unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Syllabus summary: Introductory structural dynamics, natural frequency, free and forced vibration, structural damping. Single and multi-degree of freedom systems, finite element dynamic analysis, consistent mass matrix, damping matrix, free vibration, forced vibration, wind loading on structures.

Objectives: To provide an understanding of the dynamic behaviour of structural systems and wind loads on structures.

Outcomes: To be able to determine the natural frequency of simple structural systems manually and complex systems using computer analyses; to be able to perform analyses for the effects of forced vibration and structural damping; to be able to perform wind analyses on low and high rise structures.

Textbooks

William T. Thomson Theory of Vibration with Applications 2nd Ed. (Allen & Unwin, 1983).

Clough & Penzien Dynamics of Structures (McGraw-Hill Book Co., 1993).

'Vibrations in Civil Engineering', Postgraduate Course, Department of Civil Engineering, The University of Sydney, May, 1981.

AS 1170.2-1989 SAA Loading Code Part 2: Wind Loads (Standards Australia).

Aynsley, Melbourne and Vickery Architectural Aerodynamics (Applied Science Publishers).

Narayanan and Roberts Ed. Structures Subjected to Dynamic Loading (Elsevier Applied Science).

Holmes, Walker and Melbourne A Commentary on the Australian Standard for Wind Loads (Australian Wind Engineering Society).

CIVL 4220 Steel Structures 2

5 credit points

Prerequisite: CIVL 3206 Steel Structures 1. **Offered:** July. **Classes:** 28hrs lec. 28hrs tut. **Assessment:** One 3 hr exam at end of the semester plus assessment of assignment work.

Fourth year elective unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Syllabus summary: Local buckling behaviour and design; stability analysis and design of steel structures including flexural-torsional buckling analysis. Advanced connections - behaviour, analysis and design. Shell structures -behaviour and membrane analysis.

Objectives: To develop a working knowledge of the behaviour and design of steel structures beyond a basic competency.

Outcomes: Proficiency in the design of steel structures.

Textbooks

Trahair and Bradford Behaviour and Design of Steel Structures (Chapman & Hall, 1991).

Standards Australia AS4100 - Steel Structures (1998).

Hogan and Thomas Design of Structural Connections, 4th Edition, (AISC 1994).

Syam and Chapman Design of Structural Steel Hollow Section Connections (AISC, 1996).

Gibson Thin Shells (Pergamon, 1980).

Vinson the Behaviour of Plates and Shells (Wiley, 1974).

Reference books

Bulson Stability of Flat Plates (Chatto & Windus, 1970).

Hancock Design of Cold-Formed Structures (AISC, 1994).

Rraus Thin Elastic Shells (Wiley, 1967).

Calladine Theory of Shell Structures (CUP, 1983).

Other books as indicated during classes.

Library Classification: 624.17, 624.182

CIVL 4221 Bridge Engineering

5 credit points

Prerequisite: CIVL 3223 Concrete Structures - Behaviour, CIVL 3224 Concrete Structures - Design and CIVL 3206 Steel Structures 1. **Offered:** February. **Classes:** 26hrs lec & 26hrs tut. **Assessment:** Based on submitted work, seminar presentations and one 3hr exam. Fourth year elective unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Syllabus summary: Highway and railway bridge loading; influence lines; analysis; transverse load distribution; computer modelling of bridges; effects of temperature and concrete creep and shrinkage; bridge bearings; selection of structural forms; standardised bridge systems, skew and curved bridges, bridge foundations; construction methods; case studies of significant bridges.

Objectives: To develop an understanding of the key issues in the design, construction and maintenance of bridges.

Outcomes: An appreciation of the relevance of all other courses of study to the practice of all aspects of Bridge Engineering.

Reference books

NAASRA Bridge Design Specification.

Australian and New Zealand Railway Conferences Railway Bridge Design Manual.

CIVL 4222 Finite Element Methods

5 credit points

Prerequisite: CIVL 3204 Structural Analysis. **Offered:** February.**Classes:** Sem: 26hrs lec & 26hrs tut. **Assessment:** Classwork, assignments and one 3hr exam.

Fourth year elective unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Syllabus summary: Introduction to finite elements, analysis of bars, beams and assemblages. Analysis of elastic continua, in-plane stresses in plates, plane strain problems, plate bending, use and testing of finite element packages.

Objectives: To provide an understanding of the basics of finite element analysis and how to apply this to the solution of engineering problems.

Outcomes: A knowledge of methods of formulating finite element equations, basic element types, the use of finite element methods for solving problems in structural and continuum analysis and the use of finite element packages.

Reference books

Zienkiewicz The Finite Element Method 3rd edn (McGraw-Hill, 1977).

Bathe and Wilson Numerical Methods in Finite Element Analysis (Prentice Hall, 1976).

Cook Concepts and Applications of Finite element Analysis (John Wiley, 1974).

CIVL 4406 Environmental Geotechnics

5 credit points

Prerequisite: CIVL 3401 Soil Mechanics A, CIVL 3402 Soil Mechanics B. **Offered:** July. **Classes:** Lectures and tutorials - 52 hours. **Assessment:** Tutorial and assignment submissions, as indicated at the commencement of the course.

Fourth year elective unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Syllabus summary: Landfill design, including clay mineralogy, effects of chemicals on soil permeability, flow rates through membranes, effect of punctures, composite liners, mechanisms of mass transport, diffusion, dispersion, advective transport, sorption, predicting transport time, solutions to advection-dispersion equation, design of liners, stability of clay liners on slopes, design of covers, infiltration rates. Tailings disposal, including types of tailings dams, design of dams, water balances, rehabilitation, use of slope stability and seepage software.

Objectives: To develop an understanding of the geotechnical aspects of the design and management of industrial and domestic waste disposal systems.

Outcomes: Students should gain an understanding of: the role of geotechnics in the design of waste management systems; current design methods and technologies. In particular, they should be able to predict: likely interactions between waste and soil; of pollutant movement in the ground, and be able to evaluate strategies for the containment of industrial and domestic wastes and mine tailings.

Reference Books

S. G. Vick Planning, Design and Analysis of Tailings Dams (Wiley).

R.K. Rowe, R.M. Quigley & J.R. Booker Clayey Barrier Systems for Waste Disposal Facilities.

Library classification: 624.151

CIVL 4407 Geotechnical Engineering

5 credit points

Prerequisite: CIVL 3401 Soil Mechanics A, CIVL 3402 Soil Mechanics B. **Offered:** February. **Classes:** Lectures and tutorials - 52 hours. **Assessment:** One 3 hour examination covering the whole syllabus at the end of semester. Credit will be given for tutorial and assignment submissions, as indicated at the commencement of the course.

Fourth year elective unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Site investigation and field measurements. Behaviour, selection and design of shallow foundations. Strip and raft foundations. Pile foundation analysis and design. Foundations on rock. Cam clay theory and application using computer programs.

Objectives: To develop an understanding of: current methods used in the investigation and design of foundations on soils and rocks; the limitations of these methods.

Outcomes: Students should gain an understanding of: the design process in foundation engineering; the role of site investigation and field testing; the need to deal with uncertainty. In particular, they should develop the ability to: interpret the results of a site investigation; to use soils data to design simple foundations, and develop an appreciation of the interaction between soils, the foundation system and the supported structure.

Reference Books

Tomlinson Foundation Design and Construction (Pitman).

Peck et al. Foundation Engineering (Wiley).

Poulos and Davis Pile Foundation Analysis and Design (Wiley).

Fleming et al. Piling Engineering (Halstead Press).

Das Principles of Foundation Engineering (PWS - Kent).

CIVL 4504 Surveying 2

5 credit points

Prerequisite: CIVL 3501 Surveying 1. **Classes:** 26hrs lec & 26hrs fieldwork and tut. **Assessment:** Fieldwork, reports, tutorials, and one 3hr exam at the end of the course.*NB: Not offered in 2000.*

Fourth year elective unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Syllabus summary: CAD and database applications, electronic distance measurement, precise angle measurement, high precision engineering surveys, geodetic surveying, global positioning systems, geographic information systems, photogrammetry and remote sensing.

Objectives: To introduce students to precise measurement technologies, processes, computational procedures, and interpretive skills; to give students a high level of understanding of automated electronic measuring systems; to introduce students to data handling, manipulation, and presentation at a project level.

Outcomes: Students should gain the ability to: undertake precise measurement procedures for determining position, extent and stability of points and structures; use advanced electronic measurement equipment; handle and manipulate data in electronic form; analyse data and determine the magnitude of errors.

Textbooks

J. Fryer, M. Elfick, R. Blinker, P. Wolf Elementary Surveying (Harper Collins Publishers); or

J. Uren and W.F Price Surveying for Engineers (MacMillan); or J. Muskett Site Surveying (Blackwell)

CIVL 4607 Environmental Fluids 1

5 credit points

Offered: February. **Classes:** 26 hrs lec, 26hrs tut. **Assessment:** Tests and assignment submissions as indicated at the beginning of the course.

Fourth year elective unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Syllabus summary: Elements of meteorology; precipitation measurement and analysis; design rainfall intensities; hydrographs; peak discharge calculations; evaporation and transpiration, infiltration and groundwater; surface runoff, flood routing.

Objectives: To develop an understanding of: basic meteorological principles; the principles of hydrology; the importance of flood routing; the principles of flood mitigation; irrigation requirements; evaporation and reservoir design.

Outcomes: Students will be able to: list the key factors which affect the climate of Australia; describe intensity-frequency-duration curves and explain their use; calculate design rainfall intensities; calculate peak flows from catchments; determine runoff hydrographs for various storm durations and intensities; state the principles of flood routing and perform flood routing calculations; assess surface runoff and infiltration in catchment; list and utilise design procedures for storage and service reservoirs; calculate reservoir safe yield; determine evaporation from reservoirs and evapo-transpiration from catchments.

Textbooks

Australian Rainfall and Runoff (I.E. Aust., 1987).

Computer Applications in Hydraulic Engineering Haestad Press
Reference books
Raudkivi Hydrology (Pergamon)
Raudkivi and Callander Analysis of Groundwater Flow (Edward Arnold).

CIVL 4608 Environmental Fluids 2

5 credit points

Assumed knowledge: Material covered in Environmental Fluids 1.
Offered: July. **Classes:** 26hrs lec, 26hrstut. **Assessment:** By tests and assignment submissions, as indicated at the beginning of the course.

Fourth year elective unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Coastal processes. Sediment transport. Breakwater design. Fluid structure interaction. Flood effects.

Objectives: To develop an understanding of: ocean wave generation, transmission and coastal effects; the principles of sediment transport; break-water design, fluid-structure interaction; flood detention basins and advanced flood routing techniques.

Outcomes: Students will be able to: list and describe the major parameters affecting ocean wave generation; describe the processes of ocean wave transmission; calculate energy transfer by waves; describe the behaviour of waves in shallow water; explain the fundamental principles of sediment transport; describe sediment transport processes in rivers; describe coastal sediment transport processes; explain basic performance requirements for breakwaters, and factors considered in their design; describe several fluid structures, together with associated fluid-structure interaction, including, but not limited to, spillways, stilling basins, bridge piers, water supply intakes; describe design considerations for flood detention basins; explain the principles of advanced flood routing techniques utilising computer programs.

Textbooks

Computer Applications in Hydraulic Engineering (Haestad Press).

CIVL 4609 Water Resources Engineering

5 credit points

Offered: July. **Classes:** Sem: 26hrs lec, 26hrs tut. **Assessment:** Tests and assignment submissions, as indicated at the beginning of the course.

Fourth year elective unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Water quality; water purification methods; water reticulation; water resource management; irrigation and hydro-power.

Objectives: To develop an understanding of: the assessment methods for water quality; physical biological and chemical treatment methods; water storage and distribution systems; management principles for water resources, including water re-use; irrigation techniques and demands; hydro-power systems.

Outcomes: Students will be able to: state the requirements of water quality for various purposes; detail the physical methods of water treatment; detail the biological methods used in water treatment; detail the chemical methods used in water treatment; design multi-node water distribution networks; explain the design principles of water supply for high-rise buildings; describe water conservation methods and management principles for water use, including storm water detention and treatment; explain 'grey water' re-use techniques and their applications; describe various irrigation methods and associated hydraulic design; design small scale hydro-power installations.

CIVL 4803 Engineering Management

4 credit points

Prohibition: CIVL 3803 Project Appraisal. **Offered:** February.
Classes: 26hrs lec, 26hrs tut.

Fourth year core unit of study for the degree in Civil Engineering.

Course objectives: To develop basic competency in project appraisal, planning and strategic management, including an appreciation of the total project life cycle analysis and associated decision processes.

Expected outcomes: Students should be able to carry out basic project appraisal, financial planning and life cycle costing tasks. Projects and ventures in both public and private sectors

will be studied. It is expected that students will develop skills in decision making regarding analysis of alternatives, financial budgeting and project capital decisions.

Syllabus summary: Framework for conceptualisation and development of capital projects; various stages in project life cycle; importance of front-end planning and optimisation; techniques for project appraisal; economic analysis of public sector projects; depreciation, capitalisation and valuation studies, replacement of long term assets, the impact of fiscal policies on projects; value engineering/management; sensitivity and project risk analysis/management; project assignment.

CIVL 4807 Project Formulation

5 credit points

Assumed knowledge: Completion of CIVL 3803 Project Appraisal or equivalent knowledge. **Offered:** July. **Classes:** Tutorials/workshops 52 hours. **Assessment:** No formal exam; assessment will be based on submitted documents and adequacy of oral presentation to a board of review.

Fourth year elective unit of study for the degree in Civil Engineering, elective for other branches. Core unit of study for the degree in Project Engineering and Management (Civil).

The unit will integrate the technical, commercial and managerial aspects of the formulation of a project or product. Technical design and specification will be carried out to the point where it can be shown that the concept is technically sound; technical innovation in the design concept for commercial edge will be encouraged. Students will be cast in the role of competing entrepreneurs faced with the exploitation of a business opportunity related to specific building and civil engineering projects and products. Groups will develop competitive proposals embodying business plans and demonstrating the technical and financial feasibility of the project and appropriate legal and managerial arrangements and corporate structure for the proposed enterprise. The unit will be conducted through workshops and with the participation of leading professionals from building, engineering, legal and financing industries.

Objectives: To develop an understanding of conceptualisation, formulation, analysis and documentation of building and civil engineering projects and products; to gain skills in the preparation of a business plan/proposal for a project or product, including technical, commercial and legal aspects and statutory approvals.

Outcomes: Students should develop an understanding of the fundamentals of project conceptualisation, appraisal, planning and optimisation plus ability to: model and analyse basic financing and cash flow requirements, risk management plan, marketing and sales plan, and design of professional documentation and presentation to a board of review.

CIVL 4808 Project Management & Information Technology

4 credit points

Coordinator A.Prof. A. Jaafari, Dr. Milad Saad QA auditor: A.Prof. R J Wheen

Assumed knowledge: Sufficient knowledge of information technology systems & communications capabilities. **Offered:** February. **Assessment:** Coursework and written examination. Details will be advised at the commencement of the course.

Fourth year core unit of study for Project Engineering & Management (Civil), elective for all other branches of engineering and faculties.

Course objectives

- To develop an understanding of information management for projects.
- To understand computer applications and current use of technology.
- To provide the ability to program and implement project management systems.

Expected Outcomes

- Understand the importance of information management for projects.
- Gain in-depth knowledge and skills in project management technology.

- Ability to apply the use of current technology and tools for projects

Syllabus summary

Fundamentals of information management; understanding of computer applications; cost benefit analysis; data capture and standardization; projects re engineering; benchmarks and testing; risk analysis; management roles and technology.

Textbooks

Published papers; internet addresses; reference books; case studies.

(Details will be advised at the commencement of the course.)

CIVL 4809 Project Planning & Tendering

4 credit points

Coordinator A.Prof. A. Jaafari QA auditor: A.Prof. R J Wheen Tutors: Mr. K K Manivong and Mr. M Chaaya

Assumed knowledge: Completion of Engineering Construction 1 & 2 or the equivalent knowledge. **Offered:** July. **Assessment:** A class test and an assignment, using an integrated system. Details will be advised at the commencement of the course.

Fourth year core unit of study for the Bachelor of Project Engineering & Management (Civil), elective for all other branches of engineering and faculties.

Course objectives

- To teach multidisciplinary project planning and scheduling skills
- To develop skills in computer-supported fully detailed planning and estimating
- To apply the principles of operational estimating to a given project including setting appropriate tendering strategies, risk analysis and setting of contingency budgets;
- To develop appropriate contractual reports and documentation, and to undertake a presentation of the proposed plans and strategies.

Expected Outcomes

Students will be able to plan and estimate engineering projects, jobs and operations based on resources and dedicated method statements. They will also develop an understanding of the processes and procedures used for computer-supported integrated planning and estimating

Syllabus Summary

Fundamentals of operational planning and estimating, resource allocation and optimisation, preparation of method statements, estimation of the quantities of resources for execution of tasks and operations, preparation of operational schedules, estimation of indirect costs, estimation of work package costs, building up estimates of direct cost, consolidation of direct cost, risk analysis, alternative analysis and optimisation of plans, setting contingencies, preparation and presentation of reports.

Textbooks

Lecture Notes on Operations Analysis and Management.

This unit will use an integrated system for teaching. Appropriate guidelines and textbooks will be given at the commencement of the unit.

Reference books

Halpin and Woodhead. Construction Management, Second

Edition, John Wiley & Sons.

Barrie and Paulson. Professional Construction Management.

CIVL 4810 Project Quality, Risk & Procurement Management

6 credit points

Coordinator A.Prof. A. Jaafari QA auditor: A.Prof. R J Wheen

Offered: July. **Assessment:** based on both coursework and written examination, details of which will be advised at the commencement of the unit.

Fourth year core unit of study for the Bachelor of Project Engineering & Management (Civil), elective for all other branches of engineering and faculties.

Course objectives: To provide underpinning knowledge and application skills in the project environment for:

- quality management
- risk management
- procurement management

Expected outcomes: Participants will be able to design and implement plans for quality time and risk on a range of simple generic projects and provide input to these plans for more complex projects. They will also be able to apply reflective learning to production of evidence towards satisfaction of competencies for recommitment as project managers.

Syllabus summary: Introduction to Modern Quality Management Principles, seven quality tools, quality assurance, preparation of quality plans. Introduction to risk analysis, planning and risk management through the project life cycle. Introduction to principles of procurement. Purchasing, contracts, partnerships and alliancing. Setup of procurement plans, administration and closure of contracts for project delivery.

Textbooks

Textbook: Turner, Handbook of Project-based Management (McGraw-Hill)

Reference books; PMIA Guide to the Project Management Body of Knowledge, www.aipm.com.

CIVL 4903 Civil Engineering Design

6 credit points

Prerequisite: CIVL 3223 Concrete Structures - Behaviour, CIVL 3224 Concrete Structures - Design, CIVL 3206 Steel Structures 1.

Offered: February. **Classes:** 13hrs lec & 39hrs of drawing office work. **Assessment:** No formal exam; assessment will be based on submissions.

Fourth year core unit of study for the degree in Civil Engineering and Project Engineering and Management (Civil).

Objectives: To give students an appreciation of the role of the designer in the development of Civil Engineering projects.

Outcomes: Students will have developed an understanding of the design philosophy. They will gain this through their involvement in a number of exercises which cover the design sequence from concept to documentation.

Syllabus summary: The design sequence including definition, value and criteria selection; generation of proposals; analysis of proposals; selection of design; development of details of a particular design selected. Feasibility studies and examination of existing works. Study of design projects by stages, including details of some aspects.

The unit is under the direction of an engineer in professional practice in cooperation with members of the academic staff. Lectures on specific aspects of design are supplemented by visits to construction, testing and manufacturing sites. Lectures and exercises on architectural design and practice and their relationship to civil engineering are included in the unit.

Reference books

The unit is of a wide-ranging nature, and all text and reference

books previous and current courses have relevance. In addition, reference will be made to many codes and guides to practice, of which the following list covers only the structural field:

Current SAA Codes, Manuals and Specifications, particularly

AS4100 - Steel Structures Code

AS3600 - Concrete Structures Code

AS 1554 - Manual Welding, Part I

AS 1170 - Loading Code, Parts I and H

AS1511 - High Strength Structural Bolting Code

MAI Steel Structures

N.A.A.S.R.A. Bridge Design Specification

AS 1720 - Timber Engineering Code

(Purchase of separate codes is recommended)

Computer Science

COMP 4300 Information Systems (Advanced Topic)

4 credit points

Prerequisite: Credit in COMP 3000 Management of Information Systems. **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester. **Assessment:** Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year recommended elective unit of study for the degree in Software Engineering. Elective unit of study for the other degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop knowledge of the concepts, and mastery of the techniques, in one specialist topic within the field of Information Systems. This would build on the broad survey provided by COMP 3000. The coverage would be at the level of an professional monograph, or papers from the research literature. The specific topic covered would vary from one offering to another, depending on staff interest and expertise. Example topics include: management of change in organisations, soft systems analysis, workflow management.

Syllabus Summary: Varies depending on specific topic.

COMP 4301 Algorithms (Advanced Topic)

4 credit points

Prerequisite: Credit in COMP 3001 Algorithms. **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester.

Assessment: Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year elective unit of study for the degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop knowledge of the concepts, and mastery of the techniques, in one specialist topic within the field of Algorithms. This would build on the broad survey provided by COMP 3001. The coverage would be at the level of an professional monograph, or papers from the research literature. The specific topic covered would vary from one offering to another, depending on staff interest and expertise. Example topics include: parallel algorithms, randomised algorithms, approximation algorithms for intractable problems.

Syllabus Summary: Varies depending on specific topic.

COMP 4302 Artificial Intelligence (Advanced Topic)

4 credit points

Prerequisite: Credit in COMP 3002 Artificial Intelligence. **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester.

Assessment: Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year elective unit of study for the degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop knowledge of the concepts, and mastery of the techniques, in one specialist topic within the field of Artificial Intelligence. This would build on the broad survey provided by COMP 3002. The coverage would be at the level of an professional monograph, or papers from the research literature. The specific topic covered would vary from one offering to another, depending on staff interest and expertise. Example topics include: Machine Learning, Natural Language Processing, Non-monotonic reasoning.

Syllabus Summary: Varies depending on specific topic.

COMP 4304 Graphics (Advanced Topic)

Prerequisite: Credit in COMP 3004 Graphics. **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester.

Assessment: Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year elective unit of study for the degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop knowledge of the concepts, and mastery of the techniques, in one specialist topic within the field of Graphics. This would build on the broad survey provided by COMP 3004. The coverage would be at the level of an professional monograph, or papers from the research literature. The specific topic covered would vary from one offering to another, depending on staff interest and expertise. Example topics include: three-dimensional rendering, constraint-maintainance image systems.

Syllabus Summary: Varies depending on specific topic.

COMP 4305 Networked Systems (Advanced Topic)

4 credit points

Prerequisite: Credit in COMP 3007 Networked Systems. **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester.

Assessment: Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year recommended elective unit of study for the degree in Software Engineering. Elective unit of study for the other degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop knowledge of the concepts, and mastery of the techniques, in one specialist topic within the field of Networked Systems. This would build on the broad survey provided by COMP 3007. The coverage would be at the level of an professional monograph, or papers from the research literature. The specific topic covered would vary from one offering to another, depending on staff interest and expertise. Example topics include: network management and performance tuning, internetworking, implementation of network protocols.

Syllabus Summary: Varies depending on specific topic.

COMP 4306 Database Systems (Advanced Topic)

4 credit points

Prerequisite: Credit in COMP 3005 Database Systems. **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester.

Assessment: Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year elective unit of study for the degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop knowledge of the concepts, and mastery of the techniques, in one specialist topic within the field of Database Systems. This would build on the broad survey provided by COMP 3005. The coverage would be at the level of an professional monograph, or papers from the research literature. The specific topic covered would vary from one offering to another, depending on staff interest and expertise. Example topics include: transaction processing monitors, advanced conceptual modelling, object-oriented databases.

Syllabus Summary: Varies depending on specific topic.

COMP 4307 Distributed Systems (Advanced Topic)

4 credit points

Prerequisite: Credit in (COMP 3007 Networked Systems or COMP 3009 Operating Systems). **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester. **Assessment:** Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year recommended elective unit of study for the degree in Software Engineering. Elective unit of study for the other degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop knowledge of the concepts, and mastery of the techniques, in one specialist topic within the field of Distributed Systems. This would build on ideas of networks or operating systems provided in the prerequisites. The coverage would be at the level of an professional monograph, or papers from the research literature. The specific topic covered would vary from one offering to another, depending on staff interest and expertise. Example topics include: electronic commerce, distributed operating systems, security in distributed systems.

Syllabus Summary: Varies depending on specific topic.

COMP 4309 Object-Oriented Systems (Advanced Topic)

4 credit points

Prerequisite: Credit in COMP 3008 Object-Oriented Systems. **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester. **Assessment:** Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year recommended elective unit of study for the degree in Software Engineering. Elective unit of study for the other degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop knowledge of the concepts, and mastery of the techniques, in one specialist topic within the field of Object-Oriented Systems. This would build on the broad survey provided by COMP 3008. The coverage would be at the level of an professional monograph, or papers from the research literature. The specific topic covered would vary from one offering to another, depending on staff interest and expertise. Example topics include: distributed object systems, implementation of object-oriented languages, type theory for object languages.

Syllabus Summary: Varies depending on specific topic.

COMP 4400 Operating Systems (Advanced Topic)

4 credit points

Prerequisite: Credit in COMP 3009 Operating Systems. **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester.

Assessment: Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year recommended elective unit of study for the degree in Software Engineering. Elective unit of study for the other degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop knowledge of the concepts, and mastery of the techniques, in one specialist topic within the field of Operating Systems. This would build on the broad survey provided by COMP 3009. The coverage would be at the level of an professional monograph, or papers from the research literature. The specific topic covered would vary from one offering to another, depending on staff interest and expertise. Example topics include: system administration, process group infrastructure, modern kernel internals.

Syllabus Summary: Varies depending on specific topic.

COMP 4401 Software engineering (Advanced Topic)

4 credit points

Prerequisite: Credit in COMP 3100 Software Engineering. **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester.

Assessment: Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year recommended elective unit of study for the degree in Software Engineering. Elective unit of study for the other degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop knowledge of the concepts, and mastery of the techniques, in one specialist topic within the field of Software Engineering. This would build on the broad survey provided by COMP 3100. The coverage would be at the level of an professional monograph, or papers from the research literature. The specific topic covered would vary from one offering to another, depending on staff interest and expertise. Example topics include: software metrics, tools for CASE, software architecture description.

Syllabus Summary: Varies depending on specific topic.

COMP 4402 User Interfaces (Advanced Topic)

4 credit points

Prerequisite: Credit in COMP 3102 User Interfaces. **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester.

Assessment: Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year elective unit of study for the degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop knowledge of the concepts, and mastery of the techniques, in one specialist topic within the field of User Interfaces. This would build on the broad survey

provided by COMP 3102. The coverage would be at the level of an professional monograph, or papers from the research literature. The specific topic covered would vary from one offering to another, depending on staff interest and expertise. Example topics include: user-adaptive systems, information filtering, usability testing.

Syllabus Summary: Varies depending on specific topic.

COMP 4403 Computation Theory (Advanced Topic)

4 credit points

Prerequisite: Credit in COMP 2003 Languages and Logic, and 8 cp of 2000-level MATH. **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester. **Assessment:** Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year elective unit of study for the degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop understanding of the theoretical limits of computation, and the proof techniques used to show these limits in specific problems.

Syllabus Summary: Computability; models of computation and their relationships; recursive sets and recursively enumerable sets; Godel incompleteness theorem; halting problem; complexity theory; speed-up theorems; reductions; NP-completeness.

COMP 4404 Scientific Visualisation (Advanced Topic)

4 credit points

Prerequisite: Credit in one of: COMP 3001 Algorithms or COMP 3304 Graphics or PHYS 3303 Scientific Visualisation. **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester.

Assessment: Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year elective unit of study for the degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop knowledge of the concepts, and mastery of the techniques, in one specialist topic within the field of Scientific Visualisation. The coverage would be at the level of an professional monograph, or papers from the research literature. The specific topic covered would vary from one offering to another, depending on staff interest and expertise. Example topics include: medical imaging and simulation.

Syllabus Summary: Varies depending on specific topic.

COMP 4601 Advances in Computer Science 1

4 credit points

Prerequisite: Permission of Head of Department. **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester.

Assessment: Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year elective unit of study for the degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop knowledge of the concepts, and mastery of the techniques, in one specialist topic within the field of Computing. This unit is used when a student wants to take a further topic within a field which has already been studied at 4000-level. Head will not grant permission unless the topic being taught is substantially different from those studied previously.

Syllabus Summary: Varies depending on specific topic.

COMP 4602 Advances in Computer Science 2

4 credit points

Prerequisite: Permission of Head of Department. **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester.

Assessment: Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year elective unit of study for the degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop knowledge of the concepts, and mastery of the techniques, in one specialist topic within the field of Computing. This unit is used when a student wants to take a further topic within a field which has already been studied at 4000-level. Head will not grant permission unless the topic being taught is substantially different from those studied previously.

Syllabus Summary: Varies depending on specific topic.

COMP 4603 Advances in Computer Science 3

4 credit points

Prerequisite: Permission of Head of Department. **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester.

Assessment: Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year elective unit of study for the degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop knowledge of the concepts, and mastery of the techniques, in one specialist topic within the field of Computing. This unit is used when a student wants to take a further topic within a field which has already been studied at 4000-level. Head will not grant permission unless the topic being taught is substantially different from those studied previously.

Syllabus Summary: Varies depending on specific topic.

COMP 4604 Advances in Computer Science 4

4 credit points

Prerequisite: Permission of Head of Department. **Classes:** 2 hrs lectures and 1 hr tutorial/lab per week for one semester.

Assessment: Written and practical assignments (individually and/or in small groups) and a final examination.

Fourth year elective unit of study for the degrees offered by the School of Electrical and Information Engineering.

Note: this unit may be available in February or July semester; it may not always be offered.

Objectives/Outcomes: To develop knowledge of the concepts, and mastery of the techniques, in one specialist topic within the field of Computing. This unit is used when a student wants to take a further topic within a field which has already been studied at 4000-level. Head will not grant permission unless the topic being taught is substantially different from those studied previously.

Syllabus Summary: Varies depending on specific topic.

Electrical Engineering

ELEC1001 Introductory Electrical Engineering

4 credit points

Assumed knowledge: MATH 1001 Differential Calculus.

Prohibition: ELEC 1102 Foundations of Electronic Circuits, and ELEC 2002 Electrical Technology. **Offered:** July. **Classes:** Two lec/wk and nine 3hr lab/tut. **Assessment:** Lab reports and assignments and a 2hr exam at end of semester.

Core unit of study for Civil Engineering, Project Engineering and Management (Civil) and Mechanical and Mechatronic Engineering.

Electricity: definitions and conventions. SI units. Charge and energy conservation laws. Electrical energy sources. Ohm's law. Voltage and current measurements. Conductivity and resistance. Power dissipation. Kirchhoff's laws. Current and voltage dividers. Potentiometers. Measurement of resistance. Thevenin's theorem. Loop currents and node voltages. Reciprocity theorem. Linearity and principle of superposition. Voltage-to-current source conversion. Delta-star conversion. Loading effect of a voltage source. Combined voltage supply circuits. Time varying voltages and currents. Average and effective values. Energy dissipation and storage. Capacitance, inductance. Steady-state DC behaviour of capacitors and inductors. Natural response of first

order circuits. Transients. C and L response to square and triangular voltages.

Alternating current quantities. Magnitude, period, frequency and phase. Complex algebra. AC behaviour of resistance, inductance and capacitance. Introduction to AC circuits. RL and RC series circuits. Impedance concept. Phasor and locus diagrams. Equivalent series and parallel impedances. Admittance. Power in AC circuits. Power triangle. Power factor. RLC series circuit behaviour. Series resonance. Introduction to AC network.

Analysis. RLC parallel circuit. Parallel resonance. Series-parallel circuits. Introduction to filters. Single phase transmission line. Domestic distribution. Wiring and grounding. Dual-voltage AC supply. Power factor correction. Nonlinear circuit elements. Introduction to semiconductors. Diodes. Transistors. V-I characteristics.. Nonlinear circuit analysis. Load line and operating point.

ELEC 1101 Foundations of Computer Systems

6 credit points

Assumed knowledge: HSC Maths 3 unit. **Offered:** February.

Classes: Six contact hours per week combining lectures, laboratory work, computing, tutorials and presentations. **Assessment:** Presentations, reports and assignments plus two 2hr exams at the end the semester.

Core unit of study for Electrical, Electrical (Information Systems), Computer, Software and Telecommunications Engineering

Number systems and codes, Parity; Logic gates and Boolean Algebra, Universal logic gates (Nand gates); Combinational logic circuits; Design and construct project; Flip-flops and related devices; Digital Arithmetic: operations and circuits, Two's complement addition and subtraction, Overflow; Counters and registers, Shift register applications; Design of synchronous, sequential circuits, Designs of synchronous, cascable counters (BCD and binary); Integrated circuit logic families; Tri-state signals and data-buses; MSI logic circuits, Applications of multiplexers, demultiplexers, decoders, priority encoders, magnitude comparators; Applications of programmable logic devices, Major project utilising programmable logic devices; Interfacing with the analog world; Memory devices; Introduction to microprocessors, stored-program computer architecture, instruction codes and addressing modes, instruction execution cycle; Digital design of an arithmetic-logic-unit for a computer.

Human communication; technical skills in written, numeric and graphical communication, word processors.

ELEC 1102 Foundations of Electronic Circuits

6 credit points

Assumed knowledge: HSC Physics 2 unit and MATH 1001

Differential Calculus. **Prohibition:** ELEC 1001 Introductory Electrical Engineering, and ELEC 2002 Electrical Technology. **Offered:** July.

Classes: Six contact hours per week combining lectures, laboratory work, computing, tutorials and projects. **Assessment:** Presentations, reports and assignments plus two 2hr exams at the end of the semester.

Core unit of study for Electrical, Electrical (Information Systems), Computer, Software and Telecommunications Engineering

Linear DC circuit elements and laws, and series and parallel circuits; concepts of equivalent circuits; operational amplifiers and circuits; network analysis.

Capacitors and inductors; first order circuits and transient responses; step responses; complex numbers, phasors, impedance and admittance; steady state analysis; frequency analysis; frequency response of RLC circuits; filters; AC power, reactive power and power factor.

Electrical measurement tools. Safety issues. Computer based simulation of circuits. Computer communication tools such as spread sheets, charting and drawing packages. Management of people, documents and projects.

ELEC 2001 Electrical and Electronic Engineering

6 credit points

Prerequisite: ELEC 1001 Introductory Electrical Engineering.

Prohibition: ELEC 2003 Electrical and Electronic Engineering A, and ELEC 2101 Circuit Analysis, and ELEC 2401 Introductory

Electronics, and ELEC 2601 Microcomputer Systems. **Offered:** February. **Classes:** (Three lec and 3hrs lab/tut) per wk. **Assessment:** Lab reports and assignments and a 3hr exam at end of semester.

Core unit of study for Mechatronic Engineering.

Polyphase energy generation. Three phase systems. Star and delta connected systems. Balanced and unbalanced loads. Magnetic fields. Solenoid and toroid. Magnetic circuit calculations. AC excitations of a magnetic circuit. Magnetising curve. Hysteresis and eddy current losses. Ideal and real transformers. Model and phasor diagram of a transformer. Principle of electromagnetic energy conversion. Production of a rotating magnetic field. Principles of AC machines. Synchronous machines. Induction motors. Equivalent circuits. Slip-torque characteristics. Methods of starting and speed control. DC machines. Shunt-existed generator. Shunt- and series-connected motors. Efficiency of DC machines.

Semiconductor devices: Diode, BJT and FET characteristics. Small-signal models. Basic circuits. Amplifiers and biasing; rectifiers. Linear power supplies. Thyristor devices, applications to motor control.

Operational amplifiers: Characteristics, ideal and real. Feedback. Design with op amps: inverting, non-inverting and differential amplifiers; integrator and differentiator; simple filters, comparator and Schmitt trigger. Digital electronics: Numbering systems. Gates and combinational logic. Latches, synchronous and asynchronous counters. Flip-flops and memory. TTL and CMOS logic families. Practical design examples.

Microprocessor fundamentals: architecture of a standard 8-bit microprocessor. Instruction set and addressing modules. Assembly language programming. Clock and reset circuits. Memory and I/O interfacing.

ELEC 2003 Electrical and Electronic Engineering A 4 credit points

Prerequisite: ELEC 1001 Introductory Electrical Engineering. **Prohibition:** ELEC 2001 Electrical and Electronic Engineering, and ELEC 2101 Circuit Analysis, and ELEC 2401 Introductory Electronics, and ELEC 2601 Microcomputer Systems. **Offered:** February. **Classes:** (3 lec and a 3hr lab/tut) per week. **Assessment:** Lab reports and assignments and a 3hr exam at end of semester. Core unit of study for Mechanical Engineering.

Three phase electric power systems. Star and delta connections. Balanced and unbalanced loads. Magnetic fields. Solenoids and toroids. Magnetic circuit calculations. AC excitations of a magnetic circuit. Magnetising curve. Hysteresis and eddy current losses. Ideal and real transformers. Model and phasor diagram of a transformer. Principle of electromagnetic energy conversion. Principles of electric machines. Methods of starting and speed control.

Semiconductor devices: Diode, BIT and FET characteristics. Small-signal models. Basic circuits. Amplifiers and biasing; rectifiers. Linear power supplies. Operational amplifiers: Characteristics, ideal and real. Feedback. Design with op amps: inverting, non-inverting and differential amplifiers; integrator and differentiator; simple filters, comparator and Schmitt trigger. Digital electronics: Numbering systems. Gates and combinational logic. Latches, synchronous and asynchronous counters. Flip-flops and memory.

ELEC 2101 Circuit Analysis

4 credit points

Assumed knowledge: ELEC 1102 Foundations of Electronic Circuits. **Prohibition:** ELEC 2001 Electrical and Electronic Engineering, and ELEC 2002 Electrical Technology, and ELEC 2003 Electrical and Electronic Engineering A. **Offered:** February. **Classes:** (Two lec and 2 hrs tut) per week. **Assessment:** Assignments and a 2hr exam at end of semester.

Core unit of study for Electrical, Electrical (Information Systems), Computer and Telecommunications Engineering.

Transient and steady state responses of electric circuits. Complex frequency analysis, phasors. Laplace transform, transfer functions and frequency response. Transformers. Two port networks. Introduction to energy conversion; balanced three phase circuits. Modelling and simulation using Matlab.

ELEC 2301 Signals and Systems

4 credit points

Assumed knowledge: MATH 1001 Differential Calculus, and MATH 1002 Linear Algebra, and MATH 1003 Integral Calculus and Modelling, and MATH 1004 Discrete Mathematics. **Prohibition:** MATH 3103 Signal Processing and MATH 3809 Signal Processing (Adv). **Offered:** July. **Classes:** (Two lec and an average of 2 hrs lab/tut) per week. **Assessment:** Lab, assignments and a 2hr exam at end of semester.

Core unit of study for Electrical, Electrical (Information Systems), Computer, Software and Telecommunications Engineering.

Continuous-time and discrete-time signals: classification and properties. Basic properties of systems: linearity, time-invariance, causality, stability. Linear time-invariant (LTI) systems: the convolution sum and convolution integral, characterisation by differential and difference equations, impulse response, singularity functions. Fourier series for continuous-time and discrete-time signals: definition, properties and effects of symmetry, periodic signals and LTI systems. Fourier transform for continuous-time and discrete-time signals: definition and properties, the generalised transform. Frequency response of LTI systems, linear and non-linear phase, Bode plots. Introduction to filtering. Sampling: impulse train sampling, the sampling theorem, reconstruction of signals, effects of undersampling. Laplace and z-transforms: definitions of bilateral and unilateral transforms, properties, pole-zero maps, analysis of LTI systems, transfer functions.

ELEC 2401 Electronic Devices and Circuits

4 credit points

Assumed knowledge: ELEC 1102 Foundations of Electronic Circuits. **Prohibition:** ELEC 2001 Electrical and Electronic Engineering, and ELEC 2002 Electrical Technology, and ELEC 2003 Electrical and Electronic Engineering A. **Offered:** July. **Classes:** (Two lec and an average of 2 hrs lab/tut) per week. **Assessment:** Lab work and a 2hr exam at end of semester.

Core unit of study for Electrical, Electrical (Information Systems), Computer, Software and Telecommunications Engineering.

Basics of semiconductors, diodes, transistors; small-signal and large-signal models, rectification, biasing, gain; FET and BIT circuits, introduction to operational amplifiers.

ELEC 2601 Microcomputer Systems

4 credit points

Assumed knowledge: ELEC 1101 Foundations of Computer Systems. **Prohibition:** ELEC 2001 Electrical and Electronic Engineering. **Offered:** February. **Classes:** (Two lec and an average of 2 hrs lab/tut) per week. **Assessment:** Lab, assignments and a 2hr exam at end of semester.

Core unit of study for Electrical, Electrical (Information Systems), Computer, Software and Telecommunications Engineering.

Computer architecture and assembly language programming. Microprocessor and microcontroller systems, memory and IO interfacing, interrupts and interrupt handling. Serial and parallel communications. Elements of real time control; CPU and memory security and protection. System design, implementation and debugging.

ELEC 3101 Circuit Theory and Design

4 credit points

Assumed knowledge: ELEC 2101 Circuit Analysis, MATH 2005 Fourier Series and Differential Equations. **Offered:** July. **Classes:** (2 lec and one 2hr tut)/wk. **Assessment:** Assignments, labs and an exam at the end of semester.

Recommended unit of study for Electrical and Telecommunications Engineering.

The main aim of the course is to teach the theory and design of active and passive analog filters. Topics covered include: Review of network functions; approximation techniques such as Butterworth, Chebyshev characteristics; filter sensitivity to parameters; passive network synthesis; active RC filters; switched capacitor filters.

ELEC 3102 Engineering Electromagnetics

4 credit points

Assumed knowledge: PHYS 2203 Physics 2EE and ELEC 2101 Circuit Analysis. **Offered:** February. **Classes:** (Two lect and a 2hr tut) per week. **Assessment:** Questions in lect/tut and a 2hr exam at end of semester.

Core unit of study for Electrical, Electrical (Information Systems) and Telecommunications Engineering.

Transmission lines (circuit theory is used to derive wave phenomena) - revision of circuit elements and static fields; Maxwell's Equations in integral form; distributed circuits, characteristic impedance, waves in transmission lines, steady state and transient behaviour, reflections, Voltage Standing Wave Ratio, impedance transformation, and matching. Fields and waves (Maxwell's equations are used to derive wave phenomena) - revision of boundary problems; Maxwell's equations in differential form; plane waves and the analogy with transmission lines, reflection of waves at boundaries, atmospheric wave propagation, propagation in waveguides, waveguide components, radiation patterns of antennas and arrays; numerical methods.

ELEC 3103 Electrical Engineering Design

4 credit points

Assumed knowledge: ELEC 2101 Circuit Analysis, and ELEC 2401 Introductory Electronics, and ELEC 2301 Signals and Systems, and ELEC 2601 Microcomputer Systems. **Offered:** July. **Classes:** (One lec and a 2 hr lab) per week. **Assessment:** Lab, assignments and a 1 hr exam at end of semester.

Recommended elective unit of study for Electrical and Software Engineering

This is a laboratory based unit where the topics involve a number of areas such as instrumentation, communications, sensing, lighting, thermal design and protection. The aim is to develop an integrated approach using basic concepts drawn from the major disciplines of Electrical and Electronic Engineering.

ELEC 3201 Fundamentals of Electrical Energy Systems

4 credit points

Assumed knowledge: ELEC 2101 Circuit Analysis. **Offered:** February. **Classes:** (Two lec and a 2 hr lab/tut) per week.

Assessment: Assignments, a quiz and a 2hr exam at end of semester.

Core unit of study for Electrical Engineering.

Systems consisting of electromechanical converters (electrical machines), electrochemical converters (batteries, fuel cells) and electronic converters as well as basic circuit elements. An introduction to conventional and alternative renewable/non-renewable energy sources, energy transmission, markets and distribution.

Basic techniques of systems modelling and analysis including per unit systems, transformers, lines, interference, power flows, transients, balanced faults, control of real and reactive power. Applications to household, transport, industrial and high voltage systems. Use of MATLAB as a modelling and simulation tool.

ELEC 3202 Power Electronics and Drives

4 credit points

Assumed knowledge: ELEC 2101 Circuit Analysis, and ELEC 2401 Introductory Electronics. **Offered:** July. **Classes:** (Two lec and a 2hr lab/tut) per week. **Assessment:** Lab reports, assignments and a 2hr exam at end of semester.

Recommended elective unit of study for Electrical Engineering.

Applications and historical context, principles of electronic control of power flow, power semiconductors, phase controlled rectifiers and derivatives, AC-AC phase control, DC-DC converters, DC-AC converters.

Electromagnetic transducers, rotating magnetic field principles, synchronous machines, induction machines, electronically controlled machine operation.

ELEC 3302 Fundamentals of Feedback Control

4 credit points

Assumed knowledge: ELEC 2301 Signals and Systems. **Prohibition:** MECH 3800 Systems Control and CHNG 3302 Process Control. **Offered:** February. **Classes:** (Two lec and a 2hr lab/tut) per week. **Assessment:** Performance in lab/tut and a 2hr exam at the end of semester.

Core unit of study for Electrical, Electrical (Information Systems), Computer and Telecommunications Engineering. Recommended elective unit of study for Software Engineering.

History and review of control. Modelling of physical processes; state variables and differential equations. Dynamic response; review of Laplace transform, transfer functions and block diagrams, poles and zeros. Design specifications in the time domain. Basic feedback principles; effect of feedback on sensitivity and disturbance rejection, steady state accuracy and stability; the Routh criterion; proportional, integral and derivative control. Design using the root locus; rules for sketching root locus; lead and lag compensators; analogue and digital implementation of controllers. Frequency response design methods; the Nyquist stability criterion; design specifications in the frequency domain, gain and phase margins; compensator design. An introduction to state space for single input single-output systems; eigenvalues, zeroes and transfer functions; introduction to state variable feedback and design of estimators.

ELEC 3401 Electronic Devices and Circuits

4 credit points

Assumed knowledge: ELEC 2401 Introductory Electronics, and ELEC 2101 Circuit Analysis. **Offered:** February. **Classes:** (2 lec and a 2hr lab) per week. **Assessment:** Lab and a 2hr exam at end of semester.

Core unit of study for Electrical, Electrical (Information Systems), Computer and Telecommunications Engineering. Recommended elective unit of study for Software Engineering.

Basics and models of semiconductor devices (diode, JFET, MOSFET and BJT), IC fabrication (bipolar and MOS), amplifier frequency response, current sources and mirrors, power amplifiers, operational amplifiers and applications, power supplies, oscillators and phase locked loops.

ELEC 3402 Communications Electronics

4 credit points

Assumed knowledge: ELEC 3401 Electronic Devices and Circuits. **Offered:** July. **Classes:** (2 lec and an average of 2 hr lab/tut) per week. **Assessment:** Practical work and a 2hr exam at end of semester.

Core unit of study for Electrical (Information Systems) and Telecommunications Engineering. Recommended elective unit of study for Electrical Engineering.

Photonic devices and models (semiconductor optical properties, lasers and photodiodes), optical transmitters and modulation, optical amplifiers, optical receivers, basic opto-electronic link, tuned amplifiers, oscillators, modulation/demodulation circuits, mixers, feedback amplifiers, high frequency amplifiers.

ELEC 3403 Switching Devices and High Speed Electronics

4 credit points

Assumed knowledge: ELEC 3401 Electronic Devices and Circuits. **Offered:** July. **Classes:** (2 lec and an average of 2 hr lab/tut) per week. **Assessment:** Practical work and a 2hr exam at end of semester.

Core unit of study for Electrical (Information Systems) and Computer Engineering. Recommended elective unit of study for Electrical and Telecommunications Engineering.

Solid state physics, PN and metal-semi junctions, semiconductor devices, digital devices (TTL, Schottky TTL, nMOS and CMOS), inverter and basic gates, output stage (open drain and tri-state), metastability and latchup in CMOS, logic family characteristics (voltage levels, noise margins, power and switching speed), interfacing logic families, protection and opto-isolators, digital circuits (switch debouncing, driving relays, reset circuits, oscillators), high speed analogue interfacing (transmission line effects and termination, inductive loads, line drivers, RFI, cross-talk and shielding).

ELEC 3502 Random Signals and Communications
4 credit points

Assumed knowledge: ELEC 2301 Signals and Systems. **Offered:** February. **Classes:** (2 lec and 2 hr lab/tut) per week. **Assessment:** Assignment and lab marks and an exam at end of semester. Core unit of study for Electrical, Electrical (Information Systems), Computer and Telecommunications Engineering. Recommended elective unit of study for Software Engineering.

An overview: sources, channels and limits to communication, signals and spectra, distortionless transmission, linear and non-linear distortion, transmission loss. Random Signals: probability and random variables, probability functions, statistical averages, probability models, random processes, random signals. Signal transmission with noise: noise models, signal-to-noise ratio, pulse detection and matched filters. Analog communication: bandpass systems and signals, double-sided amplitude modulation (AM), modulators and transmitters, suppressed-sideband amplitude modulation, frequency conversion and demodulation, frequency/phase modulation (FM/PM), transmission bandwidth and distortion, generation and detection of FM/PM, interference, receivers for FM/PM, frequency division multiplexing, a case study of analog communication systems, noise in analog communication systems.

ELEC 3503 Introduction to Digital Communications
4 credit points

Assumed knowledge: ELEC 2301 Signals and Systems. **Offered:** July. **Classes:** (2 lec and 2 hr lab/tut) per week. **Assessment:** Assignment and lab marks and an exam at end of semester. Core unit of study for Electrical, Electrical (Information Systems), Computer and Telecommunications Engineering. Recommended elective unit of study for Software Engineering.

Introduction: to Communications systems, components, signals and channels, sampling, quantization, pulse amplitude modulation (PAM), pulse code modulation (PCM), quantisation noise, time division multiplexing, delta modulation. Digital communications: baseband signals, digital PAM, eye diagram, equalization, correlative coding, error probabilities in baseband digital transmission, bandpass transmission, digital amplitude shift keying (ASK), frequency shift keying (FSK), phase shift keying (PSK) and quadrature shift keying (QPSK), error probabilities in bandpass digital transmission, a case study of digital communication systems. Introduction to information theory: fundamental limits in communications, channel capacity and channel coding, signal compression.

ELEC 3601 Digital Systems Design

4 credit points

Assumed knowledge: ELEC 2601 Microcomputer Systems or COMP 2001 Computer Systems. **Offered:** July. **Classes:** Two lec per week and nine 3-hr lab sessions. **Assessment:** Laboratory performance and 2 hr exam at end of semester. Core unit of study for Electrical, Electrical (Information Systems), Computer, Software and Telecommunications Engineering.

Structure of digital systems, programmable logic, erasable programmable logic devices (EPLD), field programmable gate arrays (FPGA), state machine design, datapath functions, computer arithmetic, serial and parallel arithmetic-logic-units, computer design, computer upgrade design exercise, design for testability, boundary scan testing, IEEE Test Access Port, floating-point arithmetic, IEEE Standard Floating-point Arithmetic, arithmetic pipe-lines, digital systems design project, specification languages, simulation.

ELEC 3701 Management for Engineers

4 credit points

Offered: February. **Classes:** (2 lec and 1 hr tut) per week. **Assessment:** Tutorials, assignments and a 2hr exam at end of semester.

Recommended elective of study for Electrical and Electrical (Information Systems) Engineering

Engineers and management; Microeconomics; Macroeconomics; Managerial decision making; Behaviour of people in organisations; Human resource management for engineers; Strategic management; Accounting and management; Operations

management; Marketing for engineers; The legal environment of business; Industrial relations; Engineering project management.

ELEC 3801 Fundamentals of Biomedical Engineering

4 credit points

Assumed knowledge: ELEC 2401 Introductory Electronics or ELEC 2001 Electrical and Electronic Engineering or ELEC 2003 Electrical and Electronic Engineering A. **Offered:** February.

Classes: Two lec and an average of 2 hours lab/tut per week.

Assessment: Lab reports and a 2hr exam at end of semester.

Recommended elective unit of study for Electrical Engineering.

Physiology and anatomy of respiratory, cardiovascular, central nervous and musculo-skeletal systems. Cell biology - membrane physiology and biochemistry, glucose metabolism. Operational amplifiers, active filters, electrodes. Electrocardiogram, vector cardiogram, defibrillation, pacemakers. Electroencephalogram, electromyogram, electroneurogram. Introduction to diagnostic imaging systems - principles of CT scanning, ultrasonic, nuclear and magnetic resonance imaging. Biomedical signal processing - sampling, A/D and D/A conversion, digital filters, ECG detection methods and systems.

ELEC 4201 Electrical Systems Modelling and Analysis

4 credit points

Assumed knowledge: ELEC 3201 Fundamentals of Electrical Energy Systems. **Offered:** February. **Classes:** (Two lec and a 2hr lab/tut) per week. **Assessment:** Assignments and a 2hr exam at end of semester.

Recommended elective unit of study for Electrical Engineering.

A broad range of topics will be presented related to electrical systems analysis, with a particular focus on electric power systems. Modelling of power system components. Analysis of power systems under normal operating conditions. Faults and protection. Transmission line transients. An introduction to various aspects of transient stability, voltage and long-term stability, dynamic stability. The electric power systems of the 21st century. Introduction to software packages such as EUROSTAG, EMPT.

ELEC 4301 Computer Control System Design

4 credit points

Assumed knowledge: ELEC 3302 Fundamentals of Feedback Control. **Offered:** February. **Classes:** (Two lec and a 2hr lab/tut) per week. **Assessment:** Assignments, lab reports and a 2hr exam at end of semester.

Recommended elective unit of study for Electrical and Computer Engineering.

State variable description of systems, canonical forms, relation to transfer functions, solution of the state equation, eigenvalues and eigenvectors. Regulator design using state feedback, controllability. State estimators, observability. Design of servomechanisms with non-zero command inputs. Introduction to optimal regulator design. Non-linear phenomena and their effect on design. Describing functions, limit cycles. Phase plane analysis, trajectories, linearisation of non-linear differential equations, equilibrium points and their classification. Sampled data systems. Discrete signals and sampling, discrete transfer functions. Discrete equivalents for continuous controller. Discrete models for sampled data systems, pulse transfer functions for feedback systems. Direct digital design by transform methods.

ELEC 4302 Image Processing and Computer Vision

4 credit points

Assumed knowledge: ELEC 2301 Signals and Systems, and ELEC 4303 Digital Signal Processing. **Offered:** July. **Classes:** (Two lec and a 1-Hr tut) per week. **Assessment:** Assignments and a 2hr exam at end of semester.

Recommended elective unit of study for Electrical, Electrical (Information Systems) and Software Engineering.

Mathematical preliminaries: two-dimensional (2D) signals and systems, image models and image transformation, image digitalisation; visual perception, sampling, quantisation and col-

our representation. Image enhancement and restoration; histogram modelling, spatial and transform operations, filtering, deconvolution and extrapolation. Image compression: predictive methods, transform coding, vector quantisation and fracta based methods. Image reconstruction: Radon transform and projection theorem computer tomography (CT) and magnetic resonance imaging (MSI) systems and three-dimensional (3D) imaging. Image analysis and computer vision; edge detection and boundary extraction, region and object representation, image segmentation and pixel classification, texture analysis and scene detection and matching.

ELEC 4303 Digital Signal Processing

4 credit points

Assumed knowledge: ELEC 2301 Signals and Systems. Offered: February. Classes: (2 lec & 2hr lab/tut)/wk. Assessment: Lab reports, assignments and one 2hr exam at end of Sem.

Core unit of study for Electrical (Information Systems), Computer and Telecommunications Engineering. Recommended elective unit of study for Electrical Engineering.

Discrete Time Signals and Systems: Time domain and frequency domain representations, Difference equations, Stability analysis, Magnitude and phase response, Linear phase systems, Z-transform. Discrete Fourier Transform: Properties of DFT, Circular and linear convolutions, Fast Fourier transform (FFT), Decimation in time algorithm, Decimation in frequency algorithm. Digital Filter Structures: I/O relations of linear discrete systems, Discrete form Realization, Cascaded/Parallel 2nd order sections, Ladder structures.

FIR Filter Design: Windowing method, DFT/Windowing method, Frequency sampling method, Optimal FTR filters. HR Filter Design: Impulse invariant transformation, Bilinear transformation, Butterworth filters, Chebyshev filters, Elliptic filters, Phase modification, Computer aided design techniques. Advanced Topics: 2-Dimensional signal processing, adaptive filtering.

ELEC 4401 Electronic Design

4 credit points

Assumed knowledge: ELEC 2301 Signals and Systems, and ELEC 3302 Fundamentals of Feedback Control and ELEC 3401 Electronic Devices and Circuits. Offered: February. Classes: (Two lec and a 2hr lab/tut) per week. Assessment: Assignments and/or quizzes, lab work and a 2hr exam at end of semester.

Core unit of study for the degree in Electrical Engineering (Information Systems). Recommended elective unit of study for Electrical, Computer and Telecommunications Engineering.

Electronic design practice, passive and active component models, electronic circuit analysis, linear and nonlinear circuits for digital and analogue communication systems, operational amplifier circuits in practice, theory and application of phase locked loops, integrated circuit techniques, electronic filter design and implementation, analog-digital conversion techniques, distortion and noise in electronic circuits, special topics in electronic design.

ELEC 4402 Integrated Circuit Design

4 credit points

Assumed knowledge: ELEC 3403 Switching Devices and High Speed Electronics, and ELEC 3601 Digital Systems Design.

Offered: February. Classes: A design project and a 2hr exam at end of semester. Assessment: (Two lec and a 2hr lab/tut) per week. Recommended elective unit of study for Electrical, Electrical (Information Systems) and Computer Engineering.

Technology (IC production process, design rules, layout). Design automation and verification (DRC, circuit extraction, simulation and hardware design languages). Basic digital building blocks (inverters, simple logic gates, transmission gates, propagation delays, power dissipation and noise margins). Digital circuits and systems (PLAs, dynamic circuits, RAM, ROM, microprocessors, systolic arrays). Semicustom design (gate arrays and standard cells). Analog VLSI (switches, active resistors, current sources and mirrors, voltage, current references, amplifiers, DAC, ADC, continuous time filters, switch capacitor circuits, analog signal processing circuits).

ELEC 4501 Data Communication Networks

4 credit points

Assumed knowledge: ELEC 3502 Random Signals and Communications, and ELEC 3503 Introduction to Digital Communications. Offered: February. Classes: Two lec and a 2hr lab/tut per week. Assessment: Assignments, lab work and a 2hr exam at end of semester.

Core unit of study for Electrical (Information Systems) and Telecommunications Engineering. Recommended elective unit of study for Electrical and Software Engineering.

Networking principles. Multiplexing - FDM, TDM, STDM, CDM. Network topologies and circuit, packet and message switching concepts. Introductory queuing and traffic theory for circuit switched and packet switched networks. Local area network architectures. Network protocols - the 7 layer ISO/OSI model, physical, data link, and network layer implementations in LANs and public networks. Upper layer protocols. Optical fibre networks and architectures.

Multi-channel optical communication systems. Introduction to FDDI, DQDB and interworking of LANs with wide area high speed networks. Comprehensive broadband networks for user access. Standards.

ELEC 4502 Digital Communication Systems

4 credit points

Assumed knowledge: ELEC 3502 Random Signals and Communications, and ELEC 3503 Introduction to Digital Communications. Offered: February. Classes: (2 lec & one 2hr lab/tut)/wk. Assessment: Assignments, lab work and one 2hr exam at end of Sem 1.

Core unit of study for Electrical (Information Systems) and Telecommunications Engineering. Recommended elective unit of study for Electrical and Computer Engineering.

Digital communications principles and performance criteria. Digitally modulated signals: non-linear modulation methods, continuous phase FSK, continuous phase modulation. Modulated carrier data transmission: QPSK, QAM, MFSK, MSK. Trellis coded modulation and modem technologies. Spread spectrum, including frequency hopping and CDMA principles. Optical communication systems - single and multi-channel systems, performance criteria and systems analysis. Satellite communications systems. Cellular mobile radio systems.

ELEC 4503 Error Control Coding

4 credit points

Assumed knowledge: ELEC 3502 Random Signals and Communications, and ELEC 3503 Introduction to Digital Communications. Offered: February. Classes: (2 lec & 1hr/tut)/wk. Assessment: Assignments and a 2hr exam at end of semester.

Recommended elective unit of study for Electrical, Electrical (Information Systems) and Telecommunications Engineering.

Error control coding principles, linear algebra, linear block codes, cyclic codes, BCH codes, Reed-Solomon codes, burst-error correcting codes, design of codecs for block codes, applications of block codes in communications and digital recording, convolutional codes, Viterbi algorithm, design of codecs for convolutional codes, applications of convolutional codes in communications, soft decision decoding of block and convolutional codes, trellis coded modulation, block coded modulation, design of codecs for trellis codes, applications of trellis codes in data transmission, multidimensional codes, turbo codes.

ELEC 4601 Computer Design

4 credit points

Assumed knowledge: ELEC 3403 Switching Devices and High Speed Electronics, and ELEC 3601 Digital Systems Design.

Offered: February. Classes: (Two lec and a 2hr lab/tut) per week. Assessment: Assignments, lab reports and a 2hr exam at end of semester.

Core unit of study for Electrical (Information Systems) and Computer Engineering. Recommended elective unit of study for Electrical, Software and Telecommunications Engineering.

Digital systems design process. Design cycle. Top down design. Specification. Functional design. Structural design. Testing. Hardware description languages. VHDL. Digital systems architectures. Processors, buses and I/O devices. Synchronous,

asynchronous and semi-synchronous buses. Bus interconnections. Memory and I/O interface design. Static and dynamic memory design. Memory interfacing. Interrupts. Vectored interrupts. Interrupt controllers. Parallel interface design. Serial interface design. Bus arbitration. Processor interfacing. IBM PC interfacing. Some case studies.

ELEC 4602 Real Time Computing

4 credit points

Assumed knowledge: ELEC 3601 Digital Systems Design, and COMP 3100 Software Engineering. **Offered:** February. Classes: (2 lec & one 2hr lab/tut)/wk. **Assessment:** Lab marks, reports and a 2hr exam at the end of semester.

Core unit of study for the degrees in Electrical (Information Systems), Computer and Software Engineering. Recommended elective unit of study for Electrical and Telecommunications Engineering.

Hard real time and embedded systems, as applied to engineering, manufacturing and automation. **Timing** and scheduling: periodic vs aperiodic processes, hard vs soft deadlines, predictability and determinacy, granularity, rate monotonic and earliest deadline scheduling. Real-time systems and software, implementation of real-time control. Real-time languages and their features. Real time operating systems. Real time software design. Embedded systems: overview, signal flow, interfacing. Reliability and fault tolerance in hardware and software. SCADA and DCCS. Some case studies.

ELEC 4604 Engineering Software Requirements

4 credit points

Assumed knowledge: ELEC 3601 Digital Systems Design, ELEC 3701 Management for Engineers, COMP 3100 Algorithms, COMP 3205 Product Development Project. **Offered:** July. Classes: (2 lec and 2 hr lab/tut) per week. **Assessment:** Lab work, project and a 2h exam at end of semester.

This unit of study will not be available until 2001. Core unit of study for Software Engineering.

The objective of this course is for students: to become aware of issues, tools and techniques involved in the engineering of software to meet specific performance, safety and security requirements; to understand the factors that affect software reliability and be familiar with design techniques that can enhance reliability. Topics covered include: systems design process; system specifications; functional decomposition; safety requirements aspects; security requirements; reliability concepts, models and design techniques.

ELEC 4701 Project Management

4 credit points

Assumed knowledge: ELEC 3701 Management for Engineers. **Offered:** July. Classes: (Two lec and one 2hr tutorial/workshop) per week. **Assessment:** Assignments and in-course involvement, and a 2hr exam at end of semester.

Recommended elective unit of study for Electrical Engineering.

The New Technology Based Firm (NTBF) and its role in wealth and job creation. The innovation process, entrepreneurship, the business plan and new venture creation. Research and development, intellectual property, patents, product development and marketing. Relevant legal, liability and commercial issues.

ELEC 4702 Practical Experience

0 credit points

Offered: February. **Assessment:** Submission, within the first two weeks of February semester, of a written (hand or typed) report of about 2500 words of the industrial experience undertaken in accordance with regulations. This report is to be general in nature, indicating the overall structure of the company, the areas that the student became familiar with and their relationship to the firm and finally, what the student did. Detailed material may be incorporated as appendices if desired, and the student should have the report vetted beforehand by a responsible officer of the company.

Core unit of study for Electrical, Electrical (Information Systems), Computer, Software and Telecommunications Engineering.

It is necessary for the student to obtain industrial experience of 12 weeks' duration. This experience is normally gained at the

end of Senior year before entering Senior Advanced Year. The work which is acceptable to the Faculty may range from process-type work in a large industrial complex, where many different engineering processes and labour management relations may be observed, to semi professional or research work with small specialist companies.

The responsibility rests with the student to obtain work acceptable to the Faculty, although the University, through the School of Electrical and Information Engineering and the Careers and Appointments Service, will assist as much as possible. The student is required to inform the School of Electrical and Information Engineering of any work arrangements made and to obtain approval of these arrangements from the School.

ELEC 4703 Thesis

12 credit points

Prerequisite: A minimum of 36 credit points from third or fourth year units of study. **Offered:** July. Classes: There are no formal classes. The bulk of the work will be carried out during the July semester with some preparatory work in the February semester.

Assessment: Thesis, final presentation and interim progress submissions.

Core unit of study for Electrical, Electrical (Information Systems), Computer, Software and Telecommunications Engineering.

Each student is required to select a topic, carry out background searches, experimental investigations, and to document such achievements and conclusions as are appropriate. The subject requires a consistent and significant effort equivalent to one or two hours per week in Semester 1, and two days per week in Semester 2.

ELEC 4704 Software Project Management

4 credit points

Assumed knowledge: ELEC 3701 Management for Engineers, COMP 3100 Algorithms, and COMP 3205 Product Development Project. **Offered:** February. Classes: (2 lec and 2 hr lab/tut) per week. **Assessment:** Lab work, project and a 2h exam at end of semester.

This unit of study will not be available until 2001. Core unit of study for Software Engineering.

The objective of this course is for students to understand the issues involved in software project management and the factors that affect software quality; to be familiar with a range of standards, techniques and tools developed to support software project management and the production of high quality software; and to be able to develop software project plans, supporting software quality plans and risk management plans. Topics covered include project management issues such as client management; management of technical teams; project planning and scheduling; risk management; configuration management; quality assurance and accreditation; legal issues. Topics on software quality include: factors affecting software quality; planning for quality; software quality assurance plans; software measurement; Australian and international standards.

ELEC 4801 Biomedical Engineering Systems

4 credit points

Assumed knowledge: ELEC 3801 Fundamentals of Biomedical Engineering. **Offered:** July. Classes: (Two lec and a 2hr lab/tut) per week. **Assessment:** Assignments, lab and a 2hr exam at end of semester.

Recommended elective unit of study for Electrical Engineering.

Advanced medical imaging - X-ray, ultrasound, magnetic resonance imaging (MRI), nuclear imaging, confocal microscopy, computed tomography (CT).

Medical image processing - pattern recognition, image compression, chromosome analysis. Functional electrical stimulation - bladder and bowel control, cerebellar and mid-brain stimulation, limb control, walking in paraplegics. Advanced instrumentation - automated blood pressure measurement and control, automated anaesthesia, artificial insulin injectors, biophotonics and optical fibre sensors. Laboratory experiments — respiratory measurements, blood pressure measurement, image processing and pattern recognition.

ELEC 5201 Electrical Systems Control

4 credit points

Assumed knowledge: ELEC 3302 Fundamentals of Feedback Control, and ELEC 4201 Electrical Systems Modelling and Analysis. Offered: July. Classes: (2 lec & 1 hrtut)/wk. Assessment: Assignments and a 2hr exam at end of semester.

Recommended elective unit of study for Electrical Engineering.

Application of control theory to a selection of electrical systems such as power systems, drives, and robotic and vehicle systems. Control issues such as voltage, frequency and power regulation, protection, stability, reliability and security. Industrial controllers. Digital control and microcontrollers. Aspects of adaptive control, robust control. Supervisory control and data acquisition (SCADA) systems.

ELEC 5202 Advanced Power Electronics and Drives

4 credit points

Assumed knowledge: ELEC 3202 Power Electronics and Drives. Offered: July. Classes: (2 lec & 1 hr/lab/tut)/wk. Assessment: Assignments and a 2hr exam at end of semester.

Recommended elective unit of study for Electrical Engineering.

Modern power semiconductor devices 'smart power'; design analysis and simulation of power electronic circuits, digital firing control; recent machine developments; DC and AC drives, analysis, control; digital techniques for control, protection and data logging; applications.

ELEC 5301 Non-linear and Adaptive Control

4 credit points

Assumed knowledge: ELEC 3302 Fundamentals of Feedback Control, and ELEC 4301 Computer Control System Design. Offered: July. Classes: (Two lec and a 2hr lab/tut) per week. Assessment: Assignments, labs and an exam at the end of semester.

Recommended elective unit of study for Electrical Engineering.

Modelling by physical equations and input-output structures; concepts of linear, nonlinear, optimal, adaptive and robust control. Nonlinear systems analysis review and extensions, stability theory, oscillations and geometric concepts. Feedback linearisation, sliding mode and passivity-based control. Model-reference adaptive control and self-tuning regulators. Other advanced control strategies, supervisory control, fuzzy control and neural networks.

ELEC 5302 Fuzzy Systems

4 credit points

Offered: July. Classes: (2 lec & one 1 hr lab/tut)/wk. Assessment: Assignments and one 2hr exam at end of Sem.

Recommended elective unit of study for Electrical Engineering.

Mathematical background: ordinary set theory, uncertainty and linguistic variables, fuzzy sets, algebra of fuzzy sets, membership functions. Fuzzy control: approximate reasoning, fuzzy logic, fuzzification, defuzzification, fuzzy associative memory, fuzzy system design, a fuzzy controlled vehicle, advanced fuzzy controllers, fuzzy-neural systems. Other applications: fuzzy pattern recognition, fuzzy image transform coding, fuzzy knowledge based systems.

ELEC 5501 Advanced Communication Networks

4 credit points

Assumed knowledge: ELEC 3502 Random Signals and Communications, and ELEC 3503 Introduction to Digital Communications, and ELEC 4501 Data Communication Networks. Offered: July. Classes: (Two lec and a 1 hr tut) per week.

Assessment: Assignments, reports and a 2hr exam at end of semester.

Recommended elective unit of study for Electrical, Electrical (Information Systems) and Telecommunications Engineering.

ISDN architecture and organisation, common channel signalling system 7. Concepts of broadband, metropolitan and wide area networks.

Network technologies, asynchronous mode transfer, fast packet switching, FDDI, DQDB. Multimedia communications networks.

Telecommunications and computer network software design, network standards, and management. Principles, design and

practice of terrestrial mobile networks, GSM, CPT and PCN. System and network reliability. Future trends in network demand and technologies.

ELEC 5502 Satellite Communication Systems

4 credit points

Assumed knowledge: ELEC 3502 Random Signals and Communications, and ELEC 3503 Introduction to Digital Communications, and ELEC 4502 Digital Communication Systems. Offered: July. Classes: (Two lec and a 1 hr tut) per week.

Assessment: Assignments and a 2hr exam at end of semester.

Recommended elective unit of study for Electrical, Electrical (Information Systems) and Telecommunications Engineering.

Introduction to satellite communication, satellite link design, propagation characteristics of fixed and mobile satellite links, channel modelling, access control schemes, system performance analysis, system design, mobile satellite services, global satellite systems, national satellite systems, mobile satellite network design, digital modem design, speech codec design, error control codec design, low earth orbit communication satellite systems.

ELEC 5503 Optical Communication Systems

4 credit points

Assumed knowledge: ELEC 3402 Communications Electronics, and ELEC 3502 Random Signals and Communications, and ELEC 3503 Introduction to Digital Communications. Offered: July.

Classes: (Two lec and a 1 hr tut) per week. Assessment: Lab, assignments and a 2hr exam at end of semester.

Recommended elective unit of study for Electrical, Electrical (Information Systems) and Telecommunications Engineering.

Introduction to optical fibre communications, optical fibre transmission characteristics, semiconductor and fibre laser signal sources, optical transmitters, direct and external modulation, optical amplifiers, optical repeaters, fibre devices and multiplexers, fibre nonlinearity, optical detectors, optical receivers and regenerators, sensitivity and error rate performance, photonic switching and processing, lightwave local area networks, multi-channel multiplexing techniques, optical fibre communication systems.

ELEC 5504 Cellular Radio Engineering

4 credit points

Assumed knowledge: ELEC 3502 Random Signals and Communications, and ELEC 3503 Introduction to Digital Communications. Offered: July. Classes: (2 lec and a 2hr lab/tut) per week. Assessment: Assignments and a 2hr exam at end of semester.

Recommended elective unit of study for Electrical, Electrical (Information Systems) and Telecommunications Engineering.

Antenna basics: principles of antenna array, array of dipoles, parasitic antennas, reflectors. Land-mobile antennas: base station antennas, vehicular antennas, portable phone antennas, pager antenna. Mobile propagation channel: mean propagation loss (global mean), Okumura-Hata formulae, COST-231 Walfish-Ikegami model. Indoor channel: Keenan-Motley model. Statistical distributions: Rayleigh fading, diversity, time dispersion, log-normal fading, noise figure and noise temperature. Radio network dimensioning: cell types, coverage, link budget, power balance, tower mounted amplifier. Interference: co-channel interference, adjacent channel interference, inter-system interference. Capacity: traffic dimensioning, frequency allocation, frequency re-use patterns, frequency planning. Radio network design cycle: initial planning, tuning, optimisation, repeaters in cellular systems, distributed network architecture using fibre-optic and cable TV. General problems: noise-limited and interference-limited sensitivity, use of the radio spectrum, system selectivity, technical regulations.

ELEC 5505 Spread Spectrum CDMA for Mobile Communications

4 credit points

Assumed knowledge: ELEC 3502 Random Signals and Communications, and ELEC 3503 Introduction to Digital Communications. Offered: February. Classes: (2 lec and a 2hr lab/tut) per week. Assessment: Assignments and a 2hr exam at end of semester.

Recommended elective unit of study for Electrical, Electrical (Information Systems) and Telecommunications Engineering.

CDMA concepts: direct sequence generator, spreading/de-spreading, correlation properties, multiuser DS CDMA on downlink, PN offsets, BS identification, Walsh functions, call identification, multiuser DS CDMA, uplink, near-far problem, power control. CDMA reception: detection in presence of noise, spreading gain, uplink performance, theoretical estimation, voice quality vs interference, simplified RAKE receiver, quadrature modulation, quadrature spreading, IS-95 common air interface, channel architecture (DS-CDMA/FDD), spectrum allocation, cellular and PCS band. Logical CDMA channels: control and traffic channels, associated signalling on traffic channels, CDMA duplex radio channel structure, channel selection, downlink/uplink processing. RF system engineering: coverage, allowable path loss, CDMA channel capacity, impact from imperfect power control, effect of sectorization, soft handoff, cell loading, downlink power budget, system access and call setup algorithm. Handoff procedures: softer, soft, semisoft, hard, CDMA to AMPS, downlink power control, uplink power control: reverse open loop, reverse inner loop, reverse outer closed loop, overload control, comments on performance tuning and CDMA optimisation.

ELEC 5601 Advanced Real Time Computing

4 credit points

Assumed knowledge: ELEC 4602 Real Time Computing. **Offered:** July. **Classes:** Two lec and a 2hr lab/tut) per week. **Assessment:** Lab mark and a 2hr exam at the end of semester.

Recommended elective unit of study for Electrical, Electrical (Information Systems), Computer and Software Engineering.

Modelling of real-time systems, design techniques, analysis and prediction of real-time behaviour, advanced scheduling techniques, simulation, verification and validation, communications, distributed real-time systems, reliability and fault tolerance, hardware architectures, CASE tools for real-time systems. Standards for real-time languages and operating systems.

ELEC 5602 Advanced Computer Architecture

4 credit points

Assumed knowledge: ELEC 4601 Computer Design and (COMP 2001 Computer Systems or COMP 2901 Computer Systems Adv). **Offered:** July. **Classes:** (Two lec and a 2hr lab/tut) per week.

Assessment: Lab mark and a 2hr exam at the end of semester.

Recommended elective unit of study for Electrical, Electrical (Information Systems), Computer and Software Engineering.

Quantitative Principles of Computer Design, Performance assessment, Scalable Performance. Memory Organization, Cache and VM, Interleaving Shared and Distributed Memory. Pipelines, Superscalar processors. Parallel processors, Multi-threading, Cache Coherency, Allocation and Scheduling, Load Balancing. Interconnection Networks, Network Properties, Shared and Distributed Memory Systems, Message Routing. Dataflow, Object Oriented, Multimedia and Hybrid Architectures.

ELEC 5603 Biologically Inspired Signal Processing

4 credit points

Offered: July. **Classes:** (2 lec & one 1hrtut)/wk. **Assessment:** Assignments and a 2hr exam at the end of semester.

Recommended elective unit of study for Electrical Engineering and Electrical Engineering (Information Systems).

Introduction to artificial intelligence, review of knowledge representation techniques. Introduction to artificial neural networks. Artificial neural networks training algorithms. Neural networks training strategies. Hardware implementations of neural networks. Analog and digital very large scale integration friendly learning algorithms. Applications: intracardiac electrogram classification, optical character recognition.

ELEC 5604 Adaptive Pattern Recognition

4 credit points

Offered: July. **Classes:** (2 lec & one 1hr lab/tut)/wk. **Assessment:** Assignments and one 2hr exam at end of Sem.

Recommended elective unit of study for Electrical Engineering.

Mathematical preliminaries: probability theory, random vectors, decision theories. Statistical approaches: feature extraction, nonlinear mapping, quadratic and linear classifiers, nonparametric estimation and classification. Fuzzy set approach: operations on fuzzy sets, the use of fuzzy sets in pattern recognition. Neural-net implementations: generalised perception, associative memories, self-organised neural nets, integrated neural-net computing environment, linking of symbolic and numeric processing.

ELEC 5605 Advanced Digital Engineering

4 credit points

Assumed knowledge: ELEC 4601 Computer Design. **Offered:** July. **Classes:** (Two lec and a 1 hr lab/tut) per week. **Assessment:**

Assignments and a 2hr exam at the end of semester.

Recommended elective unit of study for Electrical, Electrical (Information Systems) and Computer Engineering.

Advanced HDL skills for FPGA and ASIC design. CAD methodologies for design verification. Prototyping very high speed systems, reconfigurable prototypes. Testing, debugging and design for testability. Design methodologies for low power, high speed, small area or low cost. Assessment and selection of vendor technologies. System design exercise. Management of team designs.

ELEC 5606 Multimedia Systems and Applications

4 credit points

Assumed knowledge: COMP 3100 Software Engineering, ELEC 4303 Digital Signal Processing, and ELEC 4501 Data

Communication Systems. **Offered:** July. **Classes:** (Two lec and a 2hr lab/tut) per week. **Assessment:** Lab mark and a 2hr exam at end of semester.

Recommended elective unit of study for Electrical, Electrical (Information Systems), Computer, Software and Telecommunications Engineering.

This course covers the design and implementation of interactive networked multimedia processing and communication applications. The course will cover principles of switched networks, local area networks, wide area networks and their interoperability. Standards and protocols will be studied as examples, including the International Telecommunications Union (ITU) H.320 and H.323 series for conferencing, and H.324 for telephony. Video and audio coding principles will be covered and associated protocols and standards studied.

ELEC 5607 Hardware/Software Co-design

4 credit points

Assumed knowledge: ELEC 3601 Digital Systems Design and COMP 3100 Software Engineering. **Offered:** July. **Classes:** (2 lec and 2 hr lab/tut) per week. **Assessment:** Lab mark and an exam at end of semester.

Recommended elective unit of study for Electrical, Electrical (Information Systems) and Computer Engineering.

Hardware Specification; Software Specification; CAD tools Review of Operating System Principles; Review of Computer Bus and I/O Systems; Interrupts and DMA; I/O Device Abstraction; Device Drivers; Microcode Design.

ELEC 5608 Electronic Commerce

4 credit points

Assumed knowledge: ELEC 3701 Management for Engineers and ELEC 4501 Data Communication Networks. **Offered:** July. **Classes:** (2 lec and 2 hr lab/tut) per week. **Assessment:** Lab mark and an exam at end of semester.

Recommended elective unit of study for Electrical, Electrical (Information Systems) and Computer Engineering

Introduction to electronic commerce, evolving markets and trading systems. Computer & telecommunications infrastructure for electronic commerce, capacity planning. Marketing principles and strategies for electronic commerce. Security issues. Legal and regulatory issues. Specific systems for retail, money management, trading and business to business transactions. Some case studies.

ELEC 5609 Internet Engineering

4 credit points

Assumed knowledge: ELEC 4501 Data Communication Networks.

Offered: July. **Classes:** (2 lec and a 2hr lab/tut) per week.

Assessment: Assignment and lab marks and an exam at end of semester.

Recommended elective unit of study for Electrical and Electrical (Information Systems), Computer, Telecommunications and Software Engineering.

Introduction to OSI stack. Standards organisation. Review of circuit and packet switching. Internet Protocol (IP), Transport Control Protocol, User Datagram Protocol; Elementary sockets; advanced sockets; IPv4 and IPv6; Mobile Internet Protocol; Routing sockets; Datalink access; Client server design and programming models; Multicasting; Session access protocol; session description protocol; real-time protocol; Applications and standards; some study cases.

ELEC 5610 Computer and Network Security

4 credit points

Assumed knowledge: ELEC 4601 Computer Design and ELEC 4501 Data Communication Networks. **Offered:** July. **Classes:** (2 lec and a 2hr lab/tut) per week. **Assessment:** Assignment and lab marks and an exam at end of semester.

Recommended elective unit of study for Electrical and Electrical (Information Systems), Computer, Software and Telecommunications Engineering.

Physical security; discretionary and mandatory access control; biometrics; information-flow models of security; covert channels; models for integrity; cryptography; authentication; electronic cash; viruses; firewalls; electronic voting; risk assessment; secure web browsers; electronic warfare.

Mechanical Engineering

MECH 1500 Mechanical Engineering 1

6 credit points

Prohibition: MECH 1501 Engineering Statics. **Offered:** February.

Classes: Statics: 1 x 2hr plus 1x1 hr lecture-tute session/week.

Professional Eng: 2 x 1hr lecture-tute per week. **Assessment:** In-class assessments, exam, assignments.

First year core unit of study for the degrees in Mechanical and Mechatronic Engineering.

Syllabus Summary

Professional Engineering (2 Cr): structure and management of engineering projects, engineering project planning, engineering economics. Engineering management issues, total quality management, ethics, liability, environment, health, etc. Development of both verbal and written communication skills. Accessing information technology.

Statics (4 Cr): scalar and vectors; units and dimensional homogeneity. Statics of a rigid body; forces and moments; free body diagrams in two and three dimensions; resultants of forces and moments. Equilibrium of rigid bodies, trusses, frames and machines; statically determinate pin-jointed structures. Distributed forces, centroids of lines, areas and volumes; cables. Friction, wedges, screws; flexible belts.

Objectives

Students will develop skills in

- engineering management techniques
- working in groups
- verbal and written communication
- solving problems in static engineering structures

Expected outcomes

To develop an understanding of

- the role of professional engineers and their responsibilities
- the basic methods required to perform static engineering mechanics calculations.

Textbooks

Bedford and Fowler Engineering Mechanics: Statics (vol 1) SI

Edition, Addison Wesley.

Library Classification: 531.64

MECH 1501 Engineering Statics

4 credit points

Prohibition: MECH 1500 Mechanical Engineering 1. **Offered:**

February. **Classes:** 1 x 2hr plus 1 x 1 hr lec-tut session/wk.

Assessment: In-class assessment, assignments, exam.

First year core unit of study for the degree in Aeronautical Engineering

Syllabus Summary: Scalar and vectors; units and dimensional homogeneity. Statics of a rigid body; forces and moments; free body diagrams in two and three dimensions; resultants of forces and moments. Equilibrium of rigid bodies, trusses, frames and machines; statically determinate pin-jointed structures. Distributed forces, centroids of lines, areas and volumes; cables. Friction, wedges, screws; flexible belts.

Objectives: To develop an understanding of:

- the basic methods required to perform static engineering mechanics calculations

Expected outcomes: Students will develop skills in:

- solving problems in static engineering structures

Textbooks

Bedford and Fowler, Engineering Mechanics: Statics (vol 1) SI

Edition, Addison Wesley

Library Classification: 531.64

MECH 1510 Kinematics and Dynamics

6 credit points

Prohibition: MATH 1051 Mechanics 1E. **Offered:** July. **Classes:** 2 x 2hr lec-tut/wk. **Assessment:** Assignments, in-class assessment, exam.

First year core unit of study for the degrees in Mechanical and Mechatronic Engineering and Junior elective unit of study for the degree in Aeronautical Engineering.

Syllabus Summary: Particle motion; cartesian, normal and tangential, and polar coordinate systems; relative motion; work, energy and power; mass flows and variable mass systems; momentum of particles and systems of particles; collisions and the coefficient of restitution. Gearing, fundamental law of toothed gearing, parallel axis gear trains, epicyclic gear trains, tubular analysis of planetary trains, free body diagrams, power transmission.

Objectives: To develop: an understanding, and competence in, performing basic engineering mechanics calculations; problem-solving skills in team work

Expected outcomes: Students will develop problem-solving skills in engineering mechanics.

Textbooks

Bedford and Fowler, Engineering Mechanics: Dynamics (vol 2) SI

Edition, Addison Wesley.

Library Classification: 531.3

MECH 1600 Manufacturing Technology

4 credit points

Prohibition: AERO 1600 Workshop Technology. **Offered:** July.

Classes: One 3 hour lab per week. **Assessment:** Practical work.

First year core unit of study for the degrees in Mechanical and Mechatronic Engineering

(a) Fitting - Measurement, measuring tools, marking tools, testing tools, holding tools, hammers, cutting tools, bolts and studs, tapping and screwing, reaming and scraping.

(b) Machining - Various metals and their machinability, cutting tool materials, cutting tool shape, the machine tools: lathe, mill, grinder, drill, shaper, deburring and finishing operations.

(c) Welding - Various welding processes, distortions, flame cutting, resistance welding. Practical work in gas welding and arc welding.

(d) Heat treatment, blacksmithing and forging - Definition and importance of heat treatment, and the process of forging, normalising hardening, case hardening.

(e) Founding - Materials used in the foundry, moulding and core making, the casting process.

Safety requirements: All students are required to comply with the safety regulations. Students who fail to do this will not be permitted to enter the workshops. In particular, approved industrial footwear must be worn, and long hair must be protected by a hair net. Safety glasses must be worn at all times.

Objectives

To develop an understanding of a range of machining and manufacturing processes required to make mechanical components

Expected outcomes

Students should develop skills in machining and manufacturing methods through practical experience

Textbooks

Library Classification: 671.

MECH 1800 Computational Engineering 1A

7 credit points

Prohibition: MECH 1801 Computational Engineering 1C. **Offered:** February. **Classes:** Lectures and Computer labs. **Assessment:** In-class assessment, assignments, exam.

First year core unit of study for the degrees in Mechanical and Mechatronic Engineering.

CAD (2 Cr): Elements of solid modelling systems; basic spatial concepts. The manufacture and assembly of machine components. Kinematics interaction and modelling, with examples taken from machinery.

Mechatronic Design (2 Cr): Introduction to the design of mechatronic systems. Elements of mechatronic systems; actuators, sensors. Industrial examples.

Matlab: Introduction to Matlab, basic features; array operations; graphing; relations and logical operations. Linear algebra. Applications in mechanics and numerical analysis. Tool boxes.

Msoffice: Introduction to spread sheet calculations, data structures, graphing. Applications in numerical analysis. Objectives: To introduce engineering design concepts in the context of a computational environment

Expected outcomes: Students will develop skills in

- problem-solving with Matlab
- solving problems with spread sheets
- understanding spatial concepts in design
- solving engineering mechanics problems with a solid modelling package
- use of mechatronics elements

Textbooks

SolidWorks Course Notes, from Wentworth Copy Centre

The Student Edition of Matlab (Prentice Hall, 1995)

Excerpt from Etter, Engineering problem solving with Matlab (Prentice Hall, 1993)

Library Classification: 620.0042

MECH 1801 Computational Engineering 1C

5 credit points

Prohibition: MECH 1800 Computational Engineering 1A. **Offered:** February. **Classes:** Lectures and Computer labs. **Assessment:** In-class assessment, assignments, exam.

First year core unit of study for the degree in Aeronautical Engineering.

CAD (2 Cr): Elements of solid modelling systems; basic spatial concepts. The manufacture and assembly of machine components. Kinematics interaction and modelling, with examples taken from machinery

Matlab: Introduction to Matlab, basic features; array operations; graphing; relations and logical operations. Linear algebra. Applications in mechanics and numerical analysis. Tool boxes.

MS Office: Introduction to spread sheet calculations, data structures, graphing. Applications in numerical analysis.

Objectives: To introduce engineering design concepts in the context of a computational environment

Expected outcomes: Students will develop skills in

- problem-solving with Matlab
- solving problems with spread sheets
- understanding spatial concepts in design
- solving engineering mechanics problems with a solid modelling package

Textbooks

SolidWorks Course Notes, from Wentworth Copy Centre

The Student Edition of Matlab (Prentice Hall, 1995)

Etter Engineering problem solving with Matlab (Prentice Hall, 1993)

Library Classification: 620.0042

MECH 1810 Computational Engineering 1B

3 credit points

Offered: July. **Classes:** 1 hr lec and 2 hr lab/week. **Assessment:** One 11/2 hr exam and computer exercises.

First year core unit of study for the degree in Mechatronic Engineering.

Syllabus Summary: C (Mechatronic students): Introduction to programming, program design, program structures, data types, program control. Preprocessor, tokens, storage classes and types. Basis I/O. Assignment: arithmetic, relational and bit manipulation operators. Control flow: if and switch statements. Arrays, for, do and while loops. Pointers and character strings. Functions, parameter passing. Derived storage classes, structures, unions and bit fields. File I/O. Software project management, debugging techniques, user interfaces.

Objectives: To provide the basic computational tools in the context of engineering applications currently being studied.

Expected outcomes: Students will develop skills in the design and implementation of C programs to solve engineering problems

Textbooks

Kernihan and Ritchie The C programming Language 2nd edn (Prentice Hall, 1988)

McConnell Code Complete (Microsoft Press, 1994)

MECH 2201 Thermodynamics 1

4 credit points

Prohibition: MECH 2200 Thermofluids. **Offered:** February.

Classes: (2 lec and one 3hr lab/tut)/wk. **Assessment:** One 2 hr exam, assignments and laboratory work.

Second year core unit of study for the degree in Aeronautical Engineering.

Syllabus summary: Thermodynamics - concepts, work and heat, property of substances, 1st law of thermodynamics, control mass and control volume analysis of power and refrigeration cycles; thermal efficiency, entropy and 2nd law of thermodynamics, reversible and irreversible processes, isentropic efficiency.

Objectives: The understanding of thermodynamics fundamentals.

Expected Outcomes: to be able to understand engineering problems involving power systems, engine and refrigeration cycles.

Textbooks

Cengel and Boles, Thermodynamics, an Engineering Approach, 2nd edn (McGraw Hill)

Library Classification: 536.7, 621.4

MECH 2202 Fluids 1

2 credit points

Prohibition: MECH 2200 Thermofluids. **Offered:** July. **Classes:** 1 lecture/wk and labs and tuts. **Assessment:** One 11/2 hr exam, assignments and laboratory work.

Second year unit of study for the degrees in Mechanical and Mechatronic Engineering.

Syllabus Summary: Fluid properties, pressure, shear, hydrostatics, forces, moments, buoyancy, stability, continuity equations, streamlines, Euler, Bernoulli equations, linear momentum, propulsion, angular momentum, turbomachinery, dimensional analysis, boundary layers, pipe flow and friction.

Objectives: The understanding of fluids fundamentals.

Expected outcomes: To be able to analyse engineering problems involving fluid flow.

Textbooks

Potter and Wiggert, Mechanics of Fluids, Prentice-Hall.

Library Classification: 536.7, 621.4, 532., 620.106

MECH 2300 Materials 1

4 credit points

Prohibition: CIVL2101 Properties of Materials. **Offered:** July.

Classes: 2 lectures and 1 hr tut/wk plus three 3 hr lab sessions.

Assessment: One 2 hr exam plus assignment work.

Second year core unit of study for the degrees in Mechanical Engineering and Aeronautical Engineering.

Syllabus Summary: Materials classification; understanding materials properties and their relation to structure as a function

of forming methods and heat treatment processes; materials behaviour in service; selection criteria and case studies for engineering applications.

Objectives: To understand the classification of engineering materials, their properties in relation to microstructure

Expected outcomes: Students should be able to appreciate the properties of a range of engineering materials and how and why these are connected with microstructures and forming and treatment methods.

Textbooks

Callister Jr Materials Science and Engineering - An Introduction 3rd edn (John Wiley, 1994)

Reference books

Ashby and Jones Engineering Materials 1-An Introduction to their Properties and Applications (Pergamon, 1981)

Ashby and Jones Engineering Materials 2-An Introduction to Microstructures, Processing and Design (Pergamon, 1986)

Bailey The Role of Microstructure in Metal (Metallurgical Services, 1966)

Bailey Introductory Practical Metallography (Metallurgical Services, 1966)

Bailey The Structure and Strength of Metal (Metallurgical Services, 1967)

John Understanding Phase Diagrams (Macmillan, 1974)

Library Classification: 620, 624, 666-679.

MECH 2400 Mechanical Design 1

6 credit points

Offered: July. **Classes:** (2 lec/wk, plus 2 x 2hr drawing office sessions)/wk. **Assessment:** assignments and quizzes.

Second year core unit of study for the degrees in Mechanical and Mechatronic Engineering and Aeronautical Engineering.

Syllabus summary

(a) Machine Drawing — freehand sketching of machine components. Drafting techniques and standard drawing methods. Orthogonal projections and sections. Dimensioning, tolerancing, conventional symbols, detail and assembly drawings and descriptive geometry.

(b) Machine Design - engineering innovation, creativity. Teamwork. Design process, problem specification, conceptual techniques and design evaluation. Ergonomic manufacturing and assembly considerations.

Detail design of components including: design loads, failure and factor of safety; calculation approach and presentation conventions; stress effects in shape definition and material selection; introduction to engineering hardware including fasteners, bearings and mechanical power transmission. Introduction to involute gears and gear trains (including epicyclic).

Objectives

To develop an understanding of:

- the need for and use of standard drawings in the communication and definition of parts and assemblies
- creativity
- the design process from initial idea to finished product
- methods use to analyse designs
- standard components

Expected outcomes: Students will develop skills in:

- working in teams
- freehand sketching and drafting practices
- idea generation methods
- design analysis techniques and layout
- design development and testing
- written and graphical communication.

Textbooks

Textbooks

Boudny Engineering Drawing (McGraw-Hill)

Reference books

SHIGLEY & MISCHKE Mechanical Engineering Design (McGraw-Hill)

R.L. Norton Machine Design, An Intergrated Approach (Prentice Hall)

Library Classification: 621.815

MECH 2500 Engineering Dynamics 1

4 credit points

Prerequisite: MATH 1001,1002 and MECH 1510 Kinematics and Dynamics. **Offered:** July. **Classes:** Two lec/wk, three 3 hr lab sessions and ten 2 hr tutorials. **Assessment:** Exam and assignments.

Second year core unit of study for the degree in Mechanical and Mechatronic Engineering and Aeronautical Engineering.

Syllabus Summary: Planar mechanisms, linkages, mobility; instant centres of rotation, Kennedy's theorem; velocity and acceleration polygons. Kinematics of rigid bodies, frames of reference, velocity and acceleration, rotating frame of reference, relative velocity and acceleration, gyroscopic acceleration. Kinetics of rigid bodies, linear momentum and Euler's first law; angular momentum and Euler's second law; centre of mass; moments of inertia, parallel axis and parallel plane theorems, principal axes and principal moments of inertia, rotation about an axis; impulse and momentum; work and energy, kinetic and potential energies. Applications to orbital and gyroscopic motion. Introduction to Lagrangian methods.

Objectives: To develop an understanding of the basic methods required to perform rigid body dynamics calculations.

Expected outcomes: Students will develop skill in analysing planar mechanisms, and in performing rigid body dynamics calculations.

Reference

Smith and Smith Mechanics 2nd edn (Wiley, 1990)

Mabie and Reinholtz Mechanisms and Dynamics of Machinery 4th edn (Wiley, 1987)

Shigley and Uicker Theory of Machines and Mechanisms International edn (McGraw-Hill, 1981)

Bedford and Fowler Engineering Mechanics: Dynamics (Vol. 2) SI Edition, Addison Wesley

Library Classification: 621.8

MECH 2700 Mechatronics 1

6 credit points

Offered: July. **Classes:** 3 hr lectures and a 3 hr lab/wk.

Assessment: 2 hr exam plus project work.

Second year core unit of study for the degree in Mechatronic Engineering.

Mechatronic Systems: General principles of mechatronic systems. Components of systems: basic sensor devices and sensor conditioning; actuation devices including basic electrical servos, pneumatics and hydraulics; essential principles in control and regulation.

Embedded Computing: Principles of common industrial control computers including PLCs and single-board computers.

Applications: Detailed case studies of mechatronic systems with examples from manufacturing, automobile systems and other areas.

Objectives: To provide an introduction to mechatronic principles and an appreciation of the working of mechatronic systems.

Expected outcomes:

- A broad understanding of the main components of mechatronic systems.
- Understanding of the principles involved in computer controlled machinery, including sensing, acuation and control.
- Practical knowledge of the development of simple embedded computer programs
- Understanding of the practical application of mechatronic systems in applications such as manufacturing, automobile systems and robotics.

Textbooks

Library Classification: 670.427, 629.89, 629.895, 621.2, 629.804

MECH 2900 Anatomy and Physiology for Engineers

4 credit points

Prerequisite: Biology BIOL 1001 or some previous biology experience. **Offered:** February. **Classes:** 3 hrs/wk, including lectures and laboratory sessions. **Assessment:** exam plus assignments and laboratory reports.

Syllabus summary: Gross anatomy of the major body systems; physiology of cell homeostasis; physiology of nervous, circula-

tory, respiratory, musculoskeletal, digestive and renal systems relevant to biomedical engineering.

Objectives:

- Students should gain familiarity with anatomical and physiological terms and understanding their meaning
- Students should gain an understanding of the gross anatomy of the major systems in the human body and their importance in the design of biomedical devices
- Students should gain an understanding of the major physiological principles which govern the operation of the human body

Expected outcomes: Students will be able to

- a) identify the gross anatomical features of the human body
- b) describe the normal function of the major body systems (nervous, circulatory, respiratory, musculoskeletal, digestive and renal)
- c) determine how these functions relate to cellular function
- d) determine how a biomedical engineering device affects the normal anatomy and function of the body.

MECH 3200 Thermal Engineering 1

7 credit points

Prerequisite: MECH 2200 Thermofluids or MECH 2201 Thermodynamics 1. **Prohibition:** MECH 3201 Thermodynamics 2. **Offered:** February. **Classes:** (3 lec and 2 x 1 hr tut)/week and laboratory work. **Assessment:** two 2hr exams, assignments and laboratory reports.

Third year core unit of study for the degree in Mechanical Engineering.

Thermodynamics (57%): Availability, statistical entropy and second law of thermodynamics, generalised charts for properties, engine characteristics, gas mixtures, psychrometry, air conditioning and refrigeration, thermodynamics of combustion.

Heat transfer (43%): Plane and cylindrical conduction convection, thermal networks, fins, heat exchangers, LMTD and NTU methods, unsteady conduction, forced and natural convection heat transfer coefficients, dimensional analysis, radiation introduction.

Objectives: To develop an understanding of the basic principles of heat transfer, thermodynamic cycles, gas mixtures, combustion and chemical equilibrium.

Expected outcomes: Ability to tackle and solve a range of heat transfer, thermodynamics and fluid flow problems including: (i) finned heat exchangers, cooling by fluids, quenching, insulation, and solar radiation; (ii) complex thermodynamics cycles, air conditioning, combustion, chemical equilibrium, problems involving gas mixtures.

Textbooks

Incropera and DeWitt Fundamentals of Heat and Mass Transfer (Wiley)

Cengel and Boles Thermodynamics, and Engineering Approach (McGraw-Hill) 2nd Edn

Library Classification: 536.7, 621.4, 536.2

MECH 3201 Thermodynamics 2

4 credit points

Prerequisite: MECH 2200 Thermofluids or MECH 2201 Thermodynamics 1. **Prohibition:** MECH 3200 Thermal Engineering 1. **Offered:** February. **Classes:** (2 lec and 1 x 1 hr tut)/week and laboratory work. **Assessment:** one 2hr exam, assignments and laboratory reports.

Third year year core unit of study for the degree in Aeronautical Engineering

Syllabus summary: Thermodynamics: availability, statistical entropy and second law of thermodynamics, generalised charts for properties, engine characteristics, gas mixtures, psychrometry, air conditioning and refrigeration, thermodynamics of combustion.

Objectives: To develop an understanding of the basic principles of thermodynamic cycles, gas mixtures, combustion and chemical equilibrium.

Expected outcomes: Ability to tackle and solve a range of complex thermodynamics cycles, air conditioning, combustion, chemical equilibrium, problems involving gas mixtures.

Textbooks

Cengel and Boles Thermodynamics, an Engineering Approach (McGraw-Hill) 2nd Edn.

Library Classification: 536.7, 621.4

MECH 3202 Heat Transfer

3 credit points

Prerequisite: MECH 2201 Thermodynamics 1. **Offered:** February. **Classes:** 1 lec, 1 tut/week and laboratory work. **Assessment:** One 2 hr exam, assignments and laboratory reports.

Third year core unit of study for the degree in Mechanical Engineering.

Objectives: To develop an understanding of the basic principles of heat transfer.

Expected Outcomes: Ability to tackle and solve a range of heat transfer problems including finned heat exchangers, cooling by fluids, quenching, insulation and solar radiation.

Syllabus Summary: Heat Transfer. Plane and cylindrical conduction convection, thermal networks, fins, heat exchangers, LMTD and NTU methods, unsteady conduction, forced and natural convection heat transfer coefficients, dimensional analysis, radiation introduction.

MECH 3210 Fluid Mechanics

4 credit points

Prerequisite: AERO 2201 Fluid Mechanics, AERO 2200 Introductory Aerodynamics or MECH 2202 Fluids 1. **Offered:** July. **Classes:** 3 hr/week + laboratory sessions. **Assessment:** Assignments, laboratory and 2 hr exam.

Third year core unit of study for the degree in Mechanical Engineering.

Navier-Stokes equations - derivation, significance and fundamental importance.

Pipe flow - Bernoulli, shear losses, minor losses, networks.

Pumps - pump types, characteristics, applications.

Potential flow - stream function and potentials, Laplace's Equation, some basic building blocks. Flow around a cylinder, lift, drag, etc.

Boundary layers - derivation of equations, solution procedures for Laminar case, introduce the concept of turbulence, transition.

Turbulence - concept, properties of turbulence, eddy viscosity, more advanced approaches.

Turbulent flow near a wall - law of the wall, pipe flow velocity profiles.

Channel flow - flow in a channel, weir, hydraulic jump, etc.

Compressible flow - sound waves, normal shock, nozzle flow, shock tube.

Objectives: To be able to solve problems involving pipe flow, pumps, free surface flow, boundary layers, drag, lift and turbulent flow.

Expected outcomes: an intuitive understanding of energy and energy balances in fluid mechanics. Ability to design pipe networks and determine pump requirements; to determine and optimise the drag on streamlined and bluff bodies, to apply basic turbulence models.

MECH 3300 Materials 2

4 credit points

Prerequisite: MECH 2300 Materials 1 & AERO 2300 Mechanics of Solids 1. **Offered:** July. **Classes:** 2 lec/wk plus 1 tut/wk & two labs. **Assessment:** One 2 hr closed book exam plus assignments and lab reports as specified at the commencement of the semester.

Third year core unit of study for the degrees in Aeronautical and Mechanical Engineering.

Syllabus summary: Short-term and long-term mechanical properties, introductory fracture and fatigue mechanics, dislocations, polymers and polymer composite materials, ceramics and glasses, structure-property relationships, selection of materials in mechanical design.

Objectives: (a) To understand the relationship between properties of materials and their microstructures; and (b) to improve mechanical design based on knowledge of mechanics and properties of materials.

Expected outcomes: Students should gain the capabilities to select proper materials for simple engineering design.

Textbooks

Lecture notes

Reference Books

Ashby & Jones Engineering Materials 1 (Butterworth Heinemann)
 Ashby & Jones Engineering Materials 2 (Butterworth Heinemann)
 Higgins Properties of Engineering Materials (Edward Arnold)
 Gallister, Jr. Materials Science and Engineering-An Introduction
 (John Wiley & Sons)
 Bolton Engineering Materials Technology (Butterworth
 Heinemann)
 Ashby Materials Selection in Mechanical Design (Pergamon
 Press)
 Library Classification: 620-624, 666-679

MECH 3310 Mechanics of Solids 2

4 credit points

Prerequisite: AERO 2300 Mechanics of Solids 1 and MATH 2005.
Offered: February. **Classes:** 2 lec/wk plus 2 tut/wk. **Assessment:**
 One two hour examination plus assignments and a lab in the
 semester.

Third year core unit of study for the degree in Mechanical Engineering.

Syllabus Summary: Stress and strain, linear elasticity and fundamental plasticity, primary solution strategy, introduction to variational methods, introduction to numerical stress analysis, case studies.

Objectives: To understand how to evaluate the behaviour of solid materials subjected to stress and deformation

Expected outcomes: Students should gain the ability to analyse simple engineering problems in terms of strength, stress, and deformation in relation to properties of materials.

Textbooks

Lecture notes

Reference books

Chakrabarty Theory of Plasticity (McGraw-Hill, 1987)
 Chandrupatla and Belegundu Introduction to Finite Elements in
 Engineering (Prentice Hall, 1991)
 Courtney Mechanical Behaviour of Materials (McGraw-Hill
 Publishing Company, 1990)
 Crandall, Dahl and Lardner An Introduction to the Mechanics of
 Solids (McGraw-Hill, 1978)
 Johnson and Mellor, Engineering Plasticity (D. Van Nostrand
 Company Ltd, 1973)
 Timoshenko and Goodier Theory of Elasticity (McGraw-Hill,
 1951)

MECH 3400 Mechanical Design 2A

4 credit points

Prerequisite: MECH 2400 Mechanical Design 1. **Offered:** February.
Classes: 2 lectures & one 1 hr drawing office session/wk.
Assessment: Assignments and quizzes.

Third year core unit of study for the degrees in Mechanical and Mecharronic Engineering

Syllabus Summary: The following areas of design are usually included, together with others which may be added: Introduction to weld practice, strength analysis of welded joints leading to more extensive weldments. Principles and applications in the design of a spatial structure. Review of failure mechanism and fatigue analysis. Power screws and preloaded bolted joints. The application of the spreadsheets to design calculations and optimal analyses. Bolted joints in shear and bearing. The uses and examinations of shafts. Introduction to Computer Aided Design packages which may include a wire frame and a solid modeller. Belt and drives. Couplings and power transmission components.

Objectives: To provide students with techniques with which they can analyse classes of machine components. To demonstrate that these techniques have common underlining principles which may be applied with various degrees of precision. To make the student aware of the range of machinery that has thus far been invented and developed and how this process is continuing. To provide an understanding of the functions of the design engineer in a company structure and the effectiveness of management techniques in ensuring successful designs.

Expected outcomes: Students will be able to set up mathematical models representing the stresses, deflection and fatigue life expectancy of a range of machine components. This will

provide the student with the means of applying the underlining principles to new parts and assemblies. To be able to function in a team, set up communication links, distribute work load and make adjustments leading to desired conclusions.

Textbooks

R.L. Norton Machine Design, An Integrated Approach (Prentice Hall), or

J.Shigley et al Mechanical Engineering Design (McGraw-Hill)

Reference Books

Orlov Fundamentals of Machine Design Vol I to V (M.I.R. Moscow)

Library classification: 621.815, 001.6443

MECH 3410 Mechanical Design 2B

4 credit points

Prerequisite: MECH 2400 Mechanical Design 1. **Offered:** July.
Classes: 2 lectures & one 1 hr drawing office session/wk.
Assessment: Assignments and quizzes.

Third year core unit of study for the degrees in Mechanical and Mecharronic Engineering

Syllabus Summary: The following areas of design are usually included, together with others which may be added: 3 Dimensional drawings and solid models. Application programming from within a CAD system. Scheduling design and manufacturing tasks, Analysis of springs. Evolution and selection of CAD system for design and drafting applications. Hydrodynamic bearings. Gears and gear drives. Clutches and brakes. Open ended projects that utilises many elements of the unit of study.

Objectives: To provide students with techniques with which they can analyse classes of machine components. To demonstrate that these techniques have common underlining principles which may be applied with various degrees of precision. To make the student aware of the range of machinery that has thus far been invented and developed and how this process is continuing. To provide an understanding of the functions of the design engineer in a company structure and the effectiveness of management techniques in ensuring successful designs.

Expected outcomes: Students will be able to set up mathematical models representing the stresses, deflection and fatigue life expectancy of a range of machine components. This will provide the student with the means of applying the underlining principles to new parts and assemblies. To be able to function in a team, set up communication links, distribute work load and make adjustments leading to desired conclusions.

Textbooks

R.L. Norton Machine Design, An Intergrated Approach (Prentice Hall), or

J.Shigley et al Mechanical Engineering Design (McGraw-Hill)

Reference Books

Orlov Fundamentals of Machine Design Vol I to V (M.I.R. Moscow)

Library classification: 621.815,001.6443

MECH 3500 Engineering Dynamics 2

4 credit points

Prerequisite: MECH 2500 Engineering Dynamics 1 and (MATH 2001 & MATH 2005). **Offered:** February. **Classes:** 2 lec and 1 tut/wk plus laboratory sessions. **Assessment:** One 2 hr exam, assignments and laboratory work.

Third year core unit of study for the degrees in Mechanical and Mecharronic and Aeronautical Engineering

Syllabus Summary: Vibration of machines and structures. Modelling of linear and nonlinear mechanical systems; equations of motion; state-space representation; numerical solution. Linear system analysis in the frequency and time domains; transfer functions. Matrix formulation for multi-degree-of-freedom systems; natural frequencies; modal analysis. Introduction to the analysis of vibration and whirl of simple distributed systems such as beams and shafts.

Objectives: To provide techniques from mechanics and system theory applicable to the dynamics of machines and structures.

Expected outcomes:

(a) Competence in modelling the dynamics of mechanical systems, setting up their equations of motion and solving them numerically or analytically.

(b) Familiarity with the occurrence, isolation and measurement of mechanical vibration.

Reference books

Rao Mechanical Vibrations (Addison-Wesley, 1995)
 Inman Engineering Vibration (Prentice-Hall, 1996)
 Dimarogonas Vibration for Engineers (Prentice-Hall, 1996)
 Ogata System Dynamics (Prentice-Hall, 1992)
 Etter Engineering Problem Solving with MATLAB (Prentice-Hall)
 Library Classifications: 531.32, 620.1, 620.101, 620.3, 620.37

MECH 3600 Manufacturing Engineering

6 credit points

Prerequisite: MECH 1600 Manufacturing Technology. **Offered:** February. **Classes:** lec: 3hrs/wk; plus an average of 2hrs/wk for tut, lab and industrial visits. **Assessment:** One 2 hr exam plus labs, poster and industrial visits.

Third year core unit of study for the degrees in Mechanical and Mechatronic Engineering.

Manufacturing processes - several manufacturing processes will be considered from the points of view of fundamentals of the process, limitations on the production rates and runs and product quality, general purpose and specialised machinery, automation, numerical control and computer-aided manufacture. Processes considered include machining, casting, powder metallurgy, metal working, welding, polymer processing, blending and composite manufacture.

Manufacturing systems - economics of automation, flexible manufacturing, Just in Time, group technology, materials requirements planning, quality control, introduction of new technology, human factors, plant layout.

Objectives: To understand some fundamental manufacturing processes and systems

Expected outcomes: Students will learn how to manufacture mechanical parts and understand the principles, merits and disadvantages of some commonly used manufacturing techniques

Textbooks

Lecture notes

Reference books

S. Kalpakjran Manufacturing Processes for Engineering Materials 2nd edn (Addison-Wesley Publishing Co., 1991)
 E. DeGarmo, J.T. Black and R.A. Kohser Materials and Processes in Manufacturing 7th edn (Macmillan Publishing Co., 1990)

MECH 3601 Manufacturing Systems

2 credit points

Prerequisite: MECH 1600 Manufacturing Technology. **Offered:** February. **Classes:** 2 hrs/wk lec; plus industrial visits. **Assessment:** One 1 hr exam plus labs and industrial visits.

Third year core unit of study for the degrees in Mechanical and Mechatronic Engineering.

Objectives: to understand some fundamental manufacturing systems.

Expected outcomes: Students will understand the principles, merits and disadvantages of some commonly used manufacturing techniques.

Syllabus summary: Manufacturing systems - economics of automation, flexible manufacturing, Just in Time, group technology, materials requirements planning, quality control, introduction of new technology, human factors, plant layout.

Textbooks

Lecture notes

Reference books

S. Kalpakjran, Manufacturing Processes for Engineering Materials, 2nd edn (Addison-Wesley Publishing Co., 1991).
 E. DeGarmo, J.T. Black and R.A. Kohser, Materials and Processes in Manufacturing, 7th edn (Macmillan Publishing Co., 1990).

MECH 3610 Team Project

2 credit points

Prerequisite: 30 credit points of second year units of study. **Offered:** July. **Classes:** One hr/week for team consultations and several lectures on relevant topics; presentations in final two weeks of Semester. **Assessment:** On the basis of progressive contribution to the group effort and on the quality of the final presentations.

Third year core unit of study for the degrees in Mechanical and Mechatronic Engineering.

Syllabus Summary: Team building, considerations of conceptual design, economic analysis, project management outline, environmental impact and consideration of benefits to society in major projects. This part of the unit of study will culminate in team presentations.

Objectives: To plan a multidisciplinary project, to consider technical, managerial, economic, environmental and societal factors in bringing a project from concept to conclusion and to make a verbal presentation.

Expected outcomes: Students will learn how to work in a team, to plan and assign responsibilities and to achieve common objectives. Tasks will include information searches, conceptual planning and design and consideration of all the complexities of modern project planning.

MECH 3620 Industrial Management

5 credit points

Offered: July.

Third year core unit for the degree in Aeronautical Engineering.

Microeconomics, the Australian business environment, the role of government, accounting systems and procedures, the accounting cycle, financial statements, internal performance, financial structures, intellectual property, contract law, legal obligations of business, capital budgeting and investment analysis, introduction to contract administration.

Reference books

Stanley How to Read and Understand a Balance Sheet (Schwartz & Wilkinson, Melbourne)
 The Small Business Handbook (Small Business Development Corp., Victoria)
 Eyre Mastering Basic Management (Macmillan)
 Stoner, Collins and Vetton Management in Australia (Prentice-Hall)
 Blank and Tarquin Engineering Economy (McGraw-Hill)

MECH 3700 Mechatronics 2

5 credit points

Prerequisite: MECH 2700 Mechatronics 1. **Offered:** February. **Classes:** 2 hr lectures plus a 3 hr lab/wk. **Assessment:** 2 hr exam plus project work.

Third year core unit of study for the degree in Mechatronic Engineering.

Syllabus Summary: Mechatronics Systems Architectures: Single processor systems, multiple and distributed processing systems, special purpose architectures (DSPs etc) and their application.

Development of Advanced Mechatronic Systems: Use of multi-tasking, message passing and multi-threading in environments such as NT and/or Unix. Objected oriented programming in languages such as C++.

Design of Modern Mechatronic Systems: Standard interfacing of sensor and actuation systems; ADC/DAC, SSI, parallel, Can Bus etc. Organisation of components and overall design issues including safety, verifiability, modularity, etc. Analysis of detailed case study.

Objectives: To provide an advanced understanding of modern industrial mechatronics systems.

Expected outcomes: Understanding of modern hardware and software architectures as related to the design of mechatronic systems. Practical knowledge of the design and implementation of mechatronic systems, including organisation, safety and reliability and interaction with hardware components.

Textbooks

An extensive list of reference books will be distributed
 Library Classification: 004.22, 004.35, 005.133

MECH 3800 Systems Control

4 credit points

Prerequisite: MATH 2001 and MATH 2005. **Offered:** July. **Classes:** 2 lec and 1 tut/week plus laboratory sessions. **Assessment:** One 1 1/2 hr exam, assignments and laboratory work.

Third year core unit of study for the degrees in Mechanical and Mechatronic Engineering

Syllabus Summary: A number of case studies based on practical examples will be presented. The unit of study will concentrate on linear systems and will be based on classical control theory. Topics covered will include system modelling, time and frequency response, stability, root locus and Bode diagrams, and control using computers. Computer programs Matlab and Simulink will be used to illustrate the concepts presented in the lectures and for the design and simulation exercises associated with the case studies.

Objectives: To introduce the methods used for the analysis and design of feedback control systems.

Expected outcomes: Students will be able to develop a mathematical model and design a suitable feedback controller for a wide range of physical systems. Students will also be able to examine the behaviour of these physical systems and the performance of their controllers using computer simulations.

Reference books

G. F. Franklin, J. D. Powell and A. Emami-Naeini, "Feedback Control of Dynamic Systems", Addison-Wesley
 A. K. Ogata, "Modern Control Engineering", Prentice-Hall
 B. C. Kuo, "Automatic Control Systems", Prentice-Hall
 N. S. Nise, "Control Systems Engineering", Benjamin/Cummings
 Library classifications: 629.8, 629.83, 629.8312, 629.832

MECH3910 Biomedical Technology

3 credit points

Offered: February. **Assessment:** assignment and final exam.

Objectives: Students will gain an understanding of the uses of biomedical engineering products in therapeutic, rehabilitation and clinical settings. Students will gain an understanding of the process of biomedical regulation in Australia and other major international markets as well as the entire process of creating a new biomedical engineering product, from design through to marketing and monitoring of the product.

Syllabus summary: Covers the marketing and regulation of biomedical products, biomedical ethics, development and testing protocols for biomedical devices, rehabilitation engineering, the uses of biomedical products in hospitals. The course will include the development of a full business plan for a new biomedical engineering product, including planning of full clinical trials, regulatory submissions and marketing plan.

MECH 3920 Biomedical Design Project

2 credit points

Prohibition: MECH 3610Team Project. **Offered:** July.

Assessment: on the basis of progressive contribution to the project and on the quality of final presentation.

Objectives: To plan a biomedical project, to consider technical, managerial, economic, environmental and societal factors in taking a biomedical project from concept to conclusion.

Syllabus summary: Team building, considerations of conceptual design, economic analysis, project management outline and potential benefit to the health care system.

MECH 4101 Thesis A

0 credit points

Prerequisite: 36 credit points of Third Year units of study. **Offered:** February, July. **Assessment:** Satisfactory or Unsatisfactory on the basis of the Proposal, Progress Report and actual progress as verified by the supervisor.

Fourth year core unit of study for the degree in Mechanical and Mechatronic Engineering.

Objectives: To involve students in a research or major design project and give them the opportunity to conduct systematic investigations.

Expected outcomes: Ability to plan, submit a Proposal, to autonomously carry out a project and to write a Progress Report at the end of semester. The student can only progress to Thesis B on attainment of a Satisfactory result in Thesis A.

Syllabus summary: In the Fourth year of the unit of study, each candidate works towards and writes an undergraduate thesis from work carried out in Thesis A and B.

Towards the end of each academic year a list of suggested topics and supervisors for thesis work is published for the information of current Third year students. In the case of students enrolling in Thesis A in 2nd semester, topics will be made avail-

able in 1st semester. Each prospective Fourth year student is then required to consult with prospective supervisors to apply for a topic.

In the normal course of events some or all of the theoretical, developmental, and experimental aspects of research or design work are expected in a thesis. These aspects may be either directed by the supervisor or be of an original nature, but in any event the student is directly responsible to his or her supervisor for the execution of his or her practical work and the general layout of the thesis itself.

Thesis A is the first part of Thesis A and Thesis B and requires the student to make significant progress toward the objectives outlined in the Proposal. This includes any workshop drawings and experimental setup. Generally about 50% of the total Thesis A & B time should be spent in Thesis A. Progress is assessed by the supervisor through regular contact with the student and through the formal Progress Report.

MECH 4102 Thesis B

12 credit points

Prerequisite: MECH 4101 Thesis A (the Head of Department may allow Thesis A as corequisite in exceptional circumstances).

Offered: February, July. **Assessment:** On the basis of the submitted thesis and the report by the supervisor of the student's contribution.

Fourth year core unit of study for the degree in Mechanical and Mechatronic Engineering.

Objectives: To involve students in a research or major design project and give them the opportunity to conduct systematic investigations.

Expected outcomes: Ability to plan and execute a complete piece of scientific work and to report their study in a thesis.

Syllabus summary: In the Fourth year of the unit of study, each candidate works towards and writes an undergraduate thesis, at least one copy of which should be submitted in completed form before a date to be announced. Thesis B is the second part of Thesis A and Thesis B and requires the student to continue from the progress attained in Thesis A.

In the normal course of events some or all of the theoretical, developmental, and experimental aspects of research or design work are expected in a thesis. These aspects may be either directed by the supervisor or be of an original nature, but in any event the student is directly responsible to his or her supervisor for the execution of his or her practical work and the general layout of the thesis itself.

Theses should be typewritten on A4 with text, diagrams, graphs, photographs, etc, properly displayed. One copy should be submitted, hard-bound for the departmental library, on or before the due date. The penalty rate for late submissions will be advertised. Students are responsible for supplying their own thesis production materials.

The Charles Kolling Prize may be awarded for the best graduation thesis.

MECH 4110 Professional Engineering

4 credit points

Prerequisite: 36 credit points of Senior units of study. **Offered:** February. **Classes:** lectures/consultations/student presentations - 4hr/week for one semester. **Assessment:** student assignments/presentations and 2hr exam.

Fourth year core unit of study for the degree in Mechanical and Mechatronic Engineering.

Syllabus summary: Project management: specific aspects of project management including initial establishment of projects and design criteria, and capital cost estimating. Design management: topics will cover design integration, codes and standards, specification preparation, and sources of information. Plant engineering management: the areas will include decision making, computerised maintenance, understanding unit operations, environment protection measures, engineering as an element in the cost of production, continuous improvement, provision of plant and ancillary services, and the engineer as a trainer.

Objectives: To impart knowledge resulting in a more global approach to the practice of engineering and engineering management, as well as to provide a vehicle for improving communication skills.

Expected outcomes: A good understanding of the management of projects and engineering plants.

MECH 4120 Professional Communication

4 credit points

Prerequisite: 32 credit points of third year units of study. **Offered:**

July. **Classes:** some instructional sessions will be arranged to provide basic techniques for preparation and presentation of technical material to an audience by audio-visual means.

Assessment: Satisfactory performance in the seminar as assessed by the participants and seminar workshops as assessed by the course coordinator.

Fourth year core unit of study for the degree in Mechanical and Mechatronic Engineering.

During the latter part of the year, one or two whole days are set aside for the presentation of student addresses at a public conference. Each final year student, usually in consultation with his or her thesis supervisor, prepares an abstract of the seminar for distribution one week in advance of the conference. Although it is not obligatory, the subject for the seminar is normally closely related to the student's thesis work; thus it tends to deal in depth with some relatively narrow technical field. At the conference (where the audience comprises senior, senior advanced and postgraduate students, departmental staff and visitors), oral presentation of the thesis is followed by critical discussion under formal chairmanship.

Objectives: To improve student competence and confidence in developing and presenting a formal technical presentation.

Expected outcomes: The ability to structure and deliver a competent and informative technical presentation.

MECH 4130 Practical Experience

0 credit points

Prerequisite: 28 credit points of second year units of study.

Offered: February, July. **Classes:** 12 weeks of practical work experience. **Assessment:** A written report is required. Pass/Fail grade only is awarded. Marks will not be given. (This unit of study will not contribute to the weighted averages used to determine Honours.)

Fourth year core unit of study for the degree in Mechanical and Mechatronic Engineering.

Syllabus summary: Each student is required to work as an employee of an approved engineering organisation and to submit a satisfactory written report of his or her work. Normally 12 weeks of practical work experience (375 hours minimum) is required and this is undertaken after the completion of some or all of the prescribed third year core units of study and before enrolment in the final year of study. The University Careers and Appointments Service is available to assist students to obtain suitable employment. This unit of study must be passed in order to graduate.

The industrial experience report must be submitted early in Semester 1. The report is assessed on content in accordance with details that are distributed to students earlier. The report should contain a section on management.

Objectives: To give students the opportunity to work in an engineering organisation and gain some professional experience. To enhance student abilities and experience in technical report writing.

Expected outcomes: (i) A better appreciation of the role of engineers in the workplace, (ii) The ability to present structured observations and reflections in the mode of a formal written report.

MECH 4210 Computational Fluid Dynamics

4 credit points

Prerequisite: MECH 3210 Fluid Mechanic. **Offered:** July. **Classes:** 2 lectures and one tutorial per week. **Assessment:** tut work, projects and one 2hr exam.

Fourth year elective unit of study.

Syllabus summary: Conservation equations of fluid flow; boundary conditions, classification of flow problems. Numerical solution schemes based on pressure correction; the SIMPLE algorithm and its variants, convection schemes. Solution of the resulting algebraic equations. Turbulence modelling; implementation of boundary conditions in turbulent flow. Coupled heat

transfer: convection, combustion, radiation heat transfer. Multiphase flow. Introductions to compressible flow, the physical significance of hyperbolic equations; characteristic based methods; FCT and TVD schemes. Pitfalls to avoid in CFD.

Objectives: To give students an understanding of basic Navier-Stokes solution methods and turbulence models.

Expected outcomes: Ability to write a simple Navier-Stokes solver and to use a state-of-the-art CFD package.

Reference books

Fletcher Computational Techniques for Fluid Dynamics, vols I and 2 (Springer, 1988)

Patankar Numerical Heat Transfer and Fluid Flow (Hemisphere, 1983)

MECH 4220 Environmental Engineering

6 credit points

Prerequisite: 24 credit points of third year units of study.

Prohibition: MECH 4240 Energy and the Environment and MECH 4230 Environmental Acoustics and Noise Control. **Offered:** February. **Classes:** 5 hrs/wk plus two Saturday field-trips.

Assessment: one 1.5 hr exam, plus assignments.

Fourth year elective unit of study.

Syllabus summary: The unit of study will consist of the following components:

Environmental acoustics and noise control (2 credit points) - Basic acoustics theory, sound generation and propagation, impedance, absorbing materials, industrial noise sources, isolation methods of noise control, enclosures, instrumentation and measurement, frequency analysis, noise regulations. Computational methods in acoustics.

Energy and the Environment (4 credit points) - Economic analysis of energy systems. Urban air pollution, ozone hole and greenhouse problems, waste disposal, water pollution. Montreal Protocol, Rio and Kyoto Accords. Sustainable energy, renewable energy, energy efficiency, CO₂ capture and sequestration and other emerging control technologies.

Objectives: To acquaint students with the methods engineers use to assess and deal with the environmental consequences of industry and other human activities, with particular emphasis on impact assessment and noise.

Expected outcomes: Students will appreciate the social, economic, and legislative aspects of environmental protection. They will understand the requirements of an environmental impact statement. They will be able to make the calculations and measurements necessary to estimate acoustic noise levels in machinery, buildings and the outside environment and to make recommendations as to how best to reduce them.

Reference books

Bies and Hansen Engineering Noise Control (Allen and Unwin, 1988).

Hassall and Zaveri Acoustic Noise Measurement (Bruel and Kjaer, 1988).

Preliminary reading can be made on the web at

www.ieagreen.org.uk.

Other books as advised during classes.

Library Classification: 534.8, 620.23, 620.8, 628.1

MECH 4230 Environmental Acoustics and Noise Control

2 credit points

Prerequisite: 24 credit points of third year units of study.

Prohibition: MECH 4220 Environmental Engineering, MECH 4220 Environmental Engineering. **Offered:** February. **Classes:** 2 lec and 1 tut/w. **Assessment:** one 1.5 hr exam.

Fourth year elective unit of study.

Syllabus summary: Basic acoustics theory, sound generation and propagation, impedance, absorbing materials, industrial noise sources, isolation methods of noise control, enclosures, instrumentation and measurement, frequency analysis, noise regulations. Computational methods in acoustics.

Objectives: To acquaint students with the methods engineers use to assess and deal with the environmental noise due to industry and other human activities.

Expected outcomes: Students will appreciate the social, economic, and legislative aspects of environmental noise. They will be able to make the calculations and measurements necessary to

estimate sound levels and noise in machinery, buildings and the outside environment and to make recommendations as to how best to reduce them.

Reference books

Bies and Hansen Engineering Noise Control (Allen & Unwin, 1988)

Hassall and Zaveri Acoustic Noise Measurement (Bruel & Kjaer, 1988)

Library classification: 534.8, 620.23

MECH 4240 Energy and the Environment

4 credit points

Prerequisite: 24 credit points of Senior units of study. **Prohibition:** MECH 4220 Environmental Engineering. **Offered:** February.

Classes: 3hrs per week in Semester 1. **Assessment:** assignments and classwork.

Fourth year elective unit of study

Syllabus summary: Economic analysis of energy systems. Urban air pollution, ozone hole and greenhouse problems, waste disposal, water pollution. Montreal Protocol, Rio and Kyoto Accords. Sustainable energy, renewable energy, energy efficiency, CO₂ capture and sequestration and other emerging control technologies.

Expected outcomes: Students will be able to carry out economic and environmental impact analyses for energy systems.

Textbooks

No text or reference books are set. Preliminary reading can be made on the web at www.ieagreen.org.uk.

MECH 4250 Air conditioning and Refrigeration

3 credit points

Prerequisite: MECH 3200. **Offered:** February. **Classes:** 1.5hr lecture and 1 hrtut/wk. **Assessment:** Assignments, project and one 2hr exam.

Fourth year elective unit of study.

Syllabus summary: Applied psychrometrics, air conditioning systems, design principles, cooling load calculations, heating load calculations, introduction and use of computer-based load estimation packages software, air distribution, fans, ducts, air conditioning controls.

Refrigeration cycles, evaporators, condensers, cooling towers, compressors, pumps, throttling valves, piping, refrigerants, control, refrigeration equipment, stimulation of refrigeration systems, food refrigeration and industrial applications.

Use of CFD packages as tools to simulate flows in building and to optimise air conditioning design, energy estimation methods and software, energy management in buildings.

Objectives: To develop a practical understanding of air conditioning and refrigeration applications.

Expected outcomes: Students will be able to determine thermal loads on structures, and design an air conditioning or refrigeration system with attention to air distribution and energy consumption.

MECH 4260 Combustion and Fire Safety

3 credit points

Prerequisite: MECH 3200. **Offered:** February. **Classes:** 1.5hr lecture and 1 hrtut/wk. **Assessment:** Assignments, project and one 2 hr exam.

Fourth year elective unit of study.

Syllabus summary: Basics of combustion and chemical kinetics, flames and simple reacting systems, basics of fire dynamics: initiation, development and spread of smoke and fire, pollutants formation, use of CFD in fire remodelling.

Principles of flame inhibition, fire suppressants, fire protection systems: detection, suppression and control. Design considerations for manual and automatic systems. Fire safety regulations: prescriptive and performance based designs.

Objectives: To give students a basic understanding of combustion and fire protection, and safety issues.

Expected outcomes: Students will be able to perform a simple analysis of simple reacting systems. They will also be capable of assessing fire risks and fire protection systems in buildings.

MECH 4310 Advanced Engineering Materials

6 credit points

Prerequisite: MECH 3300 Materials 2. **Prohibition:** MECH 4315 Advanced Aerospace Materials. **Offered:** July. **Classes:** 3 lec/wk plus 3 tut & lab/wk. **Assessment:** One 2 hr exam, one project report, assignments and lab reports as specified at the commencement of the semester.

Fourth year elective unit of study.

Syllabus summary: Postyield fracture mechanics, embrittlement, creep rupture, damage tolerance, structure integrity and reliability, thin film science and technology, advanced polymer matrix composites, toughening mechanisms, processing and manufacturing, superalloys, advanced joining methods.

Objectives: To understand (a) how to conduct failure diagnosis of engineering structures, (b) how to define the relationship between properties and microstructures of advanced engineering materials, and (b) how to improve mechanical design with the knowledge of mechanics and properties of materials.

Expected outcomes: Students should gain the capabilities: (a) to conduct failure diagnosis of simplified failure cases of engineering structures, (b) to define structure-property relationships of advanced engineering materials, and (c) to improve the performance of engineering structures through tailoring materials microstructure and manufacturing processes.

Textbooks

Lecture notes

Reference books

Ashby, Materials Selection in Mechanical Design (Pergamon, 1993)

Atkins and Mai, Elastic and Plastic Fracture (Ellis Horwood, 1985)

Broek, Elementary Fracture Mechanics (third edition, Martinus Nijhoff, 1982)

Chawala, Composite Materials (Springer-Verlag, 1987)

Crawford, Plastic Engineering (second edition, Maxwell-Macmillan, 1987)

Davidge, Mechanical Behaviour of Ceramics (C.U.P., 1979)

Eckold, Design and Manufacture of Composite Structures (McGraw-Hill, 1994)

Gibson, Principles of Composite Material Mechanics (McGraw-Hill, 1994)

Richerson, Modern Ceramic Engineering (M. Dekker, 1982)

Harris, Engineering Composite Materials (Institute of Metals, 1986)

Jones, Engineering Materials 3 -Materials Failure Analysis (Pergamon, 1993)

Richerson, Modern Ceramic Engineering (M Dekker, 1982)

MECH 4315 Advanced Aerospace Materials

6 credit points

Prerequisite: MECH 3300 Materials 2. **Prohibition:** MECH 4310 Advanced Engineering Materials. **Offered:** July. **Classes:** 3 lec/wk plus 3 tut & lab/wk. **Assessment:** One 2 hr exam plus assignments and lab reports as specified at the commencement of the semester.

Fourth year elective unit of study

Syllabus summary: Postyield fracture mechanics, embrittlement, creep rupture, damage tolerance, structure integrity and reliability, thin film science and technology, advanced polymer matrix composites, toughening mechanisms, processing and manufacturing, superalloys, advanced joining methods.

Objectives: To understand (a) how to conduct failure diagnosis of engineering structures, (b) how to define the relationship between properties and microstructures of advanced engineering materials, and (b) how to improve mechanical design with the knowledge of mechanics and properties of materials.

Expected outcomes: Student should gain the capabilities: (a) to conduct failure diagnosis of simplified failure cases of engineering structures, (b) to improve the performance of engineering structures through tailoring materials microstructure and manufacturing processes.

Textbooks

Lecture notes

Reference books

Ashby, Materials Selection in Mechanical Design (Pergamon, 1993)

Atkins and Mai, Elastic and Plastic Fracture (Ellis Horwood, 1985)

Broek, Elementary Fracture Mechanics (third edition, Martinus Nijhoff, 1982)

Chawala, Composite Materials (Springer-Verlag, 1987)

Crawford, Plastic Engineering (second edition, Maxwell-Macmillan, 1987)

Davidge, Mechanical Behaviour of Ceramics (C.U.P., 1979)

Eckold, Design and Manufacture of Composite Structures (McGraw-Hill, 1994)

Gibson, Principles of Composite Materials Mechanics (McGraw-Hill, 1994)

Harris, Engineering Composite Materials (Institute of Metals, 1986)

Jones, Engineering Materials 3 - Materials Failure Analysis (Pergamon, 1993)

Richerson, Modern Ceramic Engineering (M Dekker, 1982)

MECH 4410 **Advanced Design and Analysis 1**

3 credit points

Prerequisite: MECH 3400 Mechanical Design 2A and MECH 3410 Mechanical Design 2B. **Offered:** February. **Classes:** 2 hrs/wk.

Assessment: Assessment is based on one major assignment and two minor projects, as well as attendance, participation and evidenced effort during classes in the drawing office as well as the Mech PC laboratory.

Fourth year elective unit of study.

Objectives: To develop a fuller understanding of and familiarity with the practical design processes expected in industry, including application of analysis techniques (in particular the Finite Element Method) and knowledge obtained from other courses studied.

Expected outcomes: Students should be able to undertake with a measure of confidence basic design and related analysis tasks likely to be encountered in early industrial employment, and should have an understanding of the many aspects associated with such an activity. Strong competence and understanding of the application of the Finite Element Method in stress and vibration analysis will be expected.

Syllabus summary: The course draws together the various subjects studied and introduces the student to the practical aspects of design in the commercial environment, with particular emphasis on classical machinery such as fans, ore grinding mills and vibrating screens. The course includes considerable application of the finite element method in stress and vibration analysis, with specific use of the STRAND FE code in the faculty workstation laboratory.

Textbooks

Shigley and Mischke 'Mechanical Engineering Design' 5th

Edition

Reference books

Lecture notes.

Norton, 'Machine Design - an integrated approach'

Adams and Askenazi, 'Building Better Products with Finite Element Analysis'

Gurney, 'Fatigue of Welded Structures'

Bladder, 'Considerations in Design'

Wills, 'Mineral processing technology' 6th ed.

Bleier, 'Fan Handbook: Selection, Application and Design'

Regular reference will be made to other publications, journals,

trade information as well as Australian and International

Standards and Codes of Practice, societies and organisations.

MECH 4420 **Advanced Design and Analysis 2**

3 credit points

Prerequisite: MECH 3400 Mechanical Design 2A and MECH 3410 Mechanical Design 2B. **Offered:** July. **Classes:** 2 hrs/wk.

Assessment: Assessment is based on one major assignment and two minor projects, as well as attendance, participation and evidenced effort during classes in the drawing office as well as the Mech PC laboratory.

Fourth year elective unit of study.

Objectives: To develop a fuller understanding of and familiarity with the nominated elements of the complete design process, including application of analysis techniques (in particular the Finite Element Method) and knowledge obtained from other courses studied.

Expected outcomes: Students should be able to undertake with a measure of confidence course related tasks likely to be

encountered in early industrial employment, and should have an understanding of the aspects associated with them. Competence and understanding of the application of the Finite Element Method in stress and vibration analysis will be expected.

Syllabus summary: This course is independent of MECH 4410 but inherently complements it with respect to the design and analysis related topics covered. These include structural dynamics and design for fatigue, operational troubleshooting/failure modes/design rectification techniques, design audits, quality management, machinery monitoring (strain, vibration), safety features and guarding for machines. The course includes application of the finite element method in class tasks as well as the major assignment which is related to design improvement of a given machine element, with specific use of the STRAND FE code in the faculty workstation laboratory.

Textbooks

Shigley and Mischke, 'Mechanical Engineering Design' 5th

Edition

Reference books

Lecture Notes.

Norton, 'Machine Design - an integrated approach'

Adams and Askenazi, 'Building Better Products with Finite Element Analysis'

Gurney, 'Fatigue of Welded Structures'

Regular reference will be made to other publications, journals,

trade information as well as Australian and International

Standards and Codes of Practice, societies and organisations.

MECH 4510 **Machine Vibration and Monitoring**

3 credit points

Prerequisite: MECH 3500 Engineering Dynamics 2. **Offered:** July.

Classes: 3 hrs/wk including tutorials and practical sessions.

Assessment: one 2 hr exam plus assignments.

Fourth year elective unit of study.

Syllabus summary: Review of dynamics, including modal analysis of lumped and continuous systems and appropriate methods for nonlinear systems. Aspects of applied problems, especially the dynamics of rotating machinery, the measurement of vibration and condition monitoring of machines. Some aspects of random vibrations, including measurement and prediction of failure.

Objectives: To acquaint students with:

- the types of vibration which can arise in machinery
- mathematical models which can be used to analyse vibration
- vibration measuring devices and analysis of measurements
- machine condition monitoring by vibration measurements

Expected outcomes: Students will be able to identify the causes of damaging vibration from measurements and analysis, predict the likelihood of failure due to vibration, and determine how to deal with it in order to minimise cost and loss of production.

MECH 4605 **Industrial Engineering**

8 credit points

Prerequisite: MATH 2001 and MATH 2005 and MECH 3620

Industrial Management. **Prohibition:** MECH 4620 Industrial

Ergonomics, MECH 4635 Introduction to Operations Research, and

MECH 4610 Industrial and Engineering Management. **Offered:**

February. **Classes:** 3 lec/wk plus associated tut and lab work and

industrial visits. **Assessment:** assignments plus exams.

Fourth year elective unit of study.

Industrial ergonomics - refer to syllabus summary for MECH 4620 Industrial Ergonomics.

Operations research - refer to syllabus summary for MECH 4635 Introduction to Operations Research.

Industrial and Engineering Management - total quality management, production planning and control, costing and pricing, inventory management and control, management reporting systems, value analysis, problem resolution strategies, dispute management, project management, contract administration, marketing management, business planning, the management of engineering enterprises, professional engineering skills.

Objectives

To develop an understanding of:

- principles and practices of industrial and engineering management

- effects of globalisation on Australia's economic performance, and the competitiveness of Australian firms
- insight into the importance of innovation
- roles appropriate to governments
- ergonomics
- information handling
- safety
- training
- work performance
- the role of operations research in modern industry
- problem formulation and analysis techniques for operations research problems
- the importance of reliability analysis in part and system designs
- the use of maintenance and repair to extend the useful life of systems

Expected outcomes

Students should develop skills and abilities in:

- the application of problem solving solutions to management issues
- an appreciation of the interrelationships and complexities associated with the management of a modern industrial organisation
- the development of logical, thoughtful and creative presentations concerning industrial management
- ergonomic analysis
- information processing
- consideration of the workspace
- consideration of the workers and their skills
- the solution of a range of operations research and reliability problems.

Textbooks

Samson Management for Engineering (Longmans)

Reference books

Hicks, Introduction to Industrial Engineering and Management Science (McGraw- Hill, 1977)
 Harding, Production Management 2nd edn (MacDonald & Evans, 1974)
 Hussey, Introducing Corporate Planning (Pergamon, 1972)
 Currie, Work Study 4th edn (Pitman, 1977)
 Heyde, Concise MODAPTS (AAPTS&R, 1975)
 Koontz, et al. Management 7th edn (McGraw-Hill, 1980)
 Hunt, Managing People at Work (McGraw-Hill, 1979)
 Blakemore, The Quality Solution (Australian Business Library, Vic.)
 Kotler, Fitzroy, Shaw, Australian Marketing Management (Prentice-Hall)
 Macnamara, Australian Marketing and Promotion Handbook (Australian Business Library)
 Case Studies in Australian Strategic Management
 Other books may be advised

MECH 4610 Industrial and Engineering Management
 2 credit points

Prerequisite: MECH 3620 Industrial Management. **Prohibition:** MECH 4605 Industrial Engineering. **Offered:** February. **Classes:** 2hrs lec and tut/wk plus industrial visits. **Assessment:** assignments and one 2hr exam.

Fourth year elective unit of study.

Syllabus summary

Total quality management, production planning and control, costing and pricing, inventory management and control, management reporting systems, value analysis, problem resolution strategies, dispute management, project management, contract administration, marketing management, business planning, the management of engineering enterprises, professional engineering skills.

Objectives

To develop an understanding of:

- principles and practices of industrial and engineering management
- effects of globalisation on Australia's economic performance, and the competitiveness of Australian firms
- insight into the importance of innovation
- roles appropriate to governments.

Expected outcomes

Students should develop skills and abilities in:

- the application of problem solving solutions to management issues
- an appreciation of the interrelationships and complexities associated with the
- management of a modern industrial organisation
- the development of logical, thoughtful and creative presentations concerning industrial management.

Textbooks

Samson D., Management for Engineering (Longmans)

Reference books

Hicks, Introduction to Industrial Engineering and Management Science (McGraw- Hill, 1977)
 Harding, Production Management 2nd edn (MacDonald & Evans, 1974)
 Hussey, Introducing Corporate Planning (Pergamon, 1972)
 Currie, Work Study 4th edn (Pitman, 1977)
 Heyde, Concise MODAPTS (AAPTS&R, 1975)
 Koontz, et al. Management 7th edn (McGraw-Hill, 1980)
 Hunt, Managing People at Work (McGraw-Hill, 1979)
 Blakemore, The Quality Solution (Australian Business Library, Vic.)
 Kotler, Fitzroy, Shaw, Australian Marketing Management (Prentice-Hall)
 Macnamara, Australian Marketing and Promotion Handbook (Australian Business Library)
 Case Studies in Australian Strategic Management

MECH 4620 Industrial Ergonomics

2 credit points

Prohibition: MECH 4605 Industrial Engineering. **Offered:** February. **Classes:** 2 hrs lec/tut/wk plus associated lab work. **Assessment:** assignment.

Fourth year elective unit of study.

(a) Lectures - History and scope of ergonomics; biomechanics; receiving and processing information; presentation of information; anthropometry and seating; ergonomic aspects of noise; human factors in safety; selection, skill and training; industrial lighting; fatigue, shiftwork and the organisation of work; absenteeism; mental health and automation; design of equipment and workspace; biomechanics of handling materials; ergonomic job analysis; personal factors in work performance.

(b) Laboratory - Demonstration of protective clothing and equipment. Methods of measurement of work environment. Climatic chamber.

Objectives: To introduce ergonomics and increase awareness of ergonomics issues;

To provide information about humans particularly in the workplace.

Expected outcomes: Students will have sufficient practical information to allow them to optimise the human-environment performance in the workplace.

Reference books

As advised during classes

Library Classification: 150,331.1, 611, 612, 620, 658

MECH 4635 Introduction to Operations Research

4 credit points

Prerequisite: MATH 2001 and MATH 2005. **Prohibition:** MECH 4605 Industrial Engineering. **Offered:** February. **Classes:** 1 lec and 1 tut/wk. **Assessment:** one 2hr paper plus assignments.

Fourth year elective unit of study

Syllabus summary

Method and history of operations research: broad aims; general problem approach.

Inventory control problems, with constant and random demand. Allocation problems; linear programming; transportation problem. Introduction to reliability analysis; component and system reliability; effect of maintenance and repair.

Objectives

To develop an understanding of:

- the role of operations research in modern industry problem formulation and analysis techniques for operations research problems

- the importance of reliability analysis in part and system designs
- the use of maintenance and repair to extend the useful life of systems.

Expected outcomes

Students should develop skills in:

- the solution of a range of operations research and reliability problems.

Reference books

Daellenbach, George and McNickle Introduction to Operations Research Techniques (Allyn and Bacon, 1984)

Tana Operations Research-An Introduction (Macmillan, 1976)

Lewis Introduction to Engineering Reliability (Wiley, 1987)

Library Classification: 658

MECH 4640 **Product Life Cycle Design**

2 credit points

Prerequisite: MECH 3600. **Offered:** July. **Classes:** 2 hrs/wk.

Fourth year elective unit of study.

Syllabus summary: It is becoming more and more critical that product design incorporates the implications of disposal at the end of the operational life cycle of the product. For manufacturers this is emerging as a legislative issue as environmental implications enforce their responsibility over the entire life cycle of the product. This requires consideration of processing technology, materials and parts recycling, and design for disassembly. The course content addresses these issues via examples of consumer products manufacture and their design. An assignment based on small consumer product redesign to improve recyclability will form an important component of the course. More specifically the contents focus on:

- Product life cycle engineering based on environmental and legislative issues.
- Net recovery value analysis based materials, parts, processes and energy model.
- Task analysis for disassembly planning based on clustering.
- Product profile and redesign to improve recyclability.

Objectives: To provide students with necessary knowledge and techniques to plan at the design stage the life cycle problems of the product.

Expected outcomes: Students will learn the major issues involved in product life cycle engineering, relevant methods to improve the recyclability and the principal considerations on legislative, environmental, materials, processes etc.

MECH 4650 **Workplace Industrial Relations**

2 credit points

Prerequisite: 36 credit points of senior units of study. **Offered:** July. **Classes:** 20 hrs of lectures and tutorials.

Fourth year elective unit of study.

Syllabus summary: Introduction to industrial relations, principal players in the system, Industrial relations law. Awards and agreements, working with unions, responsibility of managers, handling individual grievances, identifying and resolving conflict.

Objectives: To give students an understanding of industrial relation issues in Australia.

Expected outcomes: Students will develop skills to handle industrial relations in the workplace and deal with conflicts and disputes.

MECH 4700 **Robotic Systems**

4 credit points

Prerequisite: MECH 3500. **Offered:** July. **Classes:** (2 lec and one 2hr lab/tut)/wk. **Assessment:** one 11/2 hr exam plus assignment, project and lab work.

Fourth year elective unit of study.

Syllabus summary: Overview of robotics: definitions, arm configurations. Kinematics and dynamics of robot manipulators. Control of robots. Programming languages. Sensors. Robot applications. System design, and integration of robots with other automated machinery.

Objectives: To introduce aspects of design, control and use of industrial robots.

Expected outcomes: Students should gain an appreciation for the important factors that need to be considered in the selection and use of robots for industrial applications.

Reference Books

Fu, Gonzalez and Lee, "Robotics: control, sensing, vision and intelligence", McGraw-Hill McKerrow, "Introduction to Robotics", Addison-Wesley.

Asada, H and Slotine, J.-J.E. Robot Analysis and Control. John Wiley, 1985.

Craig, J.J. Introduction to Robotics: Mechanics and Control. Addison-Wesley, 1986.

MECH 4710 **Microprocessors in Engineered Products**

6 credit points

Prerequisite: ELEC 3601 Digital Systems Design and ELEC 3401 Electronics Devices & Circuits. **Offered:** February. **Classes:** (3 lec and one 2hr lab/tut)/wk. **Assessment:** project and assignment work, plus one 2 hr exam. Satisfactory performance in project and assignment work is required.

Fourth year elective unit of study.

Syllabus summary: Specific requirements for microprocessor-based products. Problem definition and system design. CPU, memory and interface circuits. Tools for design, development and testing of prototype systems. The unit of study will include a major project, where groups of students design, develop and commission a microprocessor-based product.

Objectives: To provide experience, confidence and basic competence in the design and implementation of microprocessor-based products and instruments. To impart a detailed knowledge of the software and hardware architecture of a typical modern microcontroller, and an understanding of the use of these resources in product design. To give experience with modern cross-development tools. To provide experience of working in a project team to prototype a realistic product to meet a specification.

Expected outcomes: The student will have a detailed knowledge of the software and hardware architecture of a modern microcontroller. This knowledge will include an in-depth understanding of the relationship between assembly language, high-level language, and the hardware, of the utilisation and interfacing of microcontroller hardware resources, and of the design and development of software comprised of multiple interrupt-driven processes. The student will have the competence to develop prototype microprocessor-based products.

Textbooks

Peatman Design with microcontrollers (McGraw Hill)

Reference books

An extensive reference list will be distributed

Library Classification: 629.398, 629.895, 621.3815, 621.38195, 001.6425,005.1

MECH 4720 **Sensors and Signals**

6 credit points

Prerequisite: MECH 3500 Engineering Dynamics 2 & MECH 3800 Systems Control & ELEC 3601 Digital Systems Design & ELEC 3401 Electronics Devices & Circuits. **Offered:** February. **Classes:** 3hrs lec, 1 hr tut and 2hrs lab/wk. **Assessment:** Laboratory work and one 3 hour exam.

Fourth year elective unit of study.

Syllabus summary: This unit of study comprises three equal parts: Devices, Signals and Systems. Devices deals with sensors and the interfacing of sensors to computers and machines. Signals deals with the modeling, conditioning and analysis of sensor signals. Systems deals with the use of sensor signals in control and systems design, with reference to key mechatronics applications:

(a) Devices: Process and machine instrumentation: sensor types (temperature, pressure, force, proximity) and properties; interfacing considerations, hardware and applications. Automotive, aerospace and robotic sensors: sensor types (accelerometers, gyroscopes, lasers, ultrasonics, radar) and measurement principles; interfacing considerations, hardware and applications. One 6-hour laboratory on sensor interfacing example.

(b) Signals: Introduction to signals and noise as stochastic processes; signal characterisation, signal conditioning. Signal

analysis in the time domain; signal analysis in the frequency domain; modeling and processing of signals; introduction to estimation theory. Two 2-hour computer laboratories; signal characterisation and signal modeling.

(c) Systems: Signal processing systems, hardware and software; special purpose and digital signal processing hardware; introduction to data fusion theory. Condition monitoring; reliability and fault detection. Example applications; process monitoring and automotive systems. One 10-hour computer laboratory on system design.

Objectives: To provide an understanding of essential sensor data processing algorithms and an understanding of a variety of different sensor technologies.

Expected outcomes: Understanding of common signals and the means of processing and interpreting sensory information. An appreciation of available sensor technologies and where they may be used.

MECH 4730 Computers in Real Time Control and Instrumentation

6 credit points

Prerequisite: ELEC 3601 Digital Systems Design & ELEC 3401 Electronics Devices & Circuits. **Offered:** February. Classes: (3 lec and one 2hr lab/tut)/wk. Assessment: Project and assignment work, plus 2 hr exam. Satisfactory performance in project and assignment work is required.

Fourth year elective unit of study.

Syllabus summary: Review of sensing, analogue and digital electronics. Signal conditioning and data acquisition. Overview of the IBM PC architecture, programming for interactive control using both assembly language and the high level language C. Timers, interrupts. Asynchronous tasks; data communication. Structured data; structures in C. Cooperative multi-tasking, real time operating systems. Design of interactive graphical displays; man-machine communication.

Objectives: Microcomputer and microprocessor system, operating in real time have become very common components in today's engineering applications. The objective of this unit of study is to teach the fundamentals of real time software and to build competence in the engineering use of such systems through lectures emphasising standard computer architectures, programming, and through intensive laboratory work with microcomputer systems interacting with experimental mechatronic processes.

Expected outcomes: The student will have a basic knowledge of the hardware components available in a microcomputer system and a detailed knowledge of facilities and capabilities typically present in a professional real time operating system. The student will have the competence to design, implement and debug interrupt-driven multitasking systems with graphical user interfaces.

Textbooks

Auslander DM, Tham CH, Real Time Software for Control, (Prentice Hall, 1990)

Library reference number: 629.8955133 1, Engineering Reserve

MECH 4900 Orthopaedic Engineering

4 credit points

Prerequisite: MECH 3300 Materials 2 and MECH 3310 Mechanics of Solids 2. **Offered:** July. Classes: 4hrs of tut/lab classes/wk. Assessment: one 2hr exam.

Fourth year elective unit of study.

Syllabus summary: Musculoskeletal anatomy, physiology and function, including basic medical terminology, anatomy and physiology, normal and abnormal joints, bones, cartilage, ligaments and tendons. Introduction to orthopaedic injuries, including fractures, bone healing, fracture fixation, electrical stimulation of bone healing. Overview of the design, manufacture and use of artificial ligaments, hip, knee and shoulder joint prosthesis, bone cement, finite element modelling of prostheses, material considerations, testing of orthopaedic implants, failure of implants.

Objectives: To introduce students to the biomechanics of the musculo-skeletal system and to the fundamentals of biomedical engineering as applied to orthopaedic devices used for the replacement and repair of the diseased or damaged skeleton.

Expected outcomes: Students will become acquainted with the physical properties of human bones and joints. They will understand how the skeleton functions as an engineering structure. They will learn the physical characteristics of the materials from which the musculoskeletal system is fabricated and be able to adapt basic engineering principles to the design and fabrication of prosthetic joints and to other devices used for replacement and repair of bones and joints.

MECH 4910 Biomaterials and Biomechanics

4 credit points

Prerequisite: 36 credit points of third year units of study. **Offered:** February. Classes: 4 hrs of lecture/tut/lab per week. **Assessment:** continual assessment and exam.

Fourth year elective unit of study.

Syllabus summary: Introduction to biomaterials, characteristics of materials, including mechanical testing and advanced analysis techniques, metallic, polymeric, ceramic, composite implant materials and their properties; structure/property relationships to biological materials and the study of 'biomimetics' (mimicry of biological materials), tissue response to implants, soft tissue replacement, hard tissue replacement and laboratory testing of biomaterials and biological materials.

Introduction to biomechanics, modelling the human body from the macroscopic level to the microscopic level, soft tissue mechanics - non-linear and viscoelastic descriptions, muscle mechanics, joint mechanics, kinematics and dynamics of human gait (gait analysis), biomechanics of cells, physiological fluid flow, biomechanics of injury, functional and mechanical response of tissues to mechanical loading.

Objectives: To gain a basic understanding of the major areas of interest in both the biomaterials and biomechanics fields, learn to apply basic engineering principles to biomedical systems, and understand the challenges and difficulties of biomedical systems.

Expected outcomes: Students should be able to:

- Apply static and dynamic mechanical analyses to the human body to describe motion.
- Understand the mechanical behaviour of biological tissues and the types of models used to describe this behaviour.
- Understand all the factors involved in the selection of a biomaterial for tissue replacement, including mechanical, biocompatibility, material property and fixation factors.
- Improve their written and oral communication skills in a technical setting.

The students should gain a basic understanding of the major areas of current research in both the biomaterials and biomechanics fields, learn to apply basic engineering principles to biomedical systems, and understand the challenges and difficulties of biomedical systems.

Reference books

J.B. Park and R.S. Lakes Biomaterials An Introduction (Plenum Press, 1992)

J. Black Orthopaedic biomaterials in research and practice (Churchill Livingstone, 1988)

Y.-C. Fung Biomechanics of Living Tissues (Springer-Verlag)

Interdisciplinary units of study

ENGG 1001 Interdisciplinary Project

12 credit points

Prerequisite: UAI score of at least 98. Students considering this option are advised to see their Head of Department. **Prohibition:** Mutually exclusive with a number of other first year units of study. As these will vary depending on the branch of Engineering, students considering this option are advised to see their Head of Department prior to enrolment. **Assessment:** A written report on the project undertaken and other oral and written presentations as specified. First year unit of study for all degree branches in Engineering.

The project is a major component of this unit of study. Although the project will be supervised by a senior Faculty member, the emphasis here is on the team members setting and achieving their own goals, and presenting their work in both oral

and written form. Groups will be expected to make an engineering project by the end of Semester 1.

ENGG 2002 Advanced Engineering Project

2 credit points

Prerequisite: Only students who have been named on the Dean's list at the end of Year 1 will be eligible. **Classes:** 2 hours tutorials per week for one semester. This Unit of study will be offered in either February or July Semesters. **Assessment:** A written report and oral presentations. Satisfactory tutorial performance is also required.

Syllabus: Students will work in groups on a defined Industrial Project, or continue with one of the projects previously carried out in study ENGG 1001. Each group will be expected to provide details and insight into how their findings could be used or exploited commercially.

Objectives/Outcomes: This unit of study is designed to provide students with an insight into engineering practice in industry. By its end, it is expected that students will be able to carry out the following tasks:

- analyse an industrial problem
- carry out the background research required to fully define and solve the problem
- work effectively as a team member at all stages of the project
- write a coherent report, outlining the problem and its solution, as well as making an oral presentation
- prepare a business plan with respect to an industrial or research project.

ENGG 2003 Introduction to Engineering Management

4 credit points

Prohibition: ELEC 3701, MECH 3620. **Classes:** Two (1 hr) lectures and one (1 hr) tutorial per week one semester. **Assessment:** Tutorial and project assignments plus a final (2 hr) examination.

Year 2 core unit of study for the "Management" stream within the degrees in Aeronautical, Chemical, Electrical, Mechanical and Mechatronics Engineering.

Syllabus: Engineers and management; communication; micro-and macro-economics; strategic management; business planning; legal responsibilities; industrial hazard management; human resource management; industrial relations; project management; quality assurance; operations management; accounting and financial management.

Objectives/Outcomes: To introduce students to a range of management concepts and techniques, and to develop an understanding of the role and challenges of management.

ENGG 2004 Introductory Engineering Studies

4 credit points

Classes: An individual study program will be tailored to meet the needs of both the student and the Department / School in which they are enrolled. **Assessment:** This unit of study will involve directed learning and short assignments together with minor project work as required.

Elective unit of study available as part of the Summer School program to overseas students enrolled in the Faculty of Engineering.

Objectives/Outcomes: Many overseas students commence their studies in the second semester of the academic year. In such cases, it may be advantageous for students to undertake additional units of study, as part of the University's Summer School program, to allow them to fit more easily into the BE degree program in subsequent years. The aim here is thus to allow overseas students the chance to undertake individual study in any area deemed to be beneficial to their overall Engineering studies.

Syllabus Summary: This will be set by the Department / School after consultation with the student.

ENGG 2005 Introductory Engineering Project

8 credit points

Classes: An individual study program will be tailored to meet the needs of both the student and the Department / School in which they are enrolled. **Assessment:** An individual assessment program will be developed to ensure that the student meets a standard consistent with those of the Faculty of Engineering.

Elective unit of study available as part of the Summer School program to overseas students enrolled in the Faculty of Engineering.

Objectives/Outcomes: Many overseas students commence their studies in the second semester of the academic year. In such cases, it may be advantageous for students to undertake additional units of study, as part of the University's Summer School program, to allow them to fit more easily into the BE degree program in subsequent years. The aim here is thus to allow overseas students the chance to undertake individual study in any area deemed to be beneficial to their overall Engineering studies.

This unit of study will involve a major project in an area of engineering within the student's discipline. The project may be supplemented by directed learning and related assignments as required.

Syllabus Summary: This will be set by the Department/School after consultation with the student.

ENGG 3001 Engineering Technology Education

2 credit points

Prerequisite: Only students who have been named on the Dean's list at the end of Year 2 will be eligible. **Classes:** 2 hours tutorials per week for one semester. This unit of study will be offered in either February or July Semesters. **Assessment:** A written report and oral demonstrations. Satisfactory tutorial performance is also required.

Syllabus: Students will work alone or with a partner to develop an educational unit for Year 9 High School Students which will involve them in some aspect of engineering science or technology and which will, at the same time, raise an awareness of, and an interest in, engineering. The units will need to be designed with due regard to the teaching and learning process. Activities undertaken as part of the units should reflect, wherever possible, aspects of professional engineering practice.

Objectives/Outcomes: This elective will help understand engineering principles and applications by investigating, explaining and practising them with Year 9 school students. At the end of this elective it is expected that students will be able to reinvestigate, identify, design, develop, implement, and evaluate experiential activities for non-engineers which reflect engineering practice; Develop skills in the management and use of personal and material resources and processes; Effectively communicate engineering principles and practices to others. Present work in written, graphical, and oral forms.

ENGG 3002 Industrial and Engineering Management

4 credit points

Prerequisite: ENGG 2003. **Prohibition:** MECH 4610. **Classes:** Two (1 hr) lectures and one (1 hr) tutorial per week one semester.

Assessment: Project assignments plus a final (2 hr) examination.

Year 3 core unit of study for the Management stream within the degrees in Aeronautical, Chemical, Electrical, Mechanical and Mechatronics Engineering.

Syllabus: Project management; industrial relations and human resource management; technology and innovation management; organisational design; management and change; leadership; environmental and sustainability issues.

Objectives: to develop in students a substantial understanding and capability in major facets of industrial and engineering management.

ENGG 4001 Innovation and International Competitiveness

4 credit points

Offered: February. **Classes:** (1 lec/1 seminar)/wk. **Assessment:**

Essay, group project case study, assignments and written exam.

Year three elective course for the degree in all branches of Engineering.

Syllabus summary: The course is designed to provide students with an understanding of the forces of international competition that are setting the rules for the future of private and public sector organisations in which engineers are employed. Introduction to challenges of modern management; understanding of the new rules of international competitiveness; effects of globalisation on Australia's economic performance; the competitiveness of Australian firms; the generation of employment and wealth; the

changing requirements on the engineer; the engineer as manager and strategist; the role of innovation in business management; product innovation and commercialisation.

Textbooks

Text and reference books

See list supplied by lecturer

ENGG 4002 New Business Creation

4 credit points

Assessment: In-course involvement (attendance and discussion); product development assignment; business case study assignment; examination.

Fourth Year elective unit of study for any Engineering Degree.

In the new economic environment, graduates must be better prepared to take control of their own employment futures which increasingly must include the option of entrepreneurship and the creation and growth of one's own company. For those graduates with a technical or engineering background, the new technology-based firm offers extremely large potential to create jobs and wealth. This unit of study provides a student with a clear understanding of the venture creation process with particular emphasis on technology-based ventures. A range of skills are developed relating to R&D management, intellectual property, technology contracts, product development, marketing, financial management and business planning. As a result, it is expected that this unit of study could be the first step for a number of its attendees to progress to active involvement in new technology based firms either in Australia or internationally.

ENGG 4003 Economic, Social and Ethical Aspects of Engineering

4 credit points

Assessment: Attendance at group discussions (10%); presentation of case study, and the leading of the discussion (40%); final exam (50%).

Fourth Year elective unit of study for any Engineering Degree.

The unit of study will proceed primarily by lecture, case study presentation and group discussion. All students undertaking the unit of study are required to present, and lead the discussion on, at least one case study. Appropriate visiting professionals will form part of the delivery.

In selecting the projects for the unit of study, the organisers will include projects across a wide range of the fields of engineering studied and researched within the Faculty of Engineering at the University of Sydney.

In preparing the case studies, presenters will aim to cover the following:

- Outline the historical context of the project.
- Outline the justification for the project from the point of those who promoted the project.
- Identify the resources required for the project and the sources of those resources.
- Identify the main engineering objectives and challenges of the project.
- Identify the social and ethical issues involved in the project from the points of view of (a) the society of the time and (b) Australian society today.
- Provide an assessment of the 'success' of the project in terms of (a) the people who promoted the project and (b) the personal opinions of the presenter of the case study.

Industrial organisations will be invited to contribute to the unit of study by:

- Suggesting engineering projects and people to be included in the unit of study.
- Suggesting retired or current members of the organisation's staff for the role of the 'staff' facilitators presenting case studies.

CHAPTER 3

Tables of undergraduate units of study

Table 1: Aeronautical Engineering

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
Aeronautical Engineering core units of study					
First Year					
AERO 1600 Workshop Technology	4		N) MECH 1600.		February
AERO 1800 Computational Engineering 1D	3				July
AERO 1900 Introductory Aeronautics	4				February
ELEC 1001 Introductory Electrical Engineering	4	A) MATH1001 Differential Calculus. N) ELEC1102 Foundations of Electronic Circuits, and ELEC2002 Electrical Technology.			July
MATH 1001 Differential Calculus	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1901 or 1011.			February
MATH 1002 Linear Algebra	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1902 or 1012.			February
MATH 1003 Integral Calculus and Modelling	3	A) HSC 4-unit Mathematics or MATH 1001. N) May not be counted with MATH 1903 or 1013.			July
MATH 1005(1) Statistics	3	A) HSC 2-unit Mathematics. N) May not be counted with MATH 1905 or 1015.			July
MECH 1501 Engineering Statics	4		N) MECH 1500 Mechanical Engineering 1.		February
MECH 1801 Computational Engineering 1C	5		N) MECH 1800 Computational Engineering 1A.		February
Second Year					
AERO 2201 Fluid Mechanics	4		N) Mutually exclusive with AERO2200 Introductory Aerodynamics, AERO2700 Space Engineering 1.		July
AERO 2300 Mechanics of Solids 1	4		P) 12 credit points of first year Maths (i.e Maths 1001,1002,1003,1005).		February
AERO 2500 Introductory Flight Mechanics and Performance	4		P) MATH 1001, 1002, 1003, 1005.		February
MATH 2001 Vector Calculus and Complex Variables	4		P) MATH (1001 or 1901) and (1002 or 1902) and (1003 or 1903). N) May not be counted with MATH 2901.		February
MATH 2005 Fourier Series and Differential Equations	4		P) MATH (1001 or 1901) and MATH (1002 or 1902) and MATH (1003 or 1903). N) May not be counted with MATH 2905.		July
MECH 2201 Thermodynamics 1	4		N) MECH 2200 Thermofluids.		February
MECH 2300 Materials 1	4		N) CIVL 2101 Properties of Materials.		July
MECH 2400 Mechanical Design 1	6				July
MECH 2500 Engineering Dynamics 1	4		P) MATH 1001, 1002 and MECH 1510 Kinematics and Dynamics.		July
Third Year					
AERO 3200 Aerodynamics 1	4		P) AERO 2200.		February

Table 1: Aeronautical Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
AERO 3250 Aerodynamics 2	4	P) AERO 2200.			July
AERO 3300 Aircraft Structures 1	4	P) AERO 2300.			February
AERO 3350 Aircraft Structures 2	4	P) AERO 2300.			July
AERO 3400(2) Aircraft Design 1	3	P) MECH 2400.			February
AERO 3450(2) Aircraft Design 2	3	P) MECH 2400.			July
AERO 3500 Flight Mechanics 1	4	P) AERO 2500.			July
MECH 3201 Thermodynamics 2	4	P) MECH 2200 Thermofluids or MECH 2201 Thermodynamics 1. N) MECH 3200 Thermal Engineering 1.			February
MECH 3300 Materials 2	4	P) MECH 2300 Materials 1 & AERO 2300 Mechanics of Solids 1.			July
MECH 3500 Engineering Dynamics 2	4	P) MECH 2500 Engineering Dynamics 1 and (MATH 2001 & MATH 2005).			February
Fourth Year					
AERO 4200 Aerodynamics 3	3	P) AERO 3250.			February
AERO 4201 Propulsion	4	P) MECH 3201.			July
AERO 4300 Aircraft Structures 3	5	P) AERO 3350. N) AERO 4301 Applied Numerical Stress Analysis.			February
AERO 4400 Aircraft Design 3	6	P) AERO 3450.			February
AERO 4500 Flight Mechanics 2	6	P) AERO 3500.			February
AERO 4600 Practical Experience	0				July
AERO 4900 Thesis or Design Project	10	P) 40 credit points of Senior Subjects.			Full Year (starts Feb)
AERO 4920(3) Seminar	2	P) 40 credit points of Senior Subjects.			July

Notes

1. MATH 1004 Discrete Mathematics is an acceptable alternative to MATH 1005.
2. Students enrolled in BE/BCom enrol in AERO 3401 Aerospace Design 1 as an alternative to AERO 3400 & AERO 3450.
3. Students enrolled in BE/BCom are exempt from this unit.

Resolutions of the Faculty of Engineering relating to Table 1**Degree eligibility****BE(Aeronautical)**

In addition to gaining credit for the 148 credit points of core units of study set out in Table 1, candidates are required to complete at least 44 credit points of elective units of study from the table of recommended elective units of study for BE(Aeronautical). A minimum of 192 credit points is required to be eligible for the award of the degree of BE (Aeronautical).

BE(Aeronautical)/BSc or BA

In addition to gaining credit for the 148 credit points of core units of study set out in Table 1, candidates are required to complete at least 80 credit points of units of study given by either the Faculty of Science for BE/BSc or Arts for BE/BA. An additional 12 credit points of elective units of study from the table of recommended elective units of study for BE(Aeronautical) are also required. A minimum of 240 credit points is required to be eligible for the combined degrees. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the faculty in which they are undertaking the combined degree.

Table 1: Aeronautical Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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BE(Aeronautical)/BCom

In addition to gaining credit for the 144 credit points of core units of study set out in Table 1, candidates are required to complete recommended units of study given by the Faculty of Economics and Business. A minimum of 240 credit points is required to be eligible for the combined degree BE/BCom. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the Faculty of Economics and Business.

BE(Aeronautical Engineering)(Management)

In addition to gaining credit for the 144 credit points of core units of study set out in Table 1, candidates are required to complete at least 24 credit points of units of study from the table of recommended elective units of study for BE (Aeronautical Engineering). Further credit of 24 credit points shall be gained by completing the units of study listed in the table of additional units of study for BE (Aeronautical Engineering)(Management).

Acceptable alternative units of study

Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent Advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing Advanced options should seek advice from their Department before enrolling. Students undertaking Study Abroad in their final year of the degree must enrol in the AERO 4620 Aeronautical International Exchange Program unit of study as an alternative to a semester's standard units.

Aeronautical Engineering recommended elective units of study**First Year**

Construction and Design

AERO 1400	Introduction to Aircraft Construction and Design	6			July
MECH 1510	Kinematics and Dynamics	6	N) MATH 1051	Mechanics 1E.	July

Second Year

AERO 2800	Aeronautical Engineering Computing	4			February
MATH 2002	Matrix Applications	4	P) MATH 1002 or 1902 or Distinction in MATH 1012. N) May not be counted with MATH 2902.		February
MATH 2052	Numerical Methods	2	C) MATH 2001 or 2901. N) MATH 2952.		July

Third Year

AERO 3501	Flying Operations	2	P) AERO 2500, AERO 2201 or AERO 2200.		
AERO 3600	Aviation Technology	4			July
AERO 3601	Aviation Operation and Management	3			July
MECH 3620	Industrial Management	5			July

Fourth Year

AERO 4250	Aerodynamics 4	3	P) AERO 3250.		July
AERO 4290	Rotary Wing Aircraft	4	P) AERO 3250.		February
AERO 4291	Advanced Computational Aerodynamics	3	P) AERO 3250.		July
AERO 4292	Aeroelasticity	3	P) AERO 3250.		July
AERO 4350	Aircraft Structures 4	3	P) AERO 3350. N) AERO 4301 Applied Numerical Stress Analysis.		July
AERO 4390	Smart Materials and Structures	3	P) AERO3350 Aircraft Structures 2 or AERO3351 Aerospace Structures 2.		July
AERO 4490	Advanced Aircraft Design	4	P) AERO 3450.		July

Table 1: Aeronautical Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
AERO 4590 Advanced Flight Mechanics	3	P) AERO 3500.			July

Notes

- Choice of electives as shown in the above table will depend on subject availability, timetabling and prerequisite conditions.
- Approved elective units of study given by Departments other than Aeronautical may be taken as alternatives, subject to the approval of the head of department.

BE (Aeronautical Engineering - Management) additional units of study

AERO 3601 Aviation Operation and Management	3				July
CHNG 3401 Project Economics	4				February
CHNG 4403 Engineering Business Skills	4				July
CHNG 4504 Environmental Decision Making	4				July
ENGG 2003(4) Introduction to Engineering Management	4	N) ELEC3701, MECH3620.			
ENGG 3002(4) Industrial and Engineering Management	4	P) ENGG2003. N) MECH4610.			
ENGG 4001 Innovation and International Competitiveness	4				February
ENGG 4002 New Business Creation	4				
MECH 4635 Introduction to Operations Research	4	P) MATH 2001 and MATH 2005. N) MECH 4605 Industrial Engineering.			February
MECH 4650 Workplace Industrial Relations	2	P) 36 credit points of senior units of study.			July
CHNG 4401 Project Engineering	4				February
or					
ELEC 4701 Project Management	4	A) ELEC3701 Management for Engineers.			July
or					
MECH 4110 Professional Engineering	4	P) 36 credit points of Senior units of study.			February

Note

- The required total of 24 credit points shall comprise ENGG 2003, ENGG 3002 and 16 credit points from the remaining units of study. In the year 2000, there will only be entry into first year (ie, no advanced standing into the later years of this stream will be possible).

Table 2: Chemical Engineering

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
Chemical Engineering core units of study					
First Year					
CHEM 1101 Chemistry 1A	6	A) HSC Mathematics 2 unit course; and the Chemistry component of the 4-unit or 3-unit HSC Science course, or 2-unit Chemistry. C) Recommended concurrent unit of study: Preferred - MATH 1001 and 1002 or 1901 and 1902; otherwise - MATH 1011 and 1012. N) May not be counted with CHEM 1001 or 1901 or 1903.			February, July
CHEM 1102 Chemistry 1B	6		Q) CHEM 1101 or a Distinction in CHEM 1001 or equivalent. C) Recommended concurrent unit of study: Preferred - MATH1003 and 1005 or 1003 and 1004 or 1903 and 1905 or 1903 and 1904; otherwise - MATH1004 and 1005 or 1013 and 1015. N) May not be counted with CHEM 1002 or 1902 or 1904.		February, July
CHNG 1001 Chemical Engineering Applications	4				February
CHNG 1101 Chemical Engineering 1A	4				February
CHNG 1102 Chemical Engineering 1B	4			P) CHNG 1101 Chemical Engineering 1A.	July
CHNG 1201 Chemical Process Case Studies	4				July
CHNG 1301 Computing for Chemical Engineers	4				February
MATH 1001 Differential Calculus	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1901 or 1011.			February
MATH 1002 Linear Algebra	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1902 or 1012.			February
MATH 1003 Integral Calculus and Modelling	3	A) HSC 4-unit Mathematics or MATH 1001. N) May not be counted with MATH 1903 or 1013.			July
MATH 1005 Statistics	3	A) HSC 2-unit Mathematics. N) May not be counted with MATH 1905 or 1015.			July
MATH 1052 Introduction to Mechanics	4				
Second Year					
CHEM 2101 Chemistry 2 (Environmental)	8		Q) CHEM 1102 or 1902 or 1904 or 1909. P) 6 credit points of Junior Mathematics. N) May not be counted with CHEM 2001 or 2301 or 2502 or 2901.		February
CHNG 2101 Chemical Engineering 2A	4				February
CHNG 2102 Chemical Engineering 2B	4				July
CHNG 2301 Chemical Engineering Computations	4			P) Maths 1001, 1002,1003,1005 CHNG 1301.	July
CHNG 2501 Sustainable Development	4				February
CHNG 2601 Materials and Corrosion	4				July
MATH 2001 Vector Calculus and Complex Variables	4			P) MATH (1001 or 1901) and (1002 or 1902) and (1003 or 1903). N) May not be counted with MATH 2901.	February
MATH 2002 Matrix Applications	4			P) MATH 1002 or 1902 or Distinction in MATH 1012. N) May not be counted with MATH 2902.	February

Table 2: Chemical Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
MATH 2005	4	P) MATH (1001 or 1901) and MATH (1002 or 1902) and MATH (1003 or 1903). N) May not be counted with MATH 2905.			July
MATH 2051	2	C) MATH 2001 or 2901, and MATH 2002 or 2902. N) MATH 2953.			July
MATH 2052	2	C) MATH 2001 or 2901. N) MATH 2952.			July
Third Year					
CHNG 3001	4	P) CHNG 2101 Chemical Engineering 2A; CHNG 2102 Chemical Engineering 2B.			February
CHNG 3101	4	P) CHNG 2101 Chemical Engineering 2A; CHNG 2102 Chemical Engineering 2B.			February
CHNG 3102	4	P) CHNG 2101 Chemical Engineering 2A; CHNG 2102 Chemical Engineering 2B.			February
CHNG 3103	4	P) CHNG 2101 Chemical Engineering 2A; CHNG 2102 Chemical Engineering 2B.			July
CHNG 3104	4	P) CHNG 2101 Chemical Engineering 2A; CHNG 2102 Chemical Engineering 2B.			July
CHNG 3105	4	P) CHNG 2101 Chemical Engineering 2A; CHNG 2102 Chemical Engineering 2B.			February
CHNG 3106	4	P) CHNG 3105 Thermodynamics 1.			July
CHNG 3107	4				July
CHNG 3301	4	P) CHNG 2301 Chemical Engineering Computations.			February
CHNG 3302	4				July
CHNG 3401	4				February
Fourth Year					
CHNG 4001	0	P) 28 credit points of 3rd Year units.			July
CHNG 4002	8	P) Students should have completed (or be enrolled in) all other 4th Year core units.			February
CHNG 4201	4	P) CHNG 3101,3102,3103,3104.			February
CHNG 4202	8	P) CHNG 3101, 3102,3103,3104; CHNG 3105 Thermodynamics 1; CHNG 3106 Thermodynamics 2; CHNG 3401 Project Economics.			July
CHNG 4401	4				February
CHNG 4402	4				February

Notes

1. For core units of study offered by other than the Faculty of Engineering, any assumed knowledge and/or prerequisite requirements will be as prescribed by that Faculty.
2. Students doing any of the combined degree options BE/BA, BE/BCom or BE/BSc will be exempt from First Year core units of study MATH 1052 and CHNG 1201.
3. Students doing the combined degree option BE/BCom will also replace the Second Year core units of study MATH 2001, MATH 2002, MATH 2005, MATH 2051 and MATH 2052 with STAT 2002 and STAT 2004.
4. Acceptable alternatives to CHEM 2101 are CHEM 2001 and CHEM 2201.

Table 2: Chemical Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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Resolutions of the Faculty of Engineering relating to Table 2

Bachelor of Engineering in Chemical Engineering

Candidates for this degree are required to complete all the core units of study in Table 2 (total 164 credit points). They are also required to gain at least 12 credit points from the Fourth Year electives listed in the table of recommended elective units of study for BE(Chem) as shown later in this table.

Bachelor of Engineering in Chemical Engineering (Bio-Process Engineering)

Candidates for this degree are required to complete all the core units of study in Table 2 (total 164 credit points). They are also required to complete CHNG 2701, CHNG 2702, MICR 2007, MICR 2008 and CHNG 4501, as well as gaining at least 4 credit points from the Fourth Year electives listed in the table of recommended elective units of study for BE(Chem) as shown later in this table.

Bachelor of Engineering in Chemical Engineering (Computer-Aided Process Engineering)

Candidates for this degree are required to complete all the core units in Table 2 (total 164 credit points). They are also required to complete CHNG 2302 and CHNG 3303, as well as gaining at least 12 credit points of suitable electives (as indicated by the Department).

Bachelor of Engineering in Chemical Engineering (Environmental and Energy Engineering)

Candidates for this degree are required to complete all the core units in Table 2 (total 164 credit points). They are also required to complete CHNG 2502 and CHNG 3501, as well as gaining at least 12 credit points of suitable electives (as indicated by the Department).

Bachelor of Engineering in Chemical Engineering (Management)

Candidates for this degree are required to complete all the core units in Table 2 (total 164 credit points). They are also required to complete ENGG 2003 and ENGG 3002, as well as gaining at least 8 credit points from the following electives:

CHNG 4403	Engineering Business Skills	4			July
CHNG 4504	Environmental Decision Making	4			July
ENGG 4001	Innovation and International Competitiveness	4			February
ENGG 4002	New Business Creation	4			
MECH 4635	Introduction to Operations Research	4	P) MATH 2001 and MATH 2005. N) MECH 4605 Industrial Engineering.		February
MECH 4650	Workplace Industrial Relations	2	P) 36 credit points of senior units of study.		July

Combined Degree (Bachelor of Engineering in Chemical Engineering with either a Bachelor of Arts or Bachelor of Science)

Candidates in these combined degree options are required to complete all the core units of study in Table 2 except where specific exemptions are noted. They are also required to gain at least 4 credit points from the Fourth Year electives listed in the table of recommended elective units of study for BE(Chem) as shown later in this table. This total of 160 credit points is only sufficient to be awarded a Bachelor of Engineering in Chemical Engineering as part of these combined degree programs.

Combined Degree (Bachelor of Engineering in Chemical Engineering with a Bachelor of Commerce)

Candidates in this combined degree option are required to complete all the core units of study in Table 2 except where specific exemptions are noted. They are also required to gain at least 4 credit points from the Fourth Year electives listed in the table of recommended elective units of study for BE(Chem) as shown below. This total of 152 credit points is only sufficient to be awarded a Bachelor of Engineering in Chemical Engineering as part of this combined degree program.

Acceptable alternative units of study

Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent Advanced level unit of study subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing Advanced options should seek advice from their Department before enrolling.

BE (Chemical) recommended elective units of study

Second Year

AERO 2300	Mechanics of Solids 1	4	P) 12 credit points of first year Maths (i.e Maths 1001,1002,1003,1005).		February
ASNS 1001	Modern Asian History and Culture 1	6			February

Table 2: Chemical Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
ASNS 1002 Modern Asian History and Culture 2	6				July
CHNG 2302 Process Data Management	4				February
CHNG 2502 Clean Products and Processes	4	P) CHNG 2501.			July
CHNG 2701 Fundamentals of Bioprocess Engineering 1	4	P) CHEM 1101 CHEM 1201.			February
CHNG 2702 Fundamentals of Bioprocess Engineering 2	4	P) CHEM 1101 CHEM 1201.			July
ELEC 1001 Introductory Electrical Engineering	4	A) MATH1001 Differential Calculus. N) ELEC1102 Foundations of Electronic Circuits, and ELEC2002 Electrical Technology.			July
ENGG 2003 Introduction to Engineering Management	4	N) ELEC3701, MECH3620.			
Third Year					
ASNS 2001 Asian Studies 2A	4				
ASNS 2002 Asian Studies 2B	4				
CHNG 3303 Flowsheeting and Optimisation	4				July
CHNG 3501 Waste Management and Treatment Technologies	4	P) CHNG 2501, CHNG 2502.			July
ENGG 3002 Industrial and Engineering Management	4	P) ENGG2003. N) MECH4610.			
MICR 2007 Microbiology for Engineers A	4				
MICR 2008 Microbiology for Engineers B	4				
Fourth Year					
ASNS 3001 Asian Studies 3A	4				
ASNS 3002 Asian Studies 3B	4				
CHNG 4003 Advances in Chemical Engineering A	4				February
CHNG 4004 Advances in Chemical Engineering B	4				July
CHNG 4005 Laboratory Projects in Unit Operations	4	P) CHNG 3001 Chemical Engineering Laboratory.			July
CHNG 4006 Professional Option	2	P) Passed at least 144 credit points.			July
CHNG 4101 Separation Processes	4	P) Unit Operations (all four components).			July
CHNG 4102 Transport Phenomena	4				July
CHNG 4103 Advances in Polymer Engineering	4				July
CHNG 4104 Reaction Engineering 2	4	P) CHNG 3107 Reaction Engineering 1.			July
CHNG 4105 Thermodynamics of Natural Gas Engineering	4	P) CHNG3105 and CHNG3106.			February

Table 2: Chemical Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
CHNG 4203 Major Industrial Project	24	P) Passed at least 144 credit points. Students wishing to do this unit of study are required to discuss the matter with the Head of Department prior to enrolment.			February
CHNG 4301 Advanced Fluid Dynamics Modelling	4				July
CHNG 4302 Reservoir Engineering	4	P) CHNG 3103 Unit Operations (Particle Mechanics); CHNG 3104 Unit Operations (Fluid Mechanics).			February
CHNG 4303 Optimisation Techniques	4	N) CHNG 4305 Process Systems Engineering.			February
CHNG 4304 Process Control 2	4	P) CHNG 3302 Process Control 1.			February
CHNG 4305 Process Systems Engineering	4	N) CHNG 4303 Optimisation Techniques.			July
CHNG 4403 Engineering Business Skills	4				July
CHNG 4501 Biochemical Engineering	8	P) CHNG 2701 & CHNG 2702 Fundamentals of Bioprocess Engineering 1 & 2; MICR 2007 Microbiology for Engineers A; MICR 2008 Microbiology for Engineers B.			July
CHNG 4502 Advanced Topics in Environmental Engineering A	4	P) All four components of Unit Operations; CHNG 3106 Thermodynamics 2.			February
CHNG 4503 Advanced Topics in Environmental Engineering B	4	P) All four components of Unit Operations; CHNG 3106 Thermodynamics 2.			July
CHNG 4504 Environmental Decision Making	4				July
CHNG 4505 Bioremediation	4				February
CHNG 4601 Advanced Particle Mechanics	4	P) All four components of Unit Operations.			July
CHNG 4602 Mineral Processing (Extractive Metallurgy)	4	P) Unit Operations (all four components).			February
CHNG 4603 Mineral Processing (Mineral Dressing)	4	P) Unit Operations (all four components).			July
CHNG 4604 Chemical Modelling of Aqueous Systems	4	P) CHNG3101, CHNG3102, CHNG3103, CHNG3104 and CHNG 3106.			February
ENGG 4001 Innovation and International Competitiveness	4				February
ENGG 4002 New Business Creation	4				
IREL 1001 Macro Industrial Relations	6	NB: Entry to this unit is restricted by quota.			February

Note: Choice of electives as shown in the above table will depend upon subject availability, timetabling and prerequisite conditions. Choices and combinations of elective units of study are subject to approval by the Head of Department.

BE Chemical Engineering (Management) additional units of study

CHNG 4403 Engineering Business Skills	4				July
CHNG 4504 Environmental Decision Making	4				July
ENGG 3002 Industrial and Engineering Management	4	P) ENGG2003. N) MECH4610.			
ENGG 4001 Innovation and International Competitiveness	4				February
ENGG 4002 New Business Creation	4				

Table 2: Chemical Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
ENGG 2003 Introduction to Engineering Management	4	N) ELEC3701, MECH3620.			
MECH 4110 Professional Engineering	4	P) 36 credit points of Senior units of study.			<i>February</i>
MECH 4635 Introduction to Operations Research	4	P) MATH 2001 and MATH 2005. N) MECH 4605 Industrial Engineering.			<i>February</i>
MECH 4650 Workplace Industrial Relations	2	P) 36 credit points of senior units of study.			<i>July</i>

Note: ENGG2003 and ENGG3002 are compulsory units of study for the management stream. The remaining 8 credit points required come from the Table above. In the year 2000, there will only be entry into first year (ie, no advanced standing into the later years of this stream will be possible).

Table 3: Civil Engineering

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
First Year					
CHEM 1401 Chemistry 1E	6	P) Mathematics 2-unit course and a satisfactory knowledge of 2-unit Chemistry or the Chemistry component of the 3 or 4-unit Science HSC course. N) CHEM 1101, CHEM 1102.			February
CIVL 1001 Civil Engineering 1	4	P) Assumed standard of knowledge. Mathematics 3 unit course and a satisfactory knowledge of 2 unit Chemistry or the Chemistry component of the 3 or 4 unit Science HSC course and of the 2 unit Physics course or the Physics component of the 3 or 4 unit Science HSC course.			February
CIVL 1004 Computational Engineering	4	N) COMP 1001 Introductory Programming or COMP 1002 Introductory Computer Science.			July
CIVL 1051 Dynamics	5	A) Assumed standard of knowledge: Mathematics 3 unit course and Science 4 unit course (or the Physics core of 3-4 unit Science) at the HSC. C) MATH 1001, 1002, 1003, 1005. N)MECH1510.			July
CIVL 1052 Statics	5	A) Mathematics 3 unit course at the HSC. C) MATH 1001, 1002, 1003, 1005. N) MECH 1500 Mechanical Engineering 1, MECH 1501 Engineering Statics.			February
ELEC 1001 Introductory Electrical Engineering	4	A) MATH1001 Differential Calculus. N) ELEC1102 Foundations of Electronic Circuits, and ELEC2002 Electrical Technology.			July
GEOL 1501 Engineering Geology 1	6	N) GEOL 1002.			February
MATH 1001 Differential Calculus	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1901 or 1011.			February
MATH 1002 Linear Algebra	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1902 or 1012.			February
MATH 1003 Integral Calculus and Modelling	3	A) HSC 4-unit Mathematics or MATH 1001. N) May not be counted with MATH 1903 or 1013.			July
MATH 1005 Statistics	3	A) HSC 2-unit Mathematics. N) May not be counted with MATH 1905 or 1015.			July
Second Year					
CIVL 2004 Engineering Communications 1	2				February
CIVL 2101 Properties of Materials	4	P) CHEM 1401 Chemistry 1E.			February
CIVL 2201 Structural Mechanics	6	P) CIVL 1051 Dynamics and CIVL 1052 Statics.			February
CIVL 2203 Structural Design	4	P) CIVL 1051 Dynamics and CIVL 1052 Statics. C) CIVL 2201 Structural Mechanics.			July
CIVL 2409 Engineering Geology 2	4	P) Either GEOL 1002 or GEOL 1501 Engineering Geology.			July
CIVL 2610 Fluids 1	6	P) MATH 1001, MATH 1002, MATH 1003, MATH 1005.			February
CIVL 2801 Engineering Construction 1	4				July
MATH 2001 Vector Calculus and Complex Variables	4	P) MATH (1001 or 1901) and (1002 or 1902) and (1003 or 1903). N) May not be counted with MATH 2901.			February
MATH 2002 Matrix Applications	4	P) MATH 1002 or 1902 or Distinction in MATH 1012. N) May not be counted with MATH 2902.			February

Table 3: Civil Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
MATH 2005	Fourier Series and Differential Equations	4	P) MATH (1001 or 1901) and MATH (1002 or 1902) and MATH (1003 or 1903). N) May not be counted with MATH 2905.		July
MATH 2051	Linear Programming & Boundary Value Problems	2	C) MATH 2001 or 2901, and MATH 2002 or 2902. N) MATH 2953.		July
MATH 2052	Numerical Methods	2	C) MATH 2001 or 2901. N) MATH 2952.		July
Third Year					
CIVL 3005	Engineering Communications 2	2	P) CIVL 2004 Engineering Communications 1.		July
CIVL 3102	Materials Aspects in Design	4	P) CIVL 2101 Properties of Materials.		July
CIVL 3204	Structural Analysis	6	P) CIVL 2201 Structural Mechanics and MATH 2002 Matrix Applications plus MATH 2005 Fourier Series and Differential Equations.		February
CIVL 3206	Steel Structures 1	6	P) CIVL 2201 Structural Mechanics. C) CIVL 3102 Materials Aspects in Design, CIVL 3204 Structural Analysis.		July
CIVL 3207	Risk and Reliability Analysis	2	P) MATH 1001, MATH 1002, MATH 1003, MATH 1005, CIVL 2201 Structural Mechanics, CIVL 2203 Structural Design.		February
CIVL 3223	Concrete Structures - Behaviour	3	P) CIVL 2201 Structural Mechanics and CIVL 2203 Structural Design. N) CIVL 3205 Concrete Structures 1.		February
CIVL 3224	Concrete Structures - Design	3	P) CIVL 2201 Structural Mechanics and CIVL 2203 Structural Design. N) CIVL 3205 Concrete Structures 1.		July
CIVL 3401	Soil Mechanics A	4	P) CIVL 2201 Structural Mechanics.		February
CIVL 3402	Soil Mechanics B	4	P) CIVL 2201 Structural Mechanics. C) CIVL 3401 Soil Mechanics A.		July
CIVL 3501	Surveying 1	4	P) MATH 1001, MATH 1002, MATH 1003, MATH 1005.		February
CIVL 3602	Fluids 2	4	P) CIVL 2610 Fluids 1.		July
CIVL 3701	Transportation Engineering and Planning	2			July
CIVL 3802	Engineering Construction 2	4	A) Completion of CIVL 2801 Engineering Construction 1 or equivalent knowledge.		February
Fourth Year					
CIVL 4008	Practical Experience	0	P) 28 credit points of Senior courses.		February
CIVL 4014	Thesis/Design/Project	5	P) 40 credit points of Senior Subjects. N) CIVL 4013 Honours Thesis/Design/Project or CIVL4015.		Full Year (starts Feb)
CIVL 4016	Professional Practice	5			July
CIVL 4803	Engineering Management	4	N) CIVL 3803 Project Appraisal.		February
CIVL 4903	Civil Engineering Design	6	P) CIVL 3223 Concrete Structures - Behaviour, CIVL 3224 Concrete Structures - Design, CIVL 3206 Steel Structures 1.		February

Note

1. For core units of study offered by other than the Faculty of Engineering, any assumed knowledge, prerequisite and corequisite; requirements will be: as prescribed by the Faculty.

Table 3: Civil Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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Resolutions of the Faculty of Engineering relating to Table 3

Degree Eligibility

Candidates for the degree of Bachelor of Engineering in Civil Engineering are expected to complete all the core units for the study in Table 3 (160 credit points). They are also required to gain at least 32 credit points from the elective units of study listed under 'Resolutions of the Department of Civil Engineering'. Of the 32 elective units of study, at least 20 of these must be from Fourth Year level units of study.

Candidates commencing one of the combined degree options from 1999 onwards (that is, Bachelor of Engineering in Civil Engineering with either a Bachelor of Arts, Bachelor of Science or Bachelor of Commerce) are required to complete all of the core units of study in Table 3 (160 credit points), except for Bachelor of Commerce where ELEC 1001, CIVL 3207 and CIVL 3005 are not required, therefore only 152 credit points are needed. This total of 160 credit points (or 152 credit points for Bachelor of Commerce) is only sufficient to be awarded a Bachelor of Engineering in Civil Engineering as part of an approved combined degree program. The remaining credit points for the combined degree will be taken in the appropriate Faculty (Arts, Science or Economics and Business) and candidates should refer to the Joint Resolutions of the Faculty of Engineering and the relevant Faculty requirements.

Note: Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent Advanced level unit of study subject to prerequisite conditions (as required by the Faculty of Science) being met.

Students considering doing Advanced options should seek advice from their Department before enrolling.

Acceptable alternative units of study

Pursuant to Resolution 3, the Faculty has prescribed the following acceptable alternatives to core units of study listed in Table 3:

		Acceptable alternative
CHEM 1401	Chemistry 1E	CHEM 1101 and CHEM 1102
CIVL 1004	Computational Engineering	COMP 1001 and COMP 1002 or MECH 1800 or MECH 1810 or MECH 1801
CIVL 1051	Dynamics	MECH 1500 or MECH 1501
CIVL 1052	Statics	MECH 1500 or MECH 1501
CIVL 2409	Engineering Geology 2	GEOL 2001 and GEOL 2002 and GEOL 2003
CIVL 4014	Thesis/Design/Project	CIVL 4013
CIVL 4014	Thesis/Design/Project	CIVL 4015 (with written approval from Head of Civil Engineering)
ELEC 1001	Introductory Electrical Engineering	PHYS 1001 and PHYS 1003 or ELEC 2002
GEOL 1501	Engineering Geology 1	GEOL 1001 and GEOL 1002
MATH 2001	Vector Calculus and Complex Variables	STAT 2002 (For BE/BCom degrees only)
MATH 2005	Fourier Series and Differential Equations	STAT 2004 (For BE/BCom degrees only)

BE (Civil) recommended elective units of study

First Year

COMP 1901	Introductory Programming	6	A) HSC 3-unit Mathematics. C) Students intending to major in Computer Science are advised to enrol in MATH 1003 and 1004 or 1004 and 1005 or 1903 and 1904 or 1904 and 1905 in their first year. N) May not be counted with COMP 1901.	February, July
COMP 1902	Introductory Computer Science	6	P) COMP 1001 or 1901. N) May not be counted with COMP 1902.	February, July
GEOL 1001	Earth and Its Environment	6	A) No previous knowledge of Geology assumed. P) See prerequisites for Intermediate Geology.	February
GEOL 1002	Earth Processes and Resources	6	A) No previous knowledge of Geology assumed.	July

Second Year

ARPH 1001	Introduction to Archaeology	6		
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Table 3: Civil Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
ARPH 1002	Introduction to Australian Archaeology	6			July
ASNS 1001	Modern Asian History and Culture 1	6			February
ASNS 1002	Modern Asian History and Culture 2	6			July
DESC 6001	Computer-Based Design	3		NB: Not available every year.	July
DESC 6002	Understanding Design	3		NB: Not available every year.	February
DESC 9030	Database Management Systems for Design	3			
DESC 9100	Introduction to ArchiCAD	3			February, July
DESC 9101	Introduction to AutoCAD	3			February, July
INFO 1000	Information Technology Tools	6			February, July
Fourth Year					
ARCH 6009	The Building Industry in Australia	3			
CHNG 4504	Environmental Decision Making	4			July
CIVL 3804	Contracts Formulation & Management	5			July
CIVL 3805	Project Scope, Time & Cost Management	6			February
CIVL 4105	Advanced Materials	5		P) CIVL 3102 Materials Aspects in Design.	July
CIVL 4218	Concrete Structures 2	5		P) CIVL 3223 Concrete Structures - Behaviour, CIVL 3224 Concrete Structures - Design.	July
CIVL 4219	Structural Dynamics	5		P) CIVL 3204 Structural Analysis.	February
CIVL 4220	Steel Structures 2	5		P) CIVL 3206 Steel Structures 1.	July
CIVL 4221	Bridge Engineering	5		P) CIVL 3223 Concrete Structures - Behaviour, CIVL 3224 Concrete Structures - Design and CIVL 3206 Steel Structures 1.	February
CIVL 4222	Finite Element Methods	5		P) CIVL 3204 Structural Analysis.	February
CIVL 4406	Environmental Geotechnics	5		P) CIVL 3401 Soil Mechanics A, CIVL 3402 Soil Mechanics B.	July
CIVL 4407	Geotechnical Engineering	5		P) CIVL 3401 Soil Mechanics A, CIVL 3402 Soil Mechanics B.	February
CIVL 4504	Surveying 2	5		P) CIVL 3501 Surveying 1. NB: Not offered in 2000.	
CIVL 4607	Environmental Fluids 1	5			February
CIVL 4608	Environmental Fluids 2	5		A) Material covered in Environmental Fluids 1.	July
CIVL 4609	Water Resources Engineering	5			July
CIVL 4807	Project Formulation	5		A) Completion of CIVL 3803 Project Appraisal or equivalent knowledge.	July

Table 3: Civil Engineering - continued

Unit of study	Credit points;	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
CIVL 4808	Project Management & Information Technology	4	A) Sufficient knowledge of information technology systems & communications capabilities.		February
CIVL 4809	Project Planning & Tendering	4	A) Completion of Engineering Construction 1 & 2 or the equivalent knowledge.		July
CIVL 4810	Project Quality, Risk & Procurement Management	6			July
GEOL 2004	Environmental Geology: Hazards	4	P) 24 credit points of Science units of study. See prerequisites for Senior Geology.		February
GEOL 2005	Environmental Geology: Resources	4	P) 24 credit points of Science units of study. See prerequisites for Senior Geology.		July
IREL 1001	Macro Industrial Relations	6	NB: Entry to this unit is restricted by quota.		February
MECH 4220	Environmental Engineering	6	P) 24 credit points of third year units of study. N) MECH4240 Energy and the Environment and MECH 4230 Environmental Acoustics and Noise Control.		February

Notes

- Choice of electives as shown in the above table will depend upon subject availability, timetabling and prerequisite conditions.
- For the BE degree (Civil), students must take at least 20 elective units of study at Fourth Year level, however, two 4 credit points of study may be replaced by at least 8 credit points available elsewhere in the Faculty of Engineering and subject to the approval of the Head of Civil Engineering.
- Honours candidates replace the core unit of study CIVL 4014 Thesis by CIVL 4013 Thesis Honours.
- CIVL 4014 may be replaced with CIVL 4015 with written approval from the Head of Civil Engineering.
- Recommended elective streams are:
Construction Engineering and Management Stream: CIVL 4807, IREL 1001, CIVL 3804, CIVL 4806, CIVL 4808, CIVL 4809, CIVL 3805.
Structural Engineering Stream: CIVL 4221, CIVL 4222, CIVL 4218, CIVL 4219, CIVL 4220.
Environmental Stream: CIVL 4406, CIVL 4607, CIVL 4608, CIVL 4609, CHNG 4504, (MECH 4220).
Geotechnical Engineering Stream: CIVL 4222, CIVL 4406, CIVL 4407, GEOL 2004, GEOL 2005.

Table 4: Computer Engineering

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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Candidates for the degree of Bachelor of Engineering in Computer Engineering, and candidates for the combined degree courses of Bachelor of Engineering in Computer Engineering with Bachelor of Arts or Bachelor of Science or Bachelor of Commerce, are required to gain credit for the core units of study set out below. Any additional credit necessary to satisfy Section 9 shall be gained by completing additional elective units of study as prescribed by the Faculty.

Computer Engineering core units of study First Year

COMP 1001	Introductory Programming	6	A) HSC 3-unit Mathematics. C) Students intending to major in Computer Science are advised to enrol in MATH 1003 and 1004 or 1004 and 1005 or 1903 and 1904 or 1904 and 1905 in their first year. N) May not be counted with COMP 1901.		February, July
COMP 1002	Introductory Computer Science	6	P) COMP 1001 or 1901. N) May not be counted with COMP 1902.		February, July
ELEC 1101	Foundations of Computer Systems	6	A) HSC Maths 3 unit.		February
ELEC 1102	Foundations of Electronic Circuits	6	A) HSC Physics 2 unit and MATH1001 Differential Calculus. N) ELEC 1001 Introductory Electrical Engineering, and ELEC2002 Electrical Technology.		July
MATH 1001	Differential Calculus	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1901 or 1011.		February
MATH 1002	Linear Algebra	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1902 or 1012.		February
MATH 1003	Integral Calculus and Modelling	3	A) HSC 4-unit Mathematics or MATH 1001. N) May not be counted with MATH 1903 or 1013.		July
MATH 1004	Discrete Mathematics	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1904.		July
PHYS 1001	Physics (Regular)	6	A) HSC Physics or HSC 4-unit Science. C) Recommended concurrent units of study: MATH 1001 and 1002 or 1901 and 1902. N) May not be counted with PHYS 1002 or 1901.		February
PHYS 1003(2)	Physics (Technological)	6	A) HSC 2-unit Physics or HSC 4-unit Science or PHYS 1001 or 1002 or 1901 or equivalent. C) Recommended concurrent units: MATH 1003 and 1005 or 1903 and 1905. N) May not be counted with PHYS 1004 or 1902.		February, July

Second Year

COMP 2002	Design and Data Structures	4	Q) COMP 1002 or 1902. N) May not be counted with COMP 1902. NB: See prerequisites for Senior Computer Science units of study. Consult Departmental Handbook.		February
COMP 2003	Languages and Logic	4	Q) COMP 1002 or 1902. P) MATH 1004 or 1904 or Econometrics or MATH 2009. N) May not be counted with COMP 1903. NB: See prerequisites for Senior Computer Science units of study. Consult Departmental Handbook.		July
COMP 2004	Programming Practice	4	Q) COMP 1002 or 1902. N) May not be counted with COMP 1904. NB: See prerequisites for Senior Computer Science units of study. Consult Departmental Handbook.		July
ELEC 2101	Circuit Analysis	4	A) ELEC 1102 Foundations of Electronic Circuits. N) ELEC2001 Electrical and Electronic Engineering, and ELEC2002 Electrical Technology, and ELEC2003 Electrical and Electronic Engineering A.		February
ELEC 2301	Signals and Systems	4	A) MATH1001 Differential Calculus, and MATH1002 Linear Algebra, and MATH1003 Integral Calculus and Modelling, and MATH1004 Discrete Mathematics. N) MATH3103 Signal Processing and MATH3809 Signal Processing (Adv).		July

Table 4: Computer Engineering -Icontinued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
ELEC 2401 Electronic Devices and Circuits	4	A) ELEC1 102 Foundations of Electronic Circuits. N) ELEC2001 Electrical and Electronic Engineering, and ELEC2002 Electrical Technology, and ELEC2003 Electrical and Electronic Engineering A.			July
ELEC 2601 Microcomputer Systems	4	A) ELEC 1101 Foundations of Computer Systems. N) ELEC2001 Electrical and Electronic Engineering.			February
MATH 2001 Vector Calculus and Complex Variables	4	P) MATH (1001 or 1901) and (1002 or 1902) and (1003 or 1903). N) May not be counted with MATH 2901.			February
MATH 2002 Matrix Applications	4	P) MATH 1002 or 1902 or Distinction in MATH 1012. N) May not be counted with MATH 2902.			February
MATH 2005 Fourier Series and Differential Equations	4	P) MATH (1001 or 1901) and MATH (1002 or 1902) and MATH (1003 or 1903). N) May not be counted with MATH 2905.			July
PHYS 2203 Physics 2EE	4				July
Third Year					
COMP 3007(3) Networked Systems	4	Q) COMP 2004 or 2904. P) COMP 2001 or 2901 or ELEC 2601. N) May not be counted with COMP 3907.			February
COMP 3009(3) Operating Systems	4	Q) COMP 2004 or 2904. P) COMP 2001 or 2901 or ELEC 2601. N) May not be counted with COMP 3909.			February
COMP 3100(3) Software Engineering	4	P) COMP 2004 or 2904. N) May not be counted with COMP 3800. <i>NB: Change to semester availability subject to Faculty approval.</i>			July
ELEC 3302 Fundamentals of Feedback Control	4	A) ELEC 2301 Signals and Systems. N) MECH3800 Systems Control and CHNG3302 Process Control.			February
ELEC 3401 Electronic Devices and Circuits	4	A) ELEC2401 Introductory Electronics, and ELEC2101 Circuit Analysis.			February
ELEC 3403 Switching Devices and High Speed Electronics	4	A) ELEC 3401 Electronic Devices and Circuits.			July
ELEC 3502 Random Signals and Communications	4	A) ELEC2301 Signals and Systems.			February
ELEC 3503 Introduction to Digital Communications	4	A) ELEC2301 Signals and Systems.			July
ELEC 3601 Digital Systems Design	4	A) ELEC2601 Microcomputer Systems or COMP2001 Computer Systems.			July
Fourth Year					
ELEC 4303 Digital Signal Processing	4	A) ELEC2301 Signals and Systems.			February
ELEC 4601 Computer Design	4	A) ELEC3403 Switching Devices and High Speed Electronics, and ELEC3601 Digital Systems Design.			February
ELEC 4602 Real Time Computing	4	A) ELEC3601 Digital Systems Design, and COMP3100 Software Engineering.			February
ELEC 4702 Practical Experience	0				February
ELEC 4703 Thesis	12	P) A minimum of 3 6 credit points from third or fourth year units of study.			July

Notes

- For core units of study offered by other than the Faculty of Engineering, any assumed knowledge, prerequisite and corequisite requirements will be as prescribed by that Faculty.
- PHYS1203 Physics 1EE is an acceptable alternative to PHYS1003 Physics (Technological).
- Students who have completed one or more of these units of study toward the Bachelor of Science degree shall, in their place, complete an equivalent number of credit points from units of study in the table below of recommended elective units of study for BE (Computer Engineering) or such other units of study as are approved by the Head of School.

Table 4: Computer Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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Resolutions of the Faculty of Engineering relating to Table 4

BE (Computer Engineering)

In addition to gaining credit for the 152 credit points of core units of study set out in Table 4, candidates are required to complete at least 20 credit points of units of study from the table of recommended elective units of study for BE (Computer Engineering). Further credit for a total of not less than 192 credit points shall be gained by completing additional elective units of study approved by the Faculty.

BE (Computer Engineering)/BSc or BA

In addition to gaining credit for the 152 credit points of core units of study set out in Table 4, candidates must complete at least 8 credit points of units of study from the table of recommended elective units of study for BE (Computer Engineering).

Candidates for combined degrees should refer to the Joint Resolutions of the Faculty of Engineering and the faculty in which they are undertaking the combined degree program.

BE (Computer Engineering)/BCom

In addition to gaining credit for the 152 credit points of core units of study set out in Table 4, candidates must complete at least 8 credit points of units of study from the table of recommended elective units of study for BE (Computer Engineering).

Candidates are also required to complete at least 100 credit points of units of study in the Faculty of Economics and Business (listed in Table A for the Bachelor of Commerce degree). The Computer Science units of study in Table 4 may be counted, to a maximum of 20 credit points, in the 100 credit points. They may also be used to satisfy the requirement for a minor (or second major) for the Bachelor of Commerce. No other units of study in Table 4 or the table of recommended electives may be counted in the 100 credit points or used to satisfy a minor or major.

Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the Faculty of Economics and Business for additional information.

Alternative units of study

Most Mathematics, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent Advanced level unit of study subject to prerequisite conditions (as required by the Faculty of Science) being met.

BE (Computer Engineering) recommended elective units of study

ELEC 4301	Computer Control System Design	4	A) ELEC 3302 Fundamentals of Feedback Control.	<i>February</i>
ELEC 4401	Electronic Design	4	A) ELEC2301 Signals and Systems, and ELEC3302 Fundamentals of Feedback Control and ELEC3401 Electronic Devices and Circuits.	<i>February</i>
ELEC 4402	Integrated Circuit Design	4	A) ELEC3403 Switching Devices and High Speed Electronics, and ELEC3601 Digital Systems Design.	<i>February</i>
ELEC 4502	Digital Communication Systems	4	A) ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.	<i>February</i>
ELEC 5601	Advanced Real Time Computing	4	A) ELEC4602 Real Time Computing.	<i>July</i>
ELEC 5602	Advanced Computer Architecture	4	A) ELEC4601 Computer Design and (COMP2001 Computer Systems or COMP2901 Computer Systems Adv).	<i>July</i>
ELEC 5605	Advanced Digital Engineering	4	A) ELEC4601 Computer Design.	<i>July</i>
ELEC 5606	Multimedia Systems and Applications	4	A) COMP3100 Software Engineering, ELEC 4303 Digital Signal Processing, and ELEC 4501 Data Communication Systems.	<i>July</i>
ELEC 5607	Hardware/Software Co-design	4	A) ELEC3601 Digital Systems Design and COMP3100 Software Engineering.	<i>July</i>
ELEC 5608	Electronic Commerce	4	A) ELEC3701 Management for Engineers and ELEC4501 Data Communication Networks.	<i>July</i>
ELEC 5609	Internet Engineering	4	A) ELEC4501 Data Communication Networks.	<i>July</i>
ELEC 5610	Computer and Network Security	4	A) ELEC4601 Computer Design and ELEC4501 Data Communication Networks.	<i>July</i>

Note

The units of study in this table may not all be available in a particular year.

Table 5: Electrical Engineering

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
Candidates for the degree of Bachelor of Engineering in Electrical Engineering, and candidates for the combined degree courses of Bachelor of Engineering in Electrical Engineering with Bachelor of Arts or Bachelor of Science or Bachelor of Commerce, are required to gain credit for the core units of study set out below. Any additional credit necessary to satisfy Section 9 shall be gained by completing additional elective units of study, as prescribed by the Faculty.					
Electrical Engineering core units of study					
First Year					
COMP 1001 Introductory Programming	6	A) HSC 3-unit Mathematics. C) Students intending to major in Computer Science are advised to enrol in MATH 1003 and 1004 or 1004 and 1005 or 1903 and 1904 or 1904 and 1905 in their first year. N) May not be counted with COMP 1901.			February, July
COMP 1002 Introductory Computer Science	6	P) COMP 1001 or 1901. N) May not be counted with COMP 1902.			February, July
ELEC 1101 Foundations of Computer Systems	6	A) HSC Maths 3 unit.			February
ELEC 1102 Foundations of Electronic Circuits	6	A) HSC Physics 2 unit and MATH1001 Differential Calculus. N) ELEC 1001 Introductory Electrical Engineering, and ELEC2002 Electrical Technology.			July
MATH 1001 Differential Calculus	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1901 or 1011.			February
MATH 1002 Linear Algebra	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1902 or 1012.			February
MATH 1003 Integral Calculus and Modelling	3	A) HSC 4-unit Mathematics or MATH 1001. N) May not be counted with MATH 1903 or 1013.			July
MATH 1004 Discrete Mathematics	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1904.			July
PHYS 1001 Physics (Regular)	6	A) HSC Physics or HSC 4-unit Science. C) Recommended concurrent units of study: MATH 1001 and 1002 or 1901 and 1902. N) May not be counted with PHYS 1002 or 1901.			February
PHYS 1003(*) Physics (Technological)	6	A) HSC 2-unit Physics or HSC 4-unit Science or PHYS 1001 or 1002 or 1901 or equivalent. C) Recommended concurrent units: MATH 1003 and 1005 or 1903 and 1905. N) May not be counted with PHYS 1004 or 1902.			February, July
Second Year					
COMP 2002 Design and Data Structures	4	Q) COMP 1002 or 1902. N) May not be counted with COMP 2902. NB: See prerequisites for Senior Computer Science units of study. Consult Departmental Handbook.			February
COMP 2004 Programming Practice	4	Q) COMP 1002 or 1902. N) May not be counted with COMP 2904. NB: See prerequisites for Senior Computer Science units of study. Consult Departmental Handbook.			July
ELEC 2101 Circuit Analysis	4	A) ELEC1102 Foundations of Electronic Circuits. N) ELEC2001 Electrical and Electronic Engineering, and ELEC2002 Electrical Technology, and ELEC2003 Electrical and Electronic Engineering A.			February
ELEC 2301 Signals and Systems	4	A) MATH1001 Differential Calculus, and MATH1002 Linear Algebra, and MATH1003 Integral Calculus and Modelling, and MATH1004 Discrete Mathematics. N) MATH3103 Signal Processing and MATH3809 Signal Processing (Adv).			July
ELEC 2401 Electronic Devices and Circuits	4	A) ELEC1102 Foundations of Electronic Circuits. N) ELEC2001 Electrical and Electronic Engineering, and ELEC2002 Electrical Technology, and ELEC2003 Electrical and Electronic Engineering A.			July

Table 5: Electrical Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
ELEC 2601 Microcomputer Systems	4	A) ELEC 1101 Foundations of Computer Systems. N) ELEC2001 Electrical and Electronic Engineering.			February
MATH 2001 Vector Calculus and Complex Variables	4		P) MATH (1001 or 1901) and (1002 or 1902) and (1003 or 1903). N) May not be counted with MATH 2901.		February
MATH 2002 Matrix Applications	4		P) MATH 1002 or 1902 or Distinction in MATH 1012. N) May not be counted with MATH 2902.		February
MATH 2005 Fourier Series and Differential Equations	4		P) MATH (1001 or 1901) and MATH (1002 or 1902) and MATH (1003 or 1903). N) May not be counted with MATH 2905.		July
PHYS 2203 Physics 2EE	4				July
Third Year					
ELEC 3102 Engineering Electromagnetics	4	A) PHYS 2203 Physics 2EE and ELEC 2101 Circuit Analysis.			February
ELEC 3201 Fundamentals of Electrical Energy Systems	4	A) ELEC2101 Circuit Analysis.			February
ELEC 3302 Fundamentals of Feedback Control	4	A) ELEC 2301 Signals and Systems. N) MECH3800 Systems Control and CHNG3302 Process Control.			February
ELEC 3401 Electronic Devices and Circuits	4	A) ELEC2401 Introductory Electronics, and ELEC2101 Circuit Analysis.			February
ELEC 3502 Random Signals and Communications	4	A) ELEC2301 Signals and Systems.			February
ELEC 3503 Introduction to Digital Communications	4	A) ELEC2301 Signals and Systems.			July
ELEC 3601 Digital Systems Design	4	A) ELEC2601 Microcomputer Systems or COMP2001 Computer Systems.			July
Fourth Year					
ELEC 4702 Practical Experience	0				February
ELEC 4703 Thesis	12	P) A minimum of 36 credit points from third or fourth year units of study.			July

Notes

For units of study offered by a Faculty other than the Faculty of Engineering, any assumed knowledge, prerequisites and corequisites, will be as prescribed by that Faculty.

(*) PHYS 1203 Physics 1EE is an acceptable alternative to PHYS 1003 (Technological).

Resolutions of the Faculty of Engineering relating to Table 5**BE (Electrical Engineering)**

In addition to gaining credit for the 128 credit points of core units of study set out in Table 5, candidates are required to complete at least 44 credit points of units of study (at least 32 of which must be at the 4 or 5 level) from the table of recommended elective units of study for BE (Electrical Engineering). Further credit for a total of not less than 192 credit points shall be gained by completing additional elective units of study approved by the Faculty.

BE (Electrical Engineering - Management)

In addition to gaining credit for the 128 credit points of core units of study set out in Table 5, candidates are required to complete at least 40 credit points of units of study (at least 28 of which must be at the 4 or 5 level) from the table of recommended elective units of study for BE (Electrical Engineering) excluding ELEC 3701 Management for Engineers and ELEC 4701 Project Management. Further credit of 24 credit points shall be gained by completing the units of study listed in the table of additional units of study for BE (Electrical Engineering - Management).

BE (Electrical Engineering)/BSc or BA

In addition to gaining credit for the 128 credit points of core units of study set out in Table 5, candidates are required to complete at least 32 credit points of units of study (at least 24 of which must be at the 4 or 5 level) from the table of recommended elective units of study for BE (Electrical Engineering).

Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the faculty in which they are undertaking the combined degree program.

Table 5: Electrical Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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BE (Electrical Engineering)/BCom

In addition to gaining credit for the 128 credit points of core units of study set out in Table 5, candidates are required to complete at least 32 credit points of units of study (at least 24 of which must be at the 4 or 5 level) from the table of recommended elective units of study for BE (Electrical Engineering).

Candidates are also required to complete at least 100 credit points of units of study in the Faculty of Economics and Business (listed in Table A for the Bachelor of Commerce degree). The 20 credit points of Computer Science units of study in Table 5 may be counted in the 100 credit points and may be used to satisfy the requirement for a minor (or second major) for the Bachelor of Commerce. No other units of study in Table 5 or the table of recommended electives may be counted in the 100 credit points or used to satisfy a minor or major. Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the Faculty of Economics and Business for additional information.

BE (Electrical Engineering)/BCom and admitted to first year prior to 1998

Candidates who commenced first year prior to 1998, in addition to satisfying the remaining core requirements set out in Table 5, are required to gain credit for at least 24 credit points of units of study (at least 8 of which must be at the 4 or 5 level) from the table of recommended elective units of study for BE (Electrical Engineering). Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the Faculty in which they are undertaking the combined degree program.

Acceptable alternative units of study

Most Mathematics, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent Advanced level unit of study subject to prerequisite conditions (as required by the Faculty of Science) being met.

BE (Electrical Engineering) recommended elective units of study**Third Year**

COMP 3100	Software Engineering	4	P) COMP 2004 or 2904. N) May not be counted with COMP 3800. <i>NB: Change to semester availability subject to Faculty approval.</i>		July
ELEC 3101	Circuit Theory and Design	4	A) ELEC2101 Circuit Analysis, MATH2005 Fourier Series and Differential Equations.		July
ELEC 3103	Electrical Engineering Design	4	A) ELEC2101 Circuit Analysis, and ELEC2401 Introductory Electronics, and ELEC 2301 Signals and Signals, and ELEC2601 Microcomputer Systems.		July
ELEC 3202	Power Electronics and Drives	4	A) ELEC2101 Circuit Analysis, and ELEC2401 Introductory Electronics.		July
ELEC 3402	Communications Electronics	4	A) ELEC3401 Electronic Devices and Circuits.		July
ELEC 3403	Switching Devices and High Speed Electronics	4	A) ELEC 3401 Electronic Devices and Circuits.		July
ELEC 3701	Management for Engineers	4			February
ELEC 3801	Fundamentals of Biomedical Engineering	4	A) ELEC2401 Introductory Electronics or ELEC2001 Electrical and Electronic Engineering or ELEC2003 Electrical and Electronic Engineering A.		February

Fourth Year

ELEC 4201	Electrical Systems Modelling and Analysis	4	A) ELEC 3201 Fundamentals of Electrical Energy Systems.		February
ELEC 4301	Computer Control System Design	4	A) ELEC 3302 Fundamentals of Feedback Control.		February
ELEC 4302	Image Processing and Computer Vision	4	A) ELEC2301 Signals and Systems, and ELEC4303 Digital Signal Processing.		July
ELEC 4303	Digital Signal Processing	4	A) ELEC2301 Signals and Systems.		February
ELEC 4401	Electronic Design	4	A) ELEC2301 Signals and Systems, and ELEC3302 Fundamentals of Feedback Control and ELEC3401 Electronic Devices and Circuits.		February
ELEC 4402	Integrated Circuit Design	4	A) ELEC3403 Switching Devices and High Speed Electronics, and ELEC3601 Digital Systems Design.		February
ELEC 4501	Data Communication Networks	4	A) ELEC 3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.		February
ELEC 4502	Digital Communication Systems	4	A) ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.		February

Table 5: Electrical Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
ELEC 4503 Error Control Coding	4	A) ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			<i>February</i>
ELEC 4601 Computer Design	4	A) ELEC3403 Switching Devices and High Speed Electronics, and ELEC3601 Digital Systems Design.			<i>February</i>
ELEC 4602 Real Time Computing	4	A) ELEC3601 Digital Systems Design, and COMP3100 Software Engineering.			<i>February</i>
ELEC 4701 Project Management	4	A) ELEC3701 Management for Engineers.			<i>July</i>
ELEC 4801 Biomedical Engineering Systems	4	A) ELEC3801 Fundamentals of Biomedical Engineering.			<i>July</i>
ELEC 5201 Electrical Systems Control	4	A) ELEC3302 Fundamentals of Feedback Control, and ELEC4201 Electrical Systems Modelling and Analysis.			<i>July</i>
ELEC 5202 Advanced Power Electronics and Drives	4	A) ELEC3202 Power Electronics and Drives.			<i>July</i>
ELEC 5301 Non-linear and Adaptive Control	4	A) ELEC3302 Fundamentals of Feedback Control, and ELEC4301 Computer Control System Design.			<i>July</i>
ELEC 5302 Fuzzy Systems	4				<i>July</i>
ELEC 5501 Advanced Communication Networks	4	A) ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications, and ELEC4501 Data Communication Networks.			<i>July</i>
ELEC 5502 Satellite Communication Systems	4	A) ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications, and ELEC4502 Digital Communication Systems.			<i>July</i>
ELEC 5503 Optical Communication Systems	4	A) ELEC3402 Communications Electronics, and ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			<i>July</i>
ELEC 5504 Cellular Radio Engineering	4	A) ELEC 3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			<i>July</i>
ELEC 5505 Spread Spectrum CDMA for Mobile Communications	4	A) ELEC 3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			<i>February</i>
ELEC 5601 Advanced Real Time Computing	4	A) ELEC4602 Real Time Computing.			<i>July</i>
ELEC 5602 Advanced Computer Architecture	4	A) ELEC4601 Computer Design and (COMP2001 Computer Systems or COMP2901 Computer Systems Adv).			<i>July</i>
ELEC 5603 Biologically Inspired Signal Processing	4				<i>July</i>
ELEC 5604 Adaptive Pattern Recognition	4				<i>July</i>
ELEC 5605 Advanced Digital Engineering	4	A)ELEC4601 Computer Design.			<i>July</i>
ELEC 5606 Multimedia Systems and Applications	4	A) COMP3100 Software Engineering, ELEC 4303 Digital Signal Processing, and ELEC 4501 Data Communication Systems.			<i>July</i>
ELEC 5607 Hardware/Software Co-design	4	A) ELEC3601 Digital Systems Design and COMP3100 Software Engineering.			<i>July</i>
ELEC 5608 Electronic Commerce	4	A) ELEC3701 Management for Engineers and ELEC4501 Data Communication Networks.			<i>July</i>
ELEC 5609 Internet Engineering	4	A) ELEC4501 Data Communication Networks.			<i>July</i>
ELEC 5610 Computer and Network Security	4	A) ELEC4601 Computer Design and ELEC4501 Data Communication Networks.			<i>July</i>

Notes

For units of study offered by a Faculty other than the Faculty of Engineering, any assumed knowledge, prerequisites and corequisites, will be as prescribed by that Faculty.

The units of study in this table may not all be available in a particular year.

Table 5: Electrical Engineering - continued

Unit of study	Credit points:	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
BE (Electrical Engineering - Management) additional units of study					
CHNG 3401	Project Economics	4			February
CHNG 4401(†)	Project Engineering	4			February
CHNG 4403	Engineering Business Skills	4			July
CHNG 4504	Environmental Decision Making	4			July
ELEC 4701(†)	Project Management	4		A) ELEC3701 Management for Engineers.	July
ENGG 2003	Introduction to Engineering Management	4		N) ELEC3701, MECH3620.	
ENGG 3002	Industrial and Engineering Management	4		P) ENGG2003. N) MECH4610.	
ENGG 4001	Innovation and International Competitiveness	4			February
ENGG 4002	New Business Creation	4			
MECH 4110m	Professional Engineering	4		P) 36 credit points of Senior units of study.	February
MECH 4635	Introduction to Operations Research	4		P) MATH 2001 and MATH 2005. N) MECH 4605 Industrial Engineering.	February
MECH 4650	Workplace Industrial Relations	2		P) 36 credit points of senior units of study.	July

Note

The required total of 24 credit points shall comprise ENGG 2003, ENGG 3002 and 16 credit points from the remaining units of study in the Table above. In the year 2000, there will only be entry into first year (ie, no advanced standing into the later years of this stream will be possible).

(†) Only one of CHNG 4401, ELEC 4701 and MECH 4110 may be counted in the 16 credit points from remaining units of study.

Table 5A: Electrical Engineering (Information Systems)

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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This degree stream is available only to students enrolled prior to 1998.

Candidates for the degree of Bachelor of Engineering in Electrical Engineering (Information Systems) are required to gain credit for the core units of study set out below. Any additional credit necessary to satisfy Section 9 shall be gained by completing additional elective units of study as prescribed by the Faculty.

Electrical Engineering (Information Systems) core units of study

First Year

COMP	Introductory Programming	6	A) HSC 3-unit Mathematics. C) Students intending to major in Computer Science are advised to enrol in MATH 1003 and 1004 or 1004 and 1005 or 1903 and 1904 or 1904 and 1905 in their first year. N) May not be counted with COMP 1901.		February, July
COMP 1002	Introductory Computer Science	6	P) COMP 1001 or 1901. N) May not be counted with COMP 1902.		February, July
ELEC 1101	Foundations of Computer Systems	6	A) HSC Maths 3 unit.		February
ELEC 1102	Foundations of Electronic Circuits	6	A) HSC Physics 2 unit and MATH1001 Differential Calculus. N) ELEC1001 Introductory Electrical Engineering, and ELEC2002 Electrical Technology.		July
MATH 1001	Differential Calculus	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1901 or 1011.		February
MATH 1002	Linear Algebra	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1902 or 1012.		February
MATH 1003	Integral Calculus and Modelling	3	A) HSC 4-unit Mathematics or MATH 1001. N) May not be counted with MATH 1903 or 1013.		July
MATH 1004	Discrete Mathematics	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1904.		July
PHYS 1001	Physics (Regular)	6	A) HSC Physics or HSC 4-unit Science. C) Recommended concurrent units of study: MATH 1001 and 1002 or 1901 and 1902. N) May not be counted with PHYS 1002 or 1901.		February
PHYS 1003(*)	Physics (Technological)	6	A) HSC 2-unit Physics or HSC 4-unit Science or PHYS 1001 or 1002 or 1901 or equivalent. C) Recommended concurrent units: MATH 1003 and 1005 or 1903 and 1905. N) May not be counted with PHYS 1004 or 1902.		February, July

Second Year

COMP 2002	Design and Data Structures	4	Q) COMP 1002 or 1902. N) May not be counted with COMP 2902. NB: See prerequisites for Senior Computer Science units of study. Consult Departmental Handbook.		February
COMP 2004	Programming Practice	4	Q) COMP 1002 or 1902. N) May not be counted with COMP 2904. NB: See prerequisites for Senior Computer Science units of study. Consult Departmental Handbook.		July
ELEC 2101	Circuit Analysis	4	A) ELEC1102 Foundations of Electronic Circuits. N) ELEC2001 Electrical and Electronic Engineering, and ELEC2002 Electrical Technology, and ELEC2003 Electrical and Electronic Engineering A.		February
ELEC 2301	Signals and Systems	4	A) MATH1001 Differential Calculus, and MATH1002 Linear Algebra, and MATH1003 Integral Calculus and Modelling, and MATH1004 Discrete Mathematics. N) MATH3103 Signal Processing and MATH3809 Signal Processing (Adv).		July
ELEC 2401	Electronic Devices and Circuits	4	A) ELEC 1102 Foundations of Electronic Circuits. N) ELEC2001 Electrical and Electronic Engineering, and ELEC2002 Electrical Technology, and ELEC2003 Electrical and Electronic Engineering A.		July

Table 5A: Electrical Engineering (Information Systems) - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
ELEC 2601	4	A) ELEC 1101 Foundations of Computer Systems. N) ELEC2001 Electrical and Electronic Engineering.			February
MATH 2001	4	P) MATH (1001 or 1901) and (1002 or 1902) and (1003 or 1903). N) May not be counted with MATH 2901.			February
MATH 2002	4	P) MATH 1002 or 1902 or Distinction in MATH 1012. N) May not be counted with MATH 2902.			February
MATH 2005	4	P) MATH (1001 or 1901) and MATH (1002 or 1902) and MATH (1003 or 1903). N) May not be counted with MATH 2905.			July
PHYS 2203	4				July
Third Year					
COMP 3100	4	P) COMP 2004 or 2904. N) May not be counted with COMP 3 800. NB: Change to semester availability subject to Faculty approval.			July
ELEC 3102	4	A) PHYS 2203 Physics 2EE and ELEC 2101 Circuit Analysis.			February
ELEC 3302	4	A) ELEC 2301 Signals and Systems. N) MECH3800 Systems Control and CHNG3302 Process Control.			February
ELEC 3401	4	A) ELEC2401 Introductory Electronics, and ELEC2101 Circuit Analysis.			February
ELEC 3402	4	A) ELEC3401 Electronic Devices and Circuits.			July
ELEC 3403	4	A) ELEC 3401 Electronic Devices and Circuits.			July
ELEC 3502	4	A) ELEC2301 Signals and Systems.			February
ELEC 3503	4	A) ELEC2301 Signals and Systems.			July
ELEC 3601	4	A) ELEC2601 Microcomputer Systems or COMP2001 Computer Systems.			July
Fourth Year					
ELEC 4303	4	A) ELEC2301 Signals and Systems.			February
ELEC 4401	4	A) ELEC2301 Signals and Systems, and ELEC3302 Fundamentals of Feedback Control and ELEC3401 Electronic Devices and Circuits.			February
ELEC 4501	4	A) ELEC 3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			February
ELEC 4502	4	A) ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			February
ELEC 4601	4	A) ELEC3403 Switching Devices and High Speed Electronics, and ELEC3601 Digital Systems Design.			February
ELEC 4602	4	A) ELEC3601 Digital Systems Design, and COMP3100 Software Engineering.			February
ELEC 4702	0				February
ELEC 4703	12	P) A minimum of 36 credit points from third or fourth year units of study.			July

Notes

For units of study offered by a Faculty other than the Faculty of Engineering, any assumed knowledge, prerequisites and corequisites, will be as prescribed by that Faculty.

(*) PHYS1203 Physics 1EE is an acceptable alternative to PHYS1003 (Technological).

Table 5A: Electrical Engineering (Information Systems) - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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Resolutions of the Faculty of Engineering relating to Table 5A

BE (Electrical Engineering - Information Systems)

In addition to gaining credit for the core units of study set out in Table 5 A, candidates are required to complete at least 12 credit points of elective units of study from the table of recommended elective units of study for BE (Electrical and Information Engineering - Information Systems). Further credit for a total of not less than 192 credit points shall be gained by completing additional elective units of study approved by the Faculty.

BE (Electrical Engineering - Information Systems)/BCom

Candidates are not required to gain credit for any additional elective units of study.

Acceptable alternative units of study

Most Mathematics, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent Advanced level unit of study subject to prerequisite conditions (as required by the Faculty of Science) being met.

BE (Electrical Engineering - Information Systems) recommended units of study**Third Year**

ELEC 3701	Management for Engineers	4				February
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Fourth Year

ELEC 4302	Image Processing and Computer Vision	4	A) ELEC2301 Signals and Systems, and ELEC4303 Digital Signal Processing.			July
ELEC 4402	Integrated Circuit Design	4	A) ELEC3403 Switching Devices and High Speed Electronics, and ELEC3601 Digital Systems Design.			February
ELEC 4503	Error Control Coding	4	A) ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			February
ELEC 5501	Advanced Communication Networks	4	A) ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications, and ELEC4501 Data Communication Networks.			July
ELEC 5502	Satellite Communication Systems	4	A) ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications, and ELEC4502 Digital Communication Systems.			July
ELEC 5503	Optical Communication Systems	4	A) ELEC3402 Communications Electronics, and ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			July
ELEC 5504	Cellular Radio Engineering	4	A) ELEC 3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			July
ELEC 5505	Spread Spectrum CDMA for Mobile Communications	4	A) ELEC 3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			February
ELEC 5601	Advanced Real Time Computing	4	A) ELEC4602 Real Time Computing.			July
ELEC 5602	Advanced Computer Architecture	4	A) ELEC4601 Computer Design and (COMP2001 Computer Systems or COMP2901 Computer Systems Adv).			July
ELEC 5603	Biologically Inspired Signal Processing	4				July
ELEC 5605	Advanced Digital Engineering	4	A)ELEC4601 Computer Design.			July
ELEC 5606	Multimedia Systems and Applications	4	A) COMP3100 Software Engineering, ELEC 4303 Digital Signal Processing, and ELEC 4501 Data Communication Systems.			July
ELEC 5607	Hardware/Software Co-design	4	A) ELEC3601 Digital Systems Design and COMP3100 Software Engineering.			July
ELEC 5608	Electronic Commerce	4	A) ELEC3701 Management for Engineers and ELEC4501 Data Communication Networks.			July
ELEC 5609	Internet Engineering	4	A) ELEC4501 Data Communication Networks.			July
ELEC 5610	Computer and Network Security	4	A) ELEC4601 Computer Design and ELEC4501 Data Communication Networks.			July

Table 5A: Electrical Engineering (Information Systems) - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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Note

The units of study in this table may not all be available in a particular year.

Table 6: Mechanical Engineering

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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Candidates for the degree of Bachelor of Engineering in Mechanical Engineering are required to gain credit for the core units of study set out below. Any additional credit necessary to satisfy Section 9 shall be gained by completing additional credit points of elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points. See note (1) relating to core units of study offered by faculties other than Engineering.

Mechanical Engineering (Mechanical) core units of study

First Year					
AERO 1800	Computational Engineering 1D	3			July
CHEM 1401(3)	Chemistry 1E	6	P) Mathematics 2-unit course and a satisfactory knowledge of 2-unit Chemistry or the Chemistry component of the 3 or 4-unit Science HSC course. N) CHEM 1101, CHEM 1102.		February
ELEC 1001	Introductory Electrical Engineering	4	A) MATH1001 Differential Calculus. N) ELEC 1102 Foundations of Electronic Circuits, and ELEC2002 Electrical Technology.		July
MATH 1001	Differential Calculus	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1901 or 1011.		February
MATH 1002	Linear Algebra	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1902 or 1012.		February
MATH 1003	Integral Calculus and Modelling	3	A) HSC 4-unit Mathematics or MATH 1001. N) May not be counted with MATH 1903 or 1013.		July
MATH 1005	Statistics	3	A) HSC 2-unit Mathematics. N) May not be counted with MATH 1905 or 1015.		July
MECH 1500	Mechanical Engineering 1	6	N) MECH 1501 Engineering Statics.		February
MECH 1510	Kinematics and Dynamics	6	N)MATH 1051 Mechanics 1E.		July
MECH 1600	Manufacturing Technology	4	N) AERO 1600 Workshop Technology.		July
MECH 1800	Computational Engineering 1A	7	N) MECH 1801 Computational Engineering 1C.		February
Second Year					
AERO 2201(6)	Fluid Mechanics	4	N) Mutually exclusive with AERO2200 Introductory Aerodynamics, AERO2700 Space Engineering 1.		July
AERO 2300	Mechanics of Solids 1	4	P) 12 credit points of first year Maths (i.e Maths 1001,1002,1003,1005).		February
ELEC 2001(4)	Electrical and Electronic Engineering	6	P) ELEC 1001 Introductory Electrical Engineering. N) ELEC 2003 Electrical and Electronic Engineering A, and ELEC2101 Circuit Analysis, and ELEC2401 Introductory Electronics, and ELEC2601 Microcomputer Systems.		February
MATH 2001	Vector Calculus and Complex Variables	4	P) MATH (1001 or 1901) and (1002 or 1902) and (1003 or 1903). N) May not be counted with MATH 2901.		February
MATH 2002(2)	Matrix Applications	4	P) MATH 1002 or 1902 or Distinction in MATH 1012. N) May not be counted with MATH 2902.		February
MATH 2005	Fourier Series and Differential Equations	4	P) MATH (1001 or 1901) and MATH (1002 or 1902) and MATH (1003 or 1903). N) May not be counted with MATH 2905.		July
MATH 2052(2)	Numerical Methods	2	C) MATH 2001 or 2901. N) MATH 2952.		July
MECH 2201	Thermodynamics 1	4	N) MECH 2200 Thermofluids.		February
MECH 2300	Materials 1	4	N) CIVL 2101 Properties of Materials.		July
MECH 2400	Mechanical Design 1	6			July

Table 6: Mechanical Engineering -- continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
MECH 2500 Engineering Dynamics 1	4	P) MATH 1001, 1002 and MECH 1510 Kinematics and Dynamics.			July
Third Year					
MECH 3200(5) Thermal Engineering 1	7	P) MECH 2201 Thermodynamics 1. N) MECH 3201 Thermodynamics 2.			February
MECH 3210(5) Fluid Mechanics	4	P) AERO 2201 Fluid Mechanics, AERO 2200 Introductory Aerodynamics or MECH 2202 Fluids 1.			July
MECH 3300(5) Materials 2	4	P) MECH 2300 Materials 1 & AERO 2300 Mechanics of Solids 1.			July
MECH 3310(5) Mechanics of Solids 2	4	P) AERO 2300 Mechanics of Solids 1 and MATH 2005.			February
MECH 3400(2) Mechanical Design 2A	4	P) MECH 2400 Mechanical Design 1.			February
MECH 3410 Mechanical Design 2B	4	P) MECH 2400 Mechanical Design 1.			July
MECH 3500 Engineering Dynamics 2	4	P) MECH 2500 Engineering Dynamics 1 and (MATH 2001 & MATH 2005).			February
MECH 3600 Manufacturing Engineering	6	P) MECH 1600 Manufacturing Technology.			February
MECH 3610(2) Team Project	2	P) 30 credit points of second year units of study.			July
MECH 3620(2) Industrial Management	5				July
MECH 3800 Systems Control	4	P) MATH 2001 and MATH 2005.			July
Fourth Year					
MECH 4101 Thesis A	0	P) 36 credit points of Third Year units of study.			February, July
MECH 4102 Thesis B	12	P) MECH 4101 Thesis A (the Head of Department may allow Thesis A as corequisite in exceptional circumstances).			February, July
MECH 4110 Professional Engineering	4	P) 36 credit points of Senior units of study.			February
MECH 4120 Professional Communication	4	P) 32 credit points of third year units of study.			July
MECH 4130 Practical Experience	0	P) 28 credit points of second year units of study.			February, July

Notes

- For core units offered by other than the Faculty of Engineering, any assumed knowledge, prerequisite requirements, will be as prescribed by that Faculty.
- These units of study are core for candidates for the degree of Bachelor of Engineering in Mechanical Engineering and the combined degree BE/BSc, but not for candidates for the combined degrees of BE/BCom, BE/LLB and BE/BA.
- For CHEM 1401, note (2) above also applies. Candidates for the combined degree BE/BSc may take as an alternative to CHEM 1401 other units of study from the Faculties of Science or Health Services, up to 12 credit points and subject to timetabling constraints.
- Candidates for the combined degrees BE/BCom, BE/LLB and BE/BA should enrol in ELEC 2003 Electrical and Electronics Engineering A (4 cp).
- Candidates for the combined degrees BE/BCom, BE/LLB and BE/BA should enrol in MECH 3202 Heat Transfer (3 cp) and should enrol in an additional 12 credit points selected from the following units of study: MECH 3201, MECH 3210, MECH 3300 and MECH 3310.
- Candidates for the combined degrees BE/BSc should enrol in MECH 2202 Fluids (2 cp) and also MATH 2051 (2 cp).

Resolutions of the Faculty of Engineering relating to Table 6

Candidates for the degree of Bachelor of Engineering in Mechanical Engineering and candidates for the degree of Bachelor of Engineering in Mechanical Engineering combined with Bachelor of Science are required to gain credit for all core units of study set out in Table 6. Additional credit necessary to satisfy Section 9 shall be gained by completing at least 30 credit points of elective units of study. At least 24 of these credit points must be chosen from mainstream electives.

Candidates for the degree of Bachelor of Engineering in Mechanical Engineering combined with Bachelor of Arts or Bachelor of Commerce or Bachelor of Law are required to gain credit for all core units of study set out in Table 6 except those marked as (2). Additional credit necessary to satisfy Section 9 shall be gained by completing at least 11 credit points of elective units of study which must be chosen from mainstream electives.

Table 6: Mechanical Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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Acceptable alternative units of study

Pursuant to Resolution 3, the Faculty has prescribed the following acceptable alternatives to core units of study listed in Table 6:

		Acceptable alternative
AERO 1800	Computational Engineering 1D	COMP 1001
CHEM 1401	Chemistry 1E	CHEM 1101
MECH 1510	Kinematics and Dynamics	PHYS 1001
MECH 1810	Computational Engineering 1B	COMP 1001

Note

Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent Advanced Level unit of study subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing Advanced Levels should seek advice from their Department before enrolling.

Resolutions of the Department of Mechanical and Mechatronic Engineering relating to Table 6

Note: Units of study not included in this table may also be selected subject to the approval of the Head of Department, Mechanical and Mechatronic Engineering.

Recommended elective units of study for BE Mechanical Engineering (Mechanical)

Mainstream electives

AERO 4301	Applied Numerical Stress Analysis	6	P) MECH 3310 Mechanics of Solids 2. N) AERO 4300 Aircraft Structures 3.	<i>February</i>
MECH 4210	Computational Fluid Dynamics	4	P) MECH 3210 Fluid Mechanic.	<i>July</i>
MECH 4220	Environmental Engineering	6	P) 24 credit points of third year units of study. N) MECH4240 Energy and the Environment and MECH 4230 Environmental Acoustics and Noise Control.	<i>February</i>
MECH 4250	Air conditioning and Refrigeration	3	P) MECH 3200.	<i>February</i>
MECH 4260	Combustion and Fire Safety	3	P) MECH 3200.	<i>February</i>
MECH 4310	Advanced Engineering Materials	6	P) MECH 3300 Materials 2. N) MECH 4315 Advanced Aerospace Materials.	<i>July</i>
MECH 4410	Advanced Design and Analysis 1	3	P) MECH 3400 Mechanical Design 2A and MECH 3410 Mechanical Design 2B.	<i>February</i>
MECH 4420	Advanced Design and Analysis 2	3	P) MECH 3400 Mechanical Design 2A and MECH 3410 Mechanical Design 2B.	<i>July</i>
MECH 4510	Machine Vibration and Monitoring	3	P) MECH 3500 Engineering Dynamics 2.	<i>July</i>
MECH 4605	Industrial Engineering	8	P) MATH 2001 and MATH 2005 and MECH 3620 Industrial Management. N) MECH 4620 Industrial Ergonomics, MECH 4635 Introduction to Operations Research, and MECH 4610 Industrial and Engineering Management.	<i>February</i>
MECH 4640	Product Life Cycle Design	2	P) MECH3600.	<i>July</i>
MECH 4650	Workplace Industrial Relations	2	P) 36 credit points of senior units of study.	<i>July</i>
MECH 4700	Robotic Systems	4	P) MECH 3500.	<i>July</i>
MECH 4900	Orthopaedic Engineering	4	P) MECH 3300 Materials 2 and MECH 3310 Mechanics of Solids 2.	<i>July</i>

Table 6: Mechanical Engineering -- continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
MECH 4910 Biomaterials and Biomechanics	4			P) 3 6 credit points of third year units of study.	February
Other electives					
ASNS 2601 Asian Studies 1A (Japanese)	4				February
ASNS 2602 Asian Studies 1B (Japanese)	4			P) ASNS 2601.	July
ASNS 2603 Asian Studies 2A (Japanese)	4			P) ASNS2602.	February
ASNS 2604 Asian Studies 2B (Japanese)	4			P) ASNS2603.	July
BIOL 1001 Concepts in Biology	6	A) HSC 2-unit Biology course. N) May not be counted with BIOL 1901.			February
CHNG 4504 Environmental Decision Making	4				July
CIVL 3701 Transportation Engineering and planning	2				July
ELEC 3801 Fundamentals of Biomedical Engineering	4	A) ELEC2401 Introductory Electronics or ELEC2001 Electrical and Electronic Engineering or ELEC2003 Electrical and Electronic Engineering A.			February
ENGG 4001 Innovation and International Competitiveness	4				February
IREL 1001 Macro Industrial Relations	6			NB: Entry to this unit is restricted by quota.	February
MECH 4230 Environmental Acoustics and Noise Control	2			P) 24 credit points of third year units of study. N) MECH 4220 Environmental Engineering, MECH 4220 Environmental Engineering.	February
MECH 4240 Energy and the Environment	4			P) 24 credit points of Senior units of study. N) MECH4220 Environmental Engineering.	February
MECH 4315 Advanced Aerospace Materials	6			P) MECH 3300 Materials 2. N) MECH 4310 Advanced Engineering Materials.	July
MECH 4610 Industrial and Engineering Management	2			P) MECH 3620 Industrial Management. N) MECH 4605 Industrial Engineering.	February
MECH 4620 Industrial Ergonomics	2			N) MECH 4605 Industrial Engineering.	February
MECH 4635 Introduction to Operations Research	4			P) MATH 2001 and MATH 2005. N) MECH 4605 Industrial Engineering.	February
BE Mechanical Engineering (Mechanical)(Management) additional units of study					
CHNG 3401 Project Economics	4				February
CHNG 4401 Project Engineering	4				February
CHNG 4403 Engineering Business Skills	4				July
CHNG 4504 Environmental Decision Making	4				July
ELEC 4701 Project Management	4			A) ELEC3701 Management for Engineers.	July
ENGG 2003 Introduction to Engineering Management	4			N) ELEC3701, MECH3620.	
ENGG 3002 Industrial and Engineering Management	4			P) ENGG2003. N)MECH4610.	
ENGG 4001 Innovation and International Competitiveness	4				February

Table 6: Mechanical Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
ENGG 4002 New Business Creation	4				
MECH 4110 Professional Engineering	4			P) 36 credit points of Senior units of study.	<i>February</i>
MECH 4635 Introduction to Operations Research	4			P) MATH 2001 and MATH 2005. N) MECH 4605 Industrial Engineering.	<i>February</i>
MECH 4650 Workplace Industrial Relations	2			P) 36 credit points of senior units of study.	<i>July</i>

Note

ENGG 2003, and ENGG 3002 are compulsory units of study for the management stream. The remaining credit points required come from the Table above. In the year 2000, there will only be entry into first year (ie, no advanced standing into the later years of this stream will be possible).

Table 7: Mechanical Engineering (Mechatronics)

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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Candidates for the degree of Bachelor of Engineering in Mechanical Engineering (Mechatronics) are required to gain credit for the core units of study set out below. Any additional credit necessary to satisfy Section 9 shall be gained by completing additional credit points of elective units of study as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points. See note (1) relating to core units of study offered by faculties other than Engineering.

Mechanical Engineering (Mechatronics) core units of study

First Year

CHEM 1401(3)	Chemistry1E	6	P) Mathematics 2-unit course and a satisfactory knowledge of 2-unit Chemistry or the Chemistry component of the 3 or 4-unit Science HSC course. N) CHEM 1101, CHEM 1102.		February
ELEC 1001	Introductory Electrical Engineering	4	A) MATH1001 Differential Calculus. N) ELEC1102 Foundations of Electronic Circuits, and ELEC2002 Electrical Technology.		July
MATH 1001	Differential Calculus	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1901 or 1011.		February
MATH 1002	Linear Algebra	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1902 or 1012.		February
MATH 1003	Integral Calculus and Modelling	3	A) HSC 4-unit Mathematics or MATH 1001. N) May not be counted with MATH 1903 or 1013.		July
MATH 1005	Statistics	3	A) HSC 2-unit Mathematics. N) May not be counted with MATH 1905 or 1015.		July
MECH 1500	Mechanical Engineering 1	6	N) MECH 1501 Engineering Statics.		February
MECH 1510	Kinematics and Dynamics	6	N) MATH 1051 Mechanics 1E.		July
MECH 1600	Manufacturing Technology	4	N) AERO 1600 Workshop Technology.		July
MECH 1800	Computational Engineering 1A	7	N) MECH 1801 Computational Engineering 1C.		February
MECH 1810	Computational Engineering 1B	3			July

Second Year

AERO 2201(5)	Fluid Mechanics	4	N) Mutually exclusive with AERO2200 Introductory Aerodynamics, AERO2700 Space Engineering 1.		July
AERO 2300	Mechanics of Solids 1	4	P) 12 credit points of first year Maths (i.e Maths 1001,1002,1003,1005).		February
ELEC 2001	Electrical and Electronic Engineering	6	P) ELEC 1001 Introductory Electrical Engineering. N) ELEC 2003 Electrical and Electronic Engineering A, and ELEC2101 Circuit Analysis, and ELEC2401 Introductory Electronics, and ELEC2601 Microcomputer Systems.		February
MATH 2001	Vector Calculus and Complex Variables	4	P) MATH (1001 or 1901) and (1002 or 1902) and (1003 or 1903). N) May not be counted with MATH 2901.		February
MATH 2002(2)	Matrix Applications	4	P) MATH 1002 or 1902 or Distinction in MATH 1012. N) May not be counted with MATH 2902,		February
MATH 2005	Fourier Series and Differential Equations	4	P) MATH (1001 or 1901) and MATH (1002 or 1902) and MATH (1003 or 1903). N) May not be counted with MATH 2905.		July
MATH 2052(2)	Numerical Methods	2	C) MATH 2001 or 2901. N) MATH 2952.		July
MECH 2201	Thermodynamics 1	4	N) MECH 2200 Thermofluids.		February
MECH 2400	Mechanical Design 1	6			July
MECH 2500	Engineering Dynamics 1	4	P) MATH 1001, 1002 and MECH 1510 Kinematics and Dynamics.		July

Table 7: Mechanical Engineering (Mechatronics) - continued

Unit of study	Credif point>	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
MECH 2700 Mechatronics 1	6				July
Third Year					
ELEC 3202 Power Electronics and Drives	4	A) ELEC2101	Circuit Analysis, and	ELEC2401 Introductory Electronics.	July
ELEC 3401 Electronic Devices and Circuits	4	A) ELEC240T	Introductory Electronics, and	ELEC2101 Circuit Analysis.	February
ELEC 3601 Digital Systems Design	4	A) ELEC2601	Microcomputer Systems or	COMP2001 Computer Systems.	July
MECH 3400(2) Mechanical Design 2A	4	P) MECH 2400	Mechanical Design 1.		February
MECH 3410(2) Mechanical Design 2B	4	P) MECH 2400	Mechanical Design 1.		July
MECH 3500 Engineering Dynamics 2	4	P) MECH 2500	Engineering Dynamics 1 and	(MATH 2001 & MATH 2005).	February
MECH 3600(4) Manufacturing Engineering	6	P) MECH 1600	Manufacturing Technology.		February
MECH 3610(2) Team Project	2	P) 30 credit points	of second year units of study.		July
MECH 3620(2) Industrial Management	5				July
MECH 3700 Mechatronics 2	5	P) MECH 2700	Mechatronics 1.		February
MECH 3800 Systems Control	4	P) MATH 2001	and MATH 2005.		July
Fourth Year					
MECH 4101 Thesis A	0	P) 36 credit points	of Third Year units of study.		February, July
MECH 4102 Thesis B	12	P) MECH 4101	Thesis A (the Head of Department may allow Thesis A as corequisite in exceptional circumstances).		February, July
MECH 4110 Professional Engineering	4	P) 36 credit points	of Senior units of study.		February
MECH 4120 Professional Communication	4	P) 32 credit points	of third year units of study.		July
MECH 4130 Practical Experience	0	P) 28 credit points	of second year units of study.		February, July

Notes

1. For core units offered by other than the Faculty of Engineering, any assumed knowledge, prerequisite requirements, will be as prescribed by that Faculty.
2. These units of study are core for candidates for the degree of Bachelor of Engineering in Mechanical Engineering (Mechatronics) and the combined degree BE/BSc, but not for candidates for the combined degrees of BE/BCom, BE/LLB and BE/BA.
3. For CHEM 1401, note (2) above also applies. Candidates for the combined degree BE/BSc may take as an alternative to CHEM 1401 other units of study from the Faculties of Science or Health Services, up to 12 credit points and subject to timetabling constraints.
4. Candidates for the combined degrees BE/BCom, BE/LLB and BE/BA should enrol in MECH 3601 Manufacturing Systems (2 cp).
5. Candidates for the combined degree BE/BSc should enrol in MECH 2202 Fluids (2 cp) and also MATH 2051 (2 cp).

Resolutions of the Faculty of Engineering relating to Table 7

Candidates for the degree of Bachelor of Engineering in Mechanical Engineering (Mechatronics) and candidates for the degree of Bachelor of Engineering in Mechanical Engineering (Mechatronics) combined with Bachelor of Science are required to gain credit for all core units of study set out in Table 7. Additional credit necessary to satisfy Section 9 shall be gained by completing at least 30 credit points of elective units of study. At least 24 of these credit points must be chosen from mainstream electives.

Candidates for the degree of Bachelor of Engineering in Mechanical Engineering (Mechatronics) combined with Bachelor of Arts or Bachelor of Law or Bachelor of Commerce are required to gain credit for all core units of study set out in Table 7 except those marked as (2). Additional credit necessary to satisfy Section 9 shall be gained by completing at least 13 credit points of elective units of study which must be chosen from mainstream electives.

Table 7: Mechanical Engineering (Mechatronics) - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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Acceptable alternative units of study

Pursuant to Resolution 3, the Faculty has prescribed the following acceptable alternatives to core units of study listed in Table 7:

	Acceptable alternative
AERO 1800 1D Computational Engineering	COMP 1001
CHEM 1401 Chemistry 1E	CHEM 1101
MECH 1510 Kinematics and Dynamics	PHYS 1001
MECH 1810 1B Computational Engineering	COMP 1001

Note

Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent Advanced Level unit of study subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing Advanced Levels should seek advice from their Department before enrolling.

Resolutions of the Department of Mechanical and Mechatronic Engineering relating to Table 7

Note: Units of study not included in this table may also be selected subject to the approval of the Head of Department, Mechanical and Mechatronic Engineering.

BE Mechanical Engineering (Mechatronics) recommended elective units of study Mainstream electives

MECH 4410 Advanced Design and Analysis 1	3	P)	MECH 3400 Mechanical Design 2A and MECH 3410 Mechanical Design 2B.	<i>February</i>
MECH 4420 Advanced Design and Analysis 2	3	P)	MECH 3400 Mechanical Design 2A and MECH 3410 Mechanical Design 2B.	<i>July</i>
MECH 4510 Machine Vibration and Monitoring	3	P)	MECH 3500 Engineering Dynamics 2.	<i>July</i>
MECH 4640 Product Life Cycle Design	2	P)	MECH3600.	<i>July</i>
MECH 4650 Workplace Industrial Relations	2	P)	36 credit points of senior units of study.	<i>July</i>
MECH 4700 Robotic Systems	4	P)	MECH 3500.	<i>July</i>
MECH 4710 Microprocessors in Engineered Products	6	P)	ELEC 3601 Digital Systems Design and ELEC 3401 Electronics Devices & Circuits.	<i>February</i>
MECH 4720 Sensors and Signals	6	P)	MECH 3500 Engineering Dynamics 2 & MECH 3800 Systems Control & ELEC 3601 Digital Systems Design & ELEC 3401 Electronics Devices & Circuits.	<i>February</i>
MECH 4730 Computers in Real Time Control and Instrumentation	6	P)	ELEC 3601 Digital Systems Design & ELEC 3401 Electronics Devices & Circuits.	<i>February</i>

Other electives

ASNS 2601 Asian Studies 1A (Japanese)	4			<i>February</i>
ASNS 2602 Asian Studies 1B (Japanese)	4	P)	ASNS 2601.	<i>July</i>
ASNS 2603 Asian Studies 2A (Japanese)	4	P)	ASNS2602.	<i>February</i>
ASNS 2604 Asian Studies 2B (Japanese)	4	P)	ASNS2603.	<i>July</i>
BIOL 1001 Concepts in Biology	6	A) HSC 2-unit Biology course. N) May not be counted with BIOL 1901.		<i>February</i>
CIVL 3701 Transportation Engineering and planning	2			<i>July</i>

Table 7: Mechanical Engineering (Mechatronics) - continued

Unit of study	Credit points;	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
ELEC 3801 Fundamentals of Biomedical Engineering	4	A) ELEC2401 Introductory Electronics or ELEC2001 Electrical and Electronic Engineering or ELEC2003 Electrical and Electronic Engineering A.			February
ENGG 4001 Innovation and International Competitiveness	4				February
IREL 1001 Macro Industrial Relations	6	NB: Entry to this unit is restricted by quota.			February
MECH 4220 Environmental Engineering	6	P) 24 credit points of third year units of study. N) MECH4240 Energy and the Environment and MECH 4230 Environmental Acoustics and Noise Control.			February
MECH 4605 Industrial Engineering	8	P) MATH 2001 and MATH 2005 and MECH 3620 Industrial Management. N) MECH 4620 Industrial Ergonomics, MECH 4635 Introduction to Operations Research, and MECH 4610 Industrial and Engineering Management.			February
MECH 4910 Biomaterials and Biomechanics	4	P) 36 credit points of third year units of study.			February

BE Mechanical Engineering (Mechatronics)(Management) additional units of study

CHNG 3401 Project Economics.	4				February
CHNG 4401 Project Engineering	4				February
CHNG 4403 Engineering Business Skills	4				July
CHNG 4504 Environmental Decision Making	4				July
ELEC 4701 Project Management	4	A) ELEC3701 Management for Engineers.			July
ENGG 2003 Introduction to Engineering Management	4	N) ELEC3701, MECH3620.			
ENGG 3002 Industrial and Engineering Management	4	P) ENGG2003. N) MECH4610.			
ENGG 4001 Innovation and International Competitiveness	4				February
ENGG 4002 New Business Creation	4				
MECH 4110 Professional Engineering	4	P) 36 credit points of Senior units of study.			February
MECH 4635 Introduction to Operations Research	4	P) MATH 2001 and MATH 2005. N) MECH 4605 Industrial Engineering.			February
MECH 4650 Workplace Industrial Relations	2	P) 36 credit points of senior units of study.			July

Note

ENGG 2003, and ENGG 3002 are compulsory units of study for the management stream. The remaining credit points required come from theTable above. In the year 2000, there will only be entry into first year (ie, noadvanced standing into the later years of this stream will be possible).

Table 8: Project Engineering and Management (Civil)

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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Candidates for the degree of Bachelor of Engineering in Project Engineering and Management (Civil) are required to gain credit for the core units of study set out below. Any additional credit necessary to satisfy Section 9 shall be gained by completing additional elective units of study, as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points.

Project Engineering and Management core units of study

First Year

ACCT 1003	Financial Accounting Concepts	6	N) Terminating unit. Cannot be counted with ACCT1001 and ACCT1002.		February
ACCT 1004	Management Accounting Concepts	6	N) Terminating unit. Cannot be counted with ACCT1001 and ACCT1002.		July
CHEM 1401	Chemistry 1E	6	P) Mathematics 2-unit course and a satisfactory knowledge of 2-unit Chemistry or the Chemistry component of the 3 or 4-unit Science HSC course. N) CHEM 1101, CHEM 1102.		February
CIVL 1001	Civil Engineering 1	4	P) Assumed standard of knowledge. Mathematics 3 unit course and a satisfactory knowledge of 2 unit Chemistry or the Chemistry component of the 3 or 4 unit Science HSC course and of the 2 unit Physics course or the Physics component of the 3 or 4 unit Science HSC course.		February
CIVL 1004	Computational Engineering	4	N) COMP 1001 Introductory Programming or COMP 1002 Introductory Computer Science.		July
CIVL 1051	Dynamics	5	A) Assumed standard of knowledge: Mathematics 3 unit course and Science 4 unit course (or the Physics core of 3-4 unit Science) at the HSC. C) MATH 1001, 1002, 1003, 1005. N) MECH 1510		July
CIVL 1052	Statics	5	A) Mathematics 3 unit course at the HSC. C) MATH 1001, 1002, 1003, 1005. N) MECH 1500 Mechanical Engineering 1, MECH 1501 Engineering Statics.		February
MATH 1001	Differential Calculus	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1901 or 1011.		February
MATH 1002	Linear Algebra	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1902 or 1012.		February
MATH 1003	Integral Calculus and Modelling	3	A) HSC 4-unit Mathematics or MATH 1001. N) May not be counted with MATH 1903 or 1013.		July
MATH 1005	Statistics	3	A) HSC 2-unit Mathematics. N) May not be counted with MATH 1905 or 1015.		July

Second Year

CIVL 2004	Engineering Communications 1	2			February
CIVL 2101	Properties of Materials	4	P) CHEM 1401 Chemistry 1E.		February
CIVL 2201	Structural Mechanics	6	P) CIVL 1051 Dynamics and CIVL 1052 Statics.		February
CIVL 2203	Structural Design	4	P) CIVL 1051 Dynamics and CIVL 1052 Statics. C) CIVL 2201 Structural Mechanics.		July
CIVL 2801	Engineering Construction 1	4			July
GEOL 1501	Engineering Geology 1	6	N) GEOL 1002.		February
IREL 1002	Micro Industrial Relations	6	NB: Entry to this unit is restricted by quota.		July
MATH 2001	Vector Calculus and Complex Variables	4	P) MATH (1001 or 1901) and (1002 or 1902) and (1003 or 1903). N) May not be counted with MATH 2901.		February
MATH 2002	Matrix Applications	4	P) MATH 1002 or 1902 or Distinction in MATH 1012. N) May not be counted with MATH 2902.		February

Table 8: Project Engineering and Management (Civil) - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
MATH 2005	4	P) MATH (1001 or 1901) and MATH (1002 or 1902) and MATH (1003 or 1903). N) May not be counted with MATH 2905.			July
MATH 2051	2	C) MATH 2001 or 2901, and MATH 2002 or 2902. N) MATH 2953.			July
MATH 2052	2	C) MATH 2001 or 2901. N) MATH 2952.			July
Third Year					
CIVL 2610	6	P) MATH 1001, MATH 1002, MATH 1003, MATH 1005.			February
CIVL 3005	2	P) CIVL 2004 Engineering Communications 1.			July
CIVL 3207	2	P) MATH 1001, MATH 1002, MATH 1003, MATH 1005, CIVL 2201 Structural Mechanics, CIVL 2203 Structural Design.			February
CIVL 3401	4	P) CIVL 2201 Structural Mechanics.			February
CIVL 3501	4	P) MATH 1001, MATH 1002, MATH 1003, MATH 1005.			February
CIVL 3701	2				July
CIVL 3802	4	A) Completion of CIVL 2801 Engineering Construction 1 or equivalent knowledge.			February
CIVL 3803	4	N) CIVL 4803 Engineering Management.			February
CIVL 3804	5				July
CIVL 3805	6				February
Fourth Year					
CIVL 4008	0	P) 28 credit points of Senior courses.			February
CIVL 4014	5	P) 40 credit points of Senior Subjects. N) CIVL 4013 Honours Thesis/Design/Project or CIVL4015.			Full Year (starts Feb)
CIVL 4016	5				July
CIVL 4807	5	A) Completion of CIVL 3803 Project Appraisal or equivalent knowledge.			July
CIVL 4808	4	A) Sufficient knowledge of information technology systems & communications capabilities.			February
CIVL 4809	4	A) Completion of Engineering Construction 1 & 2 or the equivalent knowledge.			July
CIVL 4810	6				July
CIVL 4903	6	P) CIVL 3223 Concrete Structures - Behaviour, CIVL 3224 Concrete Structures - Design, CIVL 3206 Steel Structures 1.			February

Note

1. For core units of study offered by other than the Faculty of Engineering, any assumed knowledge, prerequisite and corequisite requirements will be as prescribed by the Faculty.

Table 8: Project Engineering and Management (Civil) - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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Resolutions of the Faculty of Engineering relating to Table 8

Degree Eligibility

Candidates for the degree of Bachelor of Engineering in Project Engineering and Management (Civil) are expected to complete all the core units for study in Table 8 (170 credit points). They are also required to gain at least 22 credit points from the third and fourth year table of electives listed below.

Candidates commencing a combined degree program (that is a Bachelor of Engineering in Project Engineering and Management (Civil) with a Bachelor of Commerce) are required to complete all of the core units of study in Table 8 except for ACCT 1003, ACCT 1004 and IREL 1002, which not required, therefore only 152 credit points are needed. This total of 152 credit points is only sufficient to be awarded a Bachelor of Engineering in Project Engineering and Management (Civil) as part of an approved combined degree program. The remaining credit points for the combined degree will be taken in the Faculty of Economics and candidates should refer to the Joint Resolutions of the Faculty of Engineering and the Faculty of Economics and Business.

Note

Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent Advanced level units of study subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing Advanced options should seek advice from their Department before enrolling.

Acceptable alternative units of study

Pursuant to Resolution 3, the Faculty has prescribed the following acceptable alternatives to core units of study listed in Table 8:

	Acceptable alternative
CHEM 1401 Chemistry 1E	CHEM 1101 and CHEM 1102
CIVL 1004 Computational Engineering	COMP 1001 and COMP 1002 or MECH 1800 or MECH 1810 or MECH 1801
CIVL 1051 Dynamics	MECH 1500 or MECH 1501
CIVL 1052 Statics	MECH 1500 or MECH 1501
CIVL 4014 Thesis/Design/Project	CIVL 4013 (or CIVL 4015 with written approval from Head of Civil Engineering)
GEOL 1501 Engineering Geology 1	GEOL 1001 and GEOL 1002
MATH 2001 Vector Calculus and Complex Variables	STAT 2002 (for BE/BCom degrees only)
MATH 2005 Fourier Series and Differential Equations	STAT 2004 (for BE/BCom degrees only)

BE Project Engineering and Management (Civil) recommended elective units

Third Year

CIVL 3102	Materials Aspects in Design	4	P) CIVL 2101 Properties of Materials.	July
CIVL 3204	Structural Analysis	6	P) CIVL 2201 Structural Mechanics and MATH 2002 Matrix Applications plus MATH 2005 Fourier Series and Differential Equations.	February
CIVL 3206	Steel Structures 1	6	P) CIVL 2201 Structural Mechanics. C) CIVL 3102 Materials Aspects in Design, CIVL 3204 Structural Analysis.	July
CIVL 3223	Concrete Structures - Behaviour	3	P) CIVL 2201 Structural Mechanics and CIVL 2203 Structural Design. N) CIVL 3205 Concrete Structures 1.	February
CIVL 3224	Concrete Structures - Design	3	P) CIVL 2201 Structural Mechanics and CIVL 2203 Structural Design. N) CIVL 3205 Concrete Structures 1.	July
CIVL 3402	Soil Mechanics B	4	P) CIVL 2201 Structural Mechanics. C) CIVL 3401 Soil Mechanics A.	July
CIVL 3602	Fluids 2	4	P) CIVL 2610 Fluids 1.	July

Fourth Year

ARCH 6009	The Building Industry in Australia	3		
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Table 8: Project Engineering and Management (Civil) - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
CIVL 4105	Advanced Materials	5		P) CIVL 3102 Materials Aspects in Design.	July
CIVL 4218	Concrete Structures 2	5		P) CIVL 3223 Concrete Structures - Behaviour, CIVL 3224 Concrete Structures - Design.	July
CIVL 4219	Structural Dynamics	5		P) CIVL 3204 Structural Analysis.	February
CIVL 4220	Steel Structures 2	5		P) CIVL 3206 Steel Structures 1.	July
CIVL 4221	Bridge Engineering	5		P) CIVL 3223 Concrete Structures - Behaviour, CIVL 3224 Concrete Structures - Design and CIVL 3206 Steel Structures 1.	February
CIVL 4222	Finite Element Methods	5		P) CIVL 3204 Structural Analysis.	February
CIVL 4406	Environmental Geotechnics	5		P) CIVL 3401 Soil Mechanics A, CIVL 3402 Soil Mechanics B.	July
CIVL 4407	Geotechnical Engineering	5		P) CIVL 3401 Soil Mechanics A, CIVL 3402 Soil Mechanics B.	February
CIVL 4504	Surveying 2	5		P) CIVL 3501 Surveying 1. <i>NB: Not offered in 2000.</i>	
CIVL 4607	Environmental Fluids 1	5			February
CIVL 4608	Environmental Fluids 2	5		A) Material covered in Environmental Fluids 1.	July
CIVL 4609	Water Resources Engineering	5			July ~ ~
ECON 1001	Introductory Microeconomics	6		A) HSC 2 unit Mathematics.	February

Notes

- Choice of electives as shown in the above table will depend upon subject availability, timetabling and prerequisite conditions.
- For the BE Project Engineering and Management (Civil) degree, students must take at least 22 elective units of study at third and fourth year level, however, 2 x 4 credit points of study may be replaced by at least 8 credit points available elsewhere in the Faculty of Engineering and subject to the approval of the Head of Civil Engineering.
- Honours candidates replace the core unit of study CIVL 4014 Thesis by CIVL 4013 Thesis Honours.
- CIVL 4014 may be replaced with CIVL 4015 with written approval from the Head of Civil Engineering.

Table 9: Telecommunications Engineering

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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Telecommunications Engineering core units of study

Candidates for the degree of Bachelor of Engineering in Telecommunications Engineering, and candidates for the combined degree courses of Bachelor of Engineering in Telecommunications Engineering with Bachelor of Arts or Bachelor of Science or Bachelor of Commerce, are required to gain credit for the core units of study set out below. Any additional credit necessary to satisfy Section 9 shall be gained by completing additional elective units of study as prescribed by the Faculty.

First Year					
COMP 1001	Introductory Programming	6	A) HSC 3-unit Mathematics. C) Students intending to major in Computer Science are advised to enrol in MATH 1003 and 1004 or 1004 and 1005 or 1903 and 1904 or 1904 and 1905 in their first year. N) May not be counted with COMP 1901.		February, July
COMP 1002	Introductory Computer Science	6	P) COMP 1001 or 1901. N) May not be counted with COMP 1902.		February, July
ELEC 1101	Foundations of Computer Systems	6	A) HSC Maths 3 unit.		February
ELEC 1102	Foundations of Electronic Circuits	6	A) HSC Physics 2 unit and MATH1001 Differential Calculus. N) ELEC1001 Introductory Electrical Engineering, and ELEC2002 Electrical Technology.		July
MATH 1001	Differential Calculus	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1901 or 1011.		February
MATH 1002	Linear Algebra	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1902 or 1012.		February
MATH 1003	Integral Calculus and Modelling	3	A) HSC 4-unit Mathematics or MATH 1001. N) May not be counted with MATH 1903 or 1013.		July
MATH 1004	Discrete Mathematics	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1904.		July
PHYS 1001	Physics (Regular)	6	A) HSC Physics or HSC 4-unit Science. C) Recommended concurrent units of study: MATH 1001 and 1002 or 1901 and 1902. N) May not be counted with PHYS 1002 or 1901.		February
PHYS 1003c)	Physics (Technological)	6	A) HSC 2-unit Physics or HSC 4-unit Science or PHYS 1001 or 1002 or 1901 or equivalent. C) Recommended concurrent units: MATH 1003 and 1005 or 1903 and 1905. N) May not be counted with PHYS 1004 or 1902.		February, July
Second Year					
COMP 2002	Design and Data Structures	4	Q) COMP 1002 or 1902. N) May not be counted with COMP 2902. NB: See prerequisites for Senior Computer Science units of study. Consult Departmental Handbook.		February
COMP 2004	Programming Practice	4	Q) COMP 1002 or 1902. N) May not be counted with COMP 2904. NB: See prerequisites for Senior Computer Science units of study. Consult Departmental Handbook.		July
ELEC 2101	Circuit Analysis	4	A) ELEC 1102 Foundations of Electronic Circuits. N) ELEC2001 Electrical and Electronic Engineering, and ELEC2002 Electrical Technology, and ELEC2003 Electrical and Electronic Engineering A.		February
ELEC 2301	Signals and Systems	4	A) MATH1001 Differential Calculus, and MATH1002 Linear Algebra, and MATH1003 Integral Calculus and Modelling, and MATH1004 Discrete Mathematics. N) MATH3103 Signal Processing and MATH3809 Signal Processing (Adv).		July
ELEC 2401	Electronic Devices and Circuits	4	A) ELEC 1102 Foundations of Electronic Circuits. N) ELEC2001 Electrical and Electronic Engineering, and ELEC2002 Electrical Technology, and ELEC2003 Electrical and Electronic Engineering A.		July

Table 9: Telecommunications Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
ELEC 2601 Microcomputer Systems	4	A) ELEC 1101 Foundations of Computer Systems. N) ELEC2001 Electrical and Electronic Engineering.			February
MATH 2001 Vector Calculus and Complex Variables	4	P) MATH (1001 or 1901) and (1002 or 1902) and (1003 or 1903). N) May not be counted with MATH 2901.			February
MATH 2002 Matrix Applications	4	P) MATH 1002 or 1902 or Distinction in MATH 1012. N) May not be counted with MATH 2902.			February
MATH 2005 Fourier Series and Differential Equations	4	P) MATH (1001 or 1901) and MATH (1002 or 1902) and MATH (1003 or 1903). N) May not be counted with MATH 2905.			July
PHYS 2203 Physics 2EE	4				July
Third Year					
ELEC 3102 Engineering Electromagnetics	4	A) PHYS 2203 Physics 2EE and ELEC 2101 Circuit Analysis.			February
ELEC 3302 Fundamentals of Feedback Control	4	A) ELEC 2301 Signals and Systems. N) MECH3800 Systems Control and CHNG3302 Process Control.			February
ELEC 3401 Electronic Devices and Circuits	4	A) ELEC2401 Introductory Electronics, and ELEC2101 Circuit Analysis.			February
ELEC 3402 Communications Electronics	4	A) ELEC3401 Electronic Devices and Circuits.			July
ELEC 3502 Random Signals and Communications	4	A) ELEC2301 Signals and Systems.			February
ELEC 3503 Introduction to Digital Communications	4	A) ELEC2301 Signals and Systems.			July
ELEC 3601 Digital Systems Design	4	A) ELEC2601 Microcomputer Systems or COMP2001 Computer Systems.			July
Fourth Year					
ELEC 4303 Digital Signal Processing	4	A) ELEC2301 Signals and Systems.			February
ELEC 4501 Data Communication Networks	4	A) ELEC 3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			February
ELEC 4502 Digital Communication Systems	4	A) ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			February
ELEC 4702 Practical Experience	0				February
ELEC 4703 Thesis	12	P) A minimum of 36 credit points from third or fourth year units of study.			July

Notes

For units of study offered by other than the Faculty of Engineering, any assumed knowledge, prerequisites and corequisites will be as prescribed by that faculty.

(*) PHYS 1203 Physics 1EE is an acceptable alternative to PHYS 1003 (Technological).

Resolutions of the Faculty of Engineering relating to Table 9**BE (Telecommunications Engineering)**

In addition to gaining credit for the 140 credit points of core units of study set out in Table 9, candidates are required to complete at least 32 credit points of units of study (at least 20 of which must be at the 4 or 5 level) from the table of recommended elective units of study for BE (Telecommunications Engineering). Further credit for a total of not less than 192 credit points shall be gained by completing additional elective units of study approved by the Faculty.

BE (Telecommunications Engineering)/BSc or BA

In addition to gaining credit for the 140 credit points of core units of study set out in Table 9, candidates are required to complete at least 20 credit points of units of study (at least 12 of which must be at the 4 or 5 level) from the table of recommended elective units of study for BE (Telecommunications Engineering).

Candidates for combined degrees should refer to the Joint Resolutions of the Faculty of Engineering and the faculty in which they are undertaking the combined degree program.

Table 9: Telecommunications Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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BE (Telecommunications Engineering)/BCom

In addition to gaining credit for the 140 credit points of core units of study set out in Table 9, candidates are required to complete at least 20 credit points of units of study (at least 12 of which must be at the 4 or 5 level) from the table of recommended elective units of study for BE (Telecommunications Engineering).

Candidates are also required to complete at least 100 credit points of units of study in the Faculty of Economics and Business (listed in Table A for the Bachelor of Commerce degree). The 20 credit points of Computer Science units of study in Table 9 may be counted in the 100 credit points and may be used to satisfy the requirement for a minor (or second major) for the Bachelor of Commerce. No other units of study in Table 9 or the table of recommended electives may be counted in the 100 credit points or used to satisfy a minor or major.

Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the Faculty of Economics and Business for additional information.

Acceptable alternative units of study

Most Mathematics, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent Advanced level unit of study subject to prerequisite conditions (as required by the Faculty of Science) being met.

BE (Telecommunications Engineering) recommended elective units of study**Third Year**

COMP 3100 Software Engineering	4	P) COMP 2004 or 2904. N) May not be counted with COMP 3800. <i>NB: Change to semester availability subject to Faculty approval.</i>			July
ELEC 3101 Circuit Theory and Design	4	A) ELEC2101 Circuit Analysis, MATH2005 Fourier Series and Differential Equations.			July
ELEC 3403 Switching Devices and High Speed Electronics	4	A) ELEC 3401 Electronic Devices and Circuits.			July

Fourth Year

ELEC 4401 Electronic Design	4	A) ELEC2301 Signals and Systems, and ELEC3302 Fundamentals of Feedback Control and ELEC3401 Electronic Devices and Circuits.			February
ELEC 4503 Error Control Coding	4	A) ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			February
ELEC 4601 Computer Design	4	A) ELEC3403 Switching Devices and High Speed Electronics, and ELEC3601 Digital Systems Design.			February
ELEC 4602 Real Time Computing	4	A) ELEC3601 Digital Systems Design, and COMP3100 Software Engineering.			February
ELEC 5501 Advanced Communication Networks	4	A) ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications, and ELEC4501 Data Communication Networks.			July
ELEC 5502 Satellite Communication Systems	4	A) ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications, and ELEC4502 Digital Communication Systems.			July
ELEC 5503 Optical Communication Systems	4	A) ELEC3402 Communications Electronics, and ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			July
ELEC 5504 Cellular Radio Engineering	4	A) ELEC 3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			July
ELEC 5505 Spread Spectrum CDMA for Mobile Communications	4	A) ELEC 3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			February
ELEC 5606 Multimedia Systems and Applications	4	A) COMP3100 Software Engineering, ELEC 4303 Digital Signal Processing, and ELEC 4501 Data Communication Systems.			July
ELEC 5609 Internet Engineering	4	A) ELEC4501 Data Communication Networks.			July
ELEC 5610 Computer and Network Security	4	A) ELEC4601 Computer Design and ELEC4501 Data Communication Networks.			July

Notes

For units of study offered by a faculty other than the Faculty of Engineering, any assumed knowledge, prerequisites and corequisites, will be as prescribed by that faculty.

The units of study in this table may not all be available in a particular year.

Table 10: Software Engineering

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
Candidates for the degree of Bachelor of Engineering in Software Engineering, and candidates for the combined degree courses of Bachelor of Engineering in Software Engineering with Bachelor of Art or Bachelor of Science or Bachelor of Commerce, are required to gain credit for the core units of study set out below. Any additional credit necessary to satisfy Section 9 shall be gained by completing additional elective units of study as prescribed by the Faculty.					
Software Engineering core units of study					
First Year					
COMP 1001	Introductory Programming	6	A) HSC 3-unit Mathematics. C) Students intending to major in Computer Science are advised to enrol in MATH 1003 and 1004 or 1004 and 1005 or 1903 and 1904 or 1904 and 1905 in their first year. N) May not be counted with COMP 1901.		February, July
COMP 1002	Introductory Computer Science	6	P) COMP 1001 or 1901. N) May not be counted with COMP 1902.		February, July
ELEC 1101	Foundations of Computer Systems	6	A) HSC Maths 3 unit.		February
ELEC 1102	Foundations of Electronic Circuits	6	A) HSC Physics 2 unit and MATH1001 Differential Calculus. N) ELEC 1001 Introductory Electrical Engineering, and ELEC2002 Electrical Technology.		July
MATH 1001	Differential Calculus	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1901 or 1011.		February
MATH 1002	Linear Algebra	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1902 or 1012.		February
MATH 1003	Integral Calculus and Modelling	3	A) HSC 4-unit Mathematics or MATH 1001. N) May not be counted with MATH 1903 or 1013.		July
MATH 1004	Discrete Mathematics	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1904.		July
PHYS 1003c)	Physics (Technological)	6	A) HSC 2-unit Physics or HSC 4-unit Science or PHYS 1001 or 1002 or 1901 or equivalent. C) Recommended concurrent units: MATH 1003 and 1005 or 1903 and 1905. N) May not be counted with PHYS 1004 or 1902.		February, July
Second Year					
COMP 2002	Design and Data Structures	4	Q) COMP 1002 or 1902. N) May not be counted with COMP 2902. NB: See prerequisites for Senior Computer Science units of study. Consult Departmental Handbook.		February
COMP 2004	Programming Practice	4	Q) COMP 1002 or 1902. N) May not be counted with COMP 2904. NB: See prerequisites for Senior Computer Science units of study. Consult Departmental Handbook.		July
ELEC 2301	Signals and Systems	4	A) MATH1001 Differential Calculus, and MATH1002 Linear Algebra, and MATH1003 Integral Calculus and Modelling, and MATH1004 Discrete Mathematics. N) MATH3103 Signal Processing and MATH3809 Signal Processing (Adv).		July
ELEC 2401	Electronic Devices and Circuits	4	A) ELEC 1102 Foundations of Electronic Circuits. N) ELEC2001 Electrical and Electronic Engineering, and ELEC2002 Electrical Technology, and ELEC2003 Electrical and Electronic Engineering A.		July
ELEC 2601	Microcomputer Systems	4	A) ELEC 1101 Foundations of Computer Systems. N) ELEC2001 Electrical and Electronic Engineering.		February
INFO 2000	System Analysis and Design	4	Q) INFO 1000 or COMP 1000 or COMP 1001 or COMP 1901. N) May not be counted with COMP 2000.		February
MATH 2001	Vector Calculus and Complex Variables	4	P) MATH (1001 or 1901) and (1002 or 1902) and (1003 or 1903). N) May not be counted with MATH 2901.		February

Table 10: Software Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
MATH 2002 Matrix Applications	4	P) MATH 1002 or 1902 or Distinction in MATH 1012. N) May not be counted with MATH 2902.			February
MATH 2005 Fourier Series and Differential Equations	4	P) MATH (1001 or 1901) and MATH (1002 or 1902) and MATH (1003 or 1903). N) May not be counted with MATH 2905.			July
Third Year					
COMP 3001 Algorithms	4	Q) COMP 2002 or 2902. P) MATH 1004 or 1904 and 8 credit points in Intermediate Mathematics and/or Statistics and/or Econometrics. N) May not be counted with COMP 3901. <i>NB: Change to semester availability subject to Faculty approval.</i>			July
COMP 3007 Networked Systems	4	Q) COMP 2004 or 2904. P) COMP 2001 or 2901 or ELEC 2601. N) May not be counted with COMP 3907.			February
COMP 3008 Object-Oriented Systems	4	Q) COMP 2004 or 2904. N) May not be counted with COMP3908.			February
COMP 3009 Operating Systems	4	Q) COMP 2004 or 2904. P) COMP 2001 or 2901 or ELEC 2601. N) May not be counted with COMP 3909.			February
COMP 3100 Software Engineering	4	P) COMP 2004 or 2904. N) May not be counted with COMP 3800. <i>NB: Change to semester availability subject to Faculty approval.</i>			July
COMP 3205 Product Development Project	4	P) COMP 3008. C) Students intending to major in Computer Science are advised to enrol in one of COMP 3201, 3202, 3203, 3204 or 3205, 3206 or 3809.			February, July
ELEC 3601 Digital Systems Design	4	A) ELEC2601 Microcomputer Systems or COMP2001 Computer Systems.			July
Fourth Year					
COMP 4405 Formal Methods	4				
ELEC 4602 Real Time Computing	4	A) ELEC3601 Digital Systems Design, and COMP3100 Software Engineering.			February
ELEC 4604 Engineering Software Requirements	4	A) ELEC 3601 Digital Systems Design, ELEC 3701 Management for Engineers, COMP3100 Algorithms, COMP3205 Product Development Project.			July
ELEC 4702 Practical Experience	0				February
ELEC 4704 Software Project Management	4	A) ELEC3701 Management for Engineers, COMP 3100 Algorithms, and COMP3205 Product Development Project.			February
ELEC 4703 Thesis	12	P) A minimum of 36 credit points from third or fourth year units of study.			July

Notes

For core units of study offered by other than the Faculty of Engineering, any assumed knowledge, prerequisite and corequisite requirements will be as prescribed by that faculty.

(*) PHYS 1203 Physics 1EE is an acceptable alternative to PHYS 1003 (Technological).

Resolutions of the Faculty of Engineering relating to Table 10**BE (Software Engineering)**

In addition to gaining credit for the 134 credit points of core units of study set out in Table 10, candidates are required to complete at least 38 credit points of units of study (at least 20 of which are at the 4 or 5 level) from the table of recommended elective units of study for BE(Software Engineering). Further credit for a total of not less than 192 credit points shall be gained by completing additional elective units of study approved by the Faculty.

Table 10: Software Engineering - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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BE (Software Engineering)/BSc or BA

In addition to gaining credit for the 134 credit points of core units of study set out in Table 10, candidates must complete at least 26 credit points of units of study (at least 12 of which are at the 4 or 5 level) from the table of recommended elective units of study for BE(Software Engineering).

Candidates for combined degrees should refer to the Joint Resolutions of the Faculty of Engineering and the faculty in which they are undertaking the combined degree program.

BE (Software Engineering)/BCom

In addition to gaining credit for the 134 credit points of core units of study set out in Table 10, candidates must complete at least 26 credit points of units of study (at least 12 of which are at the 4 or 5 level) from the table of recommended elective units of study for BE(Software Engineering).

Candidates are also required to complete at least 100 credit points of units of study in the Faculty of Economics and Business (listed in Table A for the Bachelor of Commerce degree). The Computer Science units of study in Table 10 may be counted, to a maximum of 20 credit points, in the 100 credit points. They may also be used to satisfy the requirement for a minor (or second major) for the Bachelor of Commerce. No other units of study in Table 10 or the table of recommended electives may be counted in the 100 credit points or used to satisfy a minor or major.

Candidates should refer to the Joint Resolutions of the Faculty of Engineering and the Faculty of Economics and Business for additional information.

Acceptable alternative units of study

Most Mathematics, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent Advanced level unit of study subject to prerequisite conditions (as required by the Faculty of Science) being met.

BE (Software Engineering) recommended elective units of study**Third Year**

COMP 3004	Computer Graphics	4	Q) COMP 2004 or 2904. P) COMP 2002 or 2902 and MATH 1002 or 1902 and 8 credit points in Intermediate Mathematics and/or Statistics and/or Econometrics. N) May not be counted with COMP 3904.		July
COMP 3102	User Interfaces Design and Programming	4	Q) COMP 2004 or 2904. N) May not be counted with COMP 3802.		July
COMP 3204	Software Engineering Project	4	C) COMP 3100 or 3800. <i>NB: Changes to unit of study title, description, semester availability, prerequisites and corequisites subject to Faculty approval.</i>		July
ISYS 3000	Management of Information Systems	4	Q) INFO 2000 or COMP 2000.		July
ELEC 3103	Electrical Engineering Design	4	A) ELEC2101 Circuit Analysis, and ELEC2401 Introductory Electronics, and ELEC 2301 Signals and Systems, and ELEC2601 Microcomputer Systems.		July
ELEC 3302	Fundamentals of Feedback Control	4	A) ELEC 2301 Signals and Systems. N) MECH3800 Systems Control and CHNG3302 Process Control.		February
ELEC 3401	Electronic Devices and Circuits	4	A) ELEC2401 Introductory Electronics, and ELEC2101 Circuit Analysis.		February
ELEC 3502	Random Signals and Communications	4	A) ELEC2301 Signals and Systems.		February
ELEC 3503	Introduction to Digital Communications	4	A) ELEC2301 Signals and Systems.		July

Fourth Year

COMP 4300	Information Systems (Advanced Topic)	4	P) Credit in COMP3000 Management of Information Systems.		
COMP 4305	Networked Systems (Advanced Topic)	4	P) Credit in COMP3007 Networked Systems.		
COMP 4307	Distributed Systems (Advanced Topic)	4	P) Credit in (COMP3007 Networked Systems or COMP 3009 Operating Systems).		
COMP 4309	Object-Oriented Systems (Advanced Topic)	4	P) Credit in COMP3008 Object-Oriented Systems.		
COMP 4400	Operating Systems (Advanced Topic)	4	P) Credit in COMP3009 Operating Systems.		

Table 10: Software Engineering - continued

Unit of study	Credil pointss	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
COMP 4401 Software engineering (Advanced Topic)	4	P) Credit in COMP3100	Software Engineering.		
ELEC 4302 Image Processing and Computer Vision	4	A) ELEC2301 Signals and Systems, and ELEC4303 Digital Signal Processing.			<i>July</i>
ELEC 4501 Data Communication Networks	4	A) ELEC 3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			<i>February</i>
ELEC 4601 Computer Design	4	A) ELEC3403 Switching Devices and High Speed Electronics, and ELEC3601 Digital Systems Design.			<i>February</i>
ELEC 5601 Advanced Real Time Computing	4	A) ELEC4602 Real Time Computing.			<i>July</i>
ELEC 5602 Advanced Computer Architecture	4	A) ELEC4601 Computer Design and (COMP2001 Computer Systems or COMP2901 Computer Systems Adv).			<i>July</i>
ELEC 5606 Multimedia Systems and Applications	4	A) COMP3100 Software Engineering, ELEC 4303 Digital Signal Processing, and ELEC 4501 Data Communication Systems.			<i>July</i>
ELEC 5609 Internet Engineering	4	A) ELEC4501 Data Communication Networks.			<i>July</i>
ELEC 5610 Computer and Network Security	4	A) ELEC4601 Computer Design and ELEC4501 Data Communication Networks.			<i>July</i>

Notes

For units of study offered by a faculty other than the Faculty of Engineering, any assumed knowledge, prerequisites and corequisites, will be as prescribed by that faculty

The units of study in this table may not all be available in a particular year.

Table 11: Mechanical Engineering (Biomedical)

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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Candidates for the degree of Bachelor of Engineering in Mechanical Engineering (Biomedical) are required to gain credit for the core units of study set out below. Any additional credit necessary to satisfy Section 9 shall be gained by completing additional credit points of elective units of study, as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points. See note (1) relating to core units of study offered by faculties other than Engineering.

Mechanical Engineering (Biomedical) core units of study

First Year

AERO 1800	Computational Engineering 1D	3				July
BIOL 1001	Concepts in Biology	6	A) HSC 2-unit Biology course. N) May not be counted with BIOL 1901.			February
BIOL 1003	Human Biology	6	A) HSC 2-unit Biology course. N) May not be counted with BIOL 1903.			July
CHEM 1401	Chemistry 1E	6	P) Mathematics 2-unit course and a satisfactory knowledge of 2-unit Chemistry or the Chemistry component of the 3 or 4-unit Science HSC course. N) CHEM 1101, CHEM 1102.			February
ELEC 1001	Introductory Electrical Engineering	4	A) MATH1001 Differential Calculus. N) ELEC1102 Foundations of Electronic Circuits, and ELEC2002 Electrical Technology.			July
MATH 1001	Differential Calculus	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1901 or 1011.			February
MATH 1002	Linear Algebra	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1902 or 1012.			February
MATH 1003	Integral Calculus and Modelling	3	A) HSC 4-unit Mathematics or MATH 1001. N) May not be counted with MATH 1903 or 1013.			July
MATH 1005	Statistics	3	A) HSC 2-unit Mathematics. N) May not be counted with MATH 1905 or 1015.			July
MECH 1500	Mechanical Engineering 1	6	N) MECH 1501 Engineering Statics.			February
MECH 1510	Kinematics and Dynamics	6	N) MATH 1051 Mechanics 1E.			July
MECH 1800	Computational Engineering 1A	7	N) MECH 1801 Computational Engineering 1C.			February

Second Year

AERO 2201	Fluid Mechanics	4	N) Mutually exclusive with AERO2200 Introductory Aerodynamics, AERO2700 Space Engineering 1.			July
AERO 2300	Mechanics of Solids 1	4	P) 12 credit points of first year Maths (i.e Maths 1001,1002,1003,1005).			February
ELEC 2401	Electronic Devices and Circuits	4	A) ELEC1102 Foundations of Electronic Circuits. N) ELEC2001 Electrical and Electronic Engineering, and ELEC2002 Electrical Technology, and ELEC2003 Electrical and Electronic Engineering A.			July
MATH 2001	Vector Calculus and Complex Variables	4	P) MATH (1001 or 1901) and (1002 or 1902) and (1003 or 1903). N) May not be counted with MATH 2901.			February
MATH 2002	Matrix Applications	4	P) MATH 1002 or 1902 or Distinction in MATH 1012. N) May not be counted with MATH 2902.			February
MATH 2005	Fourier Series and Differential Equations	4	P) MATH (1001 or 1901) and MATH (1002 or 1902) and MATH (1003 or 1903). N) May not be counted with MATH 2905.			July
MATH 2052	Numerical Methods	2	C) MATH 2001 or 2901. N) MATH 2952.			July
MECH 1600	Manufacturing Technology	4	N) AERO 1600 Workshop Technology.			July
MECH 2201	Thermodynamics 1	4	N) MECH 2200 Thermofluids.			February

Table 11: Mechanical Engineering (Biomedical) - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
MECH 2300 Materials 1	4		N) CIVL 2101 Properties of Materials.		July
MECH 2400 Mechanical Design 1	6				July
MECH 2500 Engineering Dynamics 1	4		P) MATH 1001, 1002 and MECH 1510 Kinematics and Dynamics.		July
MECH 2900 Anatomy and Physiology for Engineers	4		P) Biology BIOL 1001 or some previous biology experience.		February
Third Year					
ELEC 3801 Fundamentals of Biomedical Engineering	4	A) ELEC2401 Introductory Electronics or ELEC2001 Electrical and Electronic Engineering or ELEC2003 Electrical and Electronic Engineering A.			February
MECH 3210 Fluid Mechanics	4		P) AERO 2201 Fluid Mechanics, AERO 2200 Introductory Aerodynamics or MECH 2202 Fluids 1.		July
MECH 3300 Materials 2	4		P) MECH 2300 Materials 1 & AERO 2300 Mechanics of Solids 1.		July
MECH 3310 Mechanics of Solids 2	4		P) AERO 2300 Mechanics of Solids 1 and MATH 2005.		February
MECH 3400 Mechanical Design 2A	4		P) MECH 2400 Mechanical Design 1.		February
MECH 3410 Mechanical Design 2B	4		P) MECH 2400 Mechanical Design 1.		July
MECH 3500 Engineering Dynamics 2	4		P) MECH 2500 Engineering Dynamics 1 and (MATH 2001 & MATH 2005).		February
MECH 3600 Manufacturing Engineering	6		P) MECH 1600 Manufacturing Technology.		February
MECH 3620 Industrial Management	5				July
MECH 3800 Systems Control	4		P) MATH 2001 and MATH 2005.		July
MECH 3910 Biomedical Technology	3				February
MECH 3920 Biomedical Design Project	2		N) MECH 3610 Team Project.		July
Fourth Year					
ELEC 4801 Biomedical Engineering Systems	4	A) ELEC3801 Fundamentals of Biomedical Engineering.			July
MECH 4101 Thesis A	0		P) 36 credit points of Third Year units of study.		February, July
MECH 4102 Thesis B	12		P) MECH 4101 Thesis A (the Head of Department may allow Thesis A as corequisite in exceptional circumstances).		February, July
MECH 4110 Professional Engineering	4		P) 36 credit points of Senior units of study.		February
MECH 4120 Professional Communication	4		P) 32 credit points of third year units of study.		July
MECH 4130 Practical Experience	0		P) 28 credit points of second year units of study.		February, July
MECH 4900 Orthopaedic Engineering	4		P) MECH 3300 Materials 2 and MECH 3310 Mechanics of Solids 2.		July
MECH 4910 Biomaterials and Biomechanics	4		P) 36 credit points of third year units of study.		February

Table 11: Mechanical Engineering (Biomedical) - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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Notes

1. For core units of study offered by faculties other than the Faculty of Engineering, any assumed knowledge, prerequisite and corequisite requirements will be as prescribed by that faculty.
2. These units of study are core for candidates for the degree of Bachelor of Engineering in Mechanical Engineering (Biomedical) and the combined degree BE/BSc, but not for candidates for the combined degrees BE/BCom and BE/BA.
3. Candidates for the combined degree BE/BSc may take as an alternative to CHEM 1401 other units of study from the Faculties of Science or Health Sciences, up to 12 credit points and subject to timetabling constraints.

Resolutions of the Faculty of Engineering relating to Table 11

Candidates for the degree of Bachelor of Engineering in Mechanical Engineering (Biomedical) and candidates for the degree of Bachelor of Engineering in Mechanical Engineering (Biomedical) combined with Bachelor of Science are required to gain credit for all core units of study set out in Table 11. Additional credit necessary to satisfy Section 9 shall be gained by completing at least 4 credit points of elective units of study.

Candidates for the degree of Bachelor of Engineering in Mechanical Engineering (Biomedical) combined with Bachelor of Arts or Bachelor of Commerce are required to gain credit for all core units of study set out in Table 6 except those marked as (2).

Acceptable alternative units of study

Pursuant to Resolution 3, the Faculty has prescribed the following acceptable alternatives to core units of study listed in Table 11.

	Acceptable alternative
AERO 1800 Computational Engineering 1D	COMP 1001
CHEM 1401 Chemistry 1E	CHEM 1101
MECH 1510 Kinematics and Dynamics	PHYS 1001
MECH 1810 Computational Engineering 1B	COMP 1001

Note

Most Mathematics, Chemistry, Physics and Computer Science units of study offered by the Faculty of Science can be replaced by an equivalent Advanced Level unit of study subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing Advanced Levels should seek advice from their Department before enrolling. Resolutions of the Department of Mechanical and Mechatronic Engineering relating to Table 11. Units of study not included in this table may also be selected subject to the approval of the Head of Department, Mechanical and Mechatronic Engineering.

BE Mechanical Engineering (Biomedical) recommended elective units of study

AERO 4301 Applied Numerical Stress Analysis	6	P) MECH 3310 Mechanics of Solids 2. N) AERO 4300 Aircraft Structures 3.	<i>February</i>
ASNS 2601 Asian Studies 1A (Japanese)	4		<i>February</i>
ASNS 2602 Asian Studies 1B (Japanese)	4	P) ASNS 2601.	<i>July</i>
ASNS 2603 Asian Studies 2A (Japanese)	4	P) ASNS2602.	<i>February</i>
ASNS 2604 Asian Studies 2B (Japanese)	4	P) ASNS2603.	<i>July</i>
BCHM 2001 Genes and Proteins	8	Q) 6 credit points of Junior Chemistry which must include one of CHEM 1101, 1102, 1901, 1902, 1903, 1904 or, with the permission of the Head of Department, exceptional performance in CHEM 1001 or 1002. N) May not be counted with AGCH 2001 or BCHM 2101 or 2901.	<i>February</i>
ENGG 4001 Innovation and International Competitiveness	4		<i>February</i>
MECH 4210 Computational Fluid Dynamics	4	P) MECH 3210 Fluid Mechanic.	<i>July</i>
MECH 4230 Environmental Acoustics and Noise Control	2	P) 24 credit points of third year units of study. N) MECH 4220 Environmental Engineering, MECH 4220 Environmental Engineering.	<i>February</i>
MECH 4240 Energy and the Environment	4	P) 24 credit points of Senior units of study. N) MECH4220 Environmental Engineering.	<i>February</i>

Table 11: Mechanical Engineering (Biomedical) - continued

Unit of study	Credit points:	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
MECH 4310 Advanced Engineering Materials	6	P) MECH 3300 Materials 2. N) MECH 4315 Advanced Aerospace Materials.			July
MECH 4610 Industrial and Engineering Management	2	P) MECH 3620 Industrial Management. N) MECH 4605 Industrial Engineering.			February
MECH 4620 Industrial Ergonomics	2	N) MECH 4605 Industrial Engineering.			February
MECH 4635 Introduction to Operations Research	4	P) MATH 2001 and MATH 2005. N) MECH 4605 Industrial Engineering.			February
MICR 2001 Introductory Microbiology	8	Q) BIOL 1002 or 1902 or 1003 or 1903. P) CHEM 1102 or 1902 or 1904. C) BIOL 1001 or 1901 and CHEM 1101 or 1901 or 1903 and MATH (1001 or 1011 or 1901) and (1005 or 1015 or 1905). N) May not be counted with MICR 2003 or 2901.			February

Table 12: Aeronautical Engineering (Space Engineering)

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
Aeronautical Engineering (Space Engineering) core units of study					
First Year					
AERO 1600 Workshop Technology	4	N) MECH 1600.			<i>February</i>
AERO 1700 Introduction to Space Engineering	3	N) Mutually exclusive with AERO 1900 Introduction to Aeronautics.			<i>February</i>
ELEC 1102 Foundations of Electronic Circuits	6	A) HSC Physics 2 unit and MATH1001 Differential Calculus. N) ELEC1001 Introductory Electrical Engineering, and ELEC2002 Electrical Technology.			<i>July</i>
MATH 1001 Differential Calculus	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1901 or 1011.			<i>February</i>
MATH 1002 Linear Algebra	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1902 or 1012.			<i>February</i>
MATH 1003 Integral Calculus and Modelling	3	A) HSC 4-unit Mathematics or MATH 1001. N) May not be counted with MATH 1903 or 1013.			<i>July</i>
MATH 1004(1) Discrete Mathematics	3	A) HSC 3-unit Mathematics. N) May not be counted with MATH 1904.			<i>July</i>
MECH 1501 Engineering Statics	4	N) MECH 1500 Mechanical Engineering 1.			<i>February</i>
MECH 1800 1A Computational Engineering	7	N) MECH 1801 Computational Engineering 1C.			<i>February</i>
Second Year					
AERO 2300 Mechanics of Solids 1	4	P) 12 credit points of first year Maths (i.e Maths 1001,1002,1003,1005).			<i>February</i>
AERO 2700 Space Engineering 1	6	N) Mutually exclusive with AERO2200 Introductory Aerodynamics, AERO2201 Fluid Mechanics, AERO2500 Intro. Flight Mech. and Performance.			<i>July</i>
MATH 2001 Vector Calculus and Complex Variables	4	P) MATH (1001 or 1901) and (1002 or 1902) and (1003 or 1903). N) May not be counted with MATH 2901.			<i>February</i>
MATH 2005 Fourier Series and Differential Equations	4	P) MATH (1001 or 1901) and MATH (1002 or 1902) and MATH (1003 or 1903). N) May not be counted with MATH 2905.			<i>July</i>
MECH 2201 Thermodynamics 1	4	N) MECH 2200 Thermofluids.			<i>February</i>
MECH 2300 Materials 1	4	N) CIVL 2101 Properties of Materials.			<i>July</i>
MECH 2400 Mechanical Design 1	6				<i>July</i>
MECH 2500 Engineering Dynamics 1	4	P) MATH 1001, 1002 and MECH 1510 Kinematics and Dynamics.			<i>July</i>
Third Year					
AERO 3301 Aerospace Structures 1	4	P) AERO 2300 Mechanics of Solids 1. N) Mutually exclusive with AERO3300 Aircraft Structures 1.			<i>February</i>
AERO 3351 Aerospace Structures 2	4	P) AERO 2300 Mechanics of Solids 1. N) Mutually exclusive with AERO3350 Aircraft Structures 2.			<i>July</i>
AERO 3401 Aerospace Design 1	4	P) MECH 2400 Mechanical Design 1. N) Mutually exclusive with AERO 3400 Aircraft Design 1.			<i>February</i>
AERO 3500 Flight Mechanics 1	4	P) AERO 2500.			<i>July</i>
AERO 3700 Space Engineering 2	8	P) : AERO2700 Space Engineering 1.			<i>July</i>
ELEC 3102 Engineering Electromagnetics	4	A) PHYS 2203 Physics 2EE and ELEC 2101 Circuit Analysis.			<i>February</i>
ELEC 3401 Electronic Devices and Circuits	4	A) ELEC2401 Introductory Electronics, and ELEC2101 Circuit Analysis.			<i>February</i>

Table 12: Aeronautical Engineering (Space Engineering) - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
ELEC 3402 Communications Electronics	4	A) ELEC3401 Electronic Devices and Circuits.			July
MECH 3201 Thermodynamics 2	4	P) MECH 2200 Thermofluids or MECH 2201 Thermodynamics 1. N) MECH 3200 Thermal Engineering 1.			February
MECH 3300 Materials 2	4	P) MECH 2300 Materials 1 & AERO 2300 Mechanics of Solids 1.			July
MECH 3500 Engineering Dynamics 2	4	P) MECH 2500 Engineering Dynamics 1 and (MATH 2001 & MATH 2005).			February
Fourth Year					
AERO 4201 Propulsion	4	P) MECH 3201.			July
AERO 4302 Aerospace Structures 3	5	P) AERO 3351 Aerospace Structures 1. N) Mutually Exclusive with AERO 4301 Applied Numerical Stress Analysis; AERO 4300 Aircraft Structures 3.			February
AERO 4351 Aerospace Structures 4	3	P) AERO 3351 Aerospace Structures 2. N) Mutually Exclusive with AERO 4350 Aircraft Structures 4.			July
AERO 4400 Aircraft Design 3	6	P) AERO 3450.			February
AERO 4500 Flight Mechanics 2	6	P) AERO 3500.			February
AERO 4600 Practical Experience	0				July
AERO 4700 Space Engineering 3	4	P) AERO3700 Space Engineering 2.			February
AERO 4900 Thesis or Design Project	10	P) 40 credit points of Senior Subjects.			Full Year (starts Feb)
AERO 4920 Seminar	2	P) 40 credit points of Senior Subjects.			July

Notes

1. MATH 1005 Statistics is an acceptable alternative to MATH 1004.

Resolutions of the Faculty of Engineering relating to the above Table**Degree eligibility****BE(Aeronautical)(Space Engineering)**

In addition to gaining credit for the 160 credit points of core units of study set out in the above table, candidates are required to complete at least 32 credit points of elective units of study from Table 2, recommended elective units of study for BE(Aeronautical)(Space Engineering). A minimum of 192 credit points is required to be eligible for the award of the degree of BE(Aeronautical)(Space Engineering).

Acceptable alternative units of study

Most units of study offered by the Faculty of Science shown in the tables can be replaced by an equivalent Advanced level unit, subject to prerequisite conditions (as required by the Faculty of Science) being met. Students considering doing Advanced options should seek advice from their Department before enrolling.

Students undertaking Study Abroad in their final year of the degree must enrol in the AERO 4620 Aeronautical International Exchange Program unit of study as an alternative to a semester's standard units.

Aeronautical Engineering (Space Engineering) recommended elective units of study**First Year**

PHYS 1003 Physics (Technological)	6	A) HSC 2-unit Physics or HSC 4-unit Science.			July
PHYS 1500 Astronomy	6	A) No assumed knowledge of Physics.			July

Second Year

AERO 2800 Aeronautical Engineering Computing	4				February
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Table 12: Aeronautical Engineering (Space Engineering) - continued

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
ELEC 2101 Circuit Analysis	4	A) ELEC 1102 Foundations of Electronic Circuits. N) ELEC2001 Electrical and Electronic Engineering, and ELEC2002 Electrical Technology, and ELEC2003 Electrical and Electronic Engineering A.			<i>February</i>
ELEC 2401 Electronic Devices and Circuits	4	A) ELEC1102 Foundations of Electronic Circuits. N) ELEC2001 Electrical and Electronic Engineering, and ELEC2002 Electrical Technology, and ELEC2003 Electrical and Electronic Engineering A.			<i>July</i>
MATH 2002 Matrix Applications	4	P) MATH 1002 or 1902 or Distinction in MATH 1012. N) May not be counted with MATH 2902.			<i>February</i>
MATH 2052 Numerical Methods	2	C) MATH 2001 or 2901. N) MATH 2952.			<i>July</i>
Third Year					
AERO 3501 Flying Operations	2	P) AERO 2500, AERO 2201 or AERO 2200.			
AERO 3601 Aviation Operation and Management	3				<i>July</i>
Fourth Year					
AERO 4250 Aerodynamics 4	3	P) AERO 3250.			<i>July</i>
AERO 4290 Rotary Wing Aircraft	4	P) AERO 3250.			<i>February</i>
AERO 4291 Advanced Computational Aerodynamics	3	P) AERO 3250.			<i>July</i>
AERO 4292 Aeroelasticity	3	P) AERO 3250.			<i>July</i>
AERO 4350 Aircraft Structures 4	3	P) AERO 3350. N) AERO 4301 Applied Numerical Stress Analysis.			<i>July</i>
AERO 4390 Smart Materials and Structures	3	P) AERO3350 Aircraft Structures 2 or AERO3351 Aerospace Structures 2.			<i>July</i>
AERO 4490 Advanced Aircraft Design	4	P) AERO 3450.			<i>July</i>
AERO 4590 Advanced Flight Mechanics	3	P) AERO 3500.			<i>July</i>
ELEC 4502 Digital Communication Systems	4	A) ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications.			<i>February</i>
ELEC 5502 Satellite Communication Systems	4	A) ELEC3502 Random Signals and Communications, and ELEC3503 Introduction to Digital Communications, and ELEC4502 Digital Communication Systems.			<i>July</i>

Notes

- Choice of electives as shown in the above table will depend on subject availability, timetabling and prerequisite conditions.
- Approved elective units of study given by Departments other than Aeronautical may be taken as alternatives, subject to the approval of the head of department.

Table 13: Advanced Engineering and Faculty-wide elective subjects

Unit of study	Credit points	A) Assumed Knowledge C) Corequisite	Q) Qualifying N) Prohibition	P) Prerequisite	Offered
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Candidates for the degree of Bachelor of Engineering in any discipline. These elective subjects are available for advanced engineering students and students in all disciplines of engineering. Any additional credit necessary to satisfy Section 9 shall be gained by completing additional elective units of study, as recommended by the Faculty, as may be necessary to gain credit for a total of not less than 192 credit points. Students are eligible for the advanced stream of engineering by obtaining a UAI of 98+ in the NSW HSC or equivalent, or by obtaining a Distinction average in Years 1 and 2 of their Engineering course, or by obtaining a Distinction average in Years 1 and 2 of their Engineering course.

ENGG 1001 Interdisciplinary Project	12			P) UAI score of at least 98. Students considering this option are advised to see their Head of Department. N) Mutually exclusive with a number of other first year units of study. As these will vary depending on the branch of Engineering, students considering this option are advised to see their Head of Department prior to enrolment.	
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ENGG 2002 Advanced Engineering Project	2			P) Only students who have been named on the Dean's list at the end of Year 1 will be eligible.	
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ENGG 3001 Engineering Technology Education	2			P) Only students who have been named on the Dean's list at the end of Year 2 will be eligible.	
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Students entering the Advanced Engineering stream should discuss this option with their Head of Department or the Dean at enrolment.

ENGG 4002 New Business Creation	4				
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ENGG 4002 New Business Creation	4				
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ENGG 4003 Economic, Social and Ethical Aspects of Engineering	4				
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These units of study are elective units of study available in any discipline of Engineering.

Regulations

Undergraduate degree requirements Bachelor of Engineering Resolutions of the Senate

1. Specialisations

- (1) The degree of Bachelor of Engineering shall be awarded in the following specialisations:
 - (i) Aeronautical Engineering (including Space and Management)
 - (ii) Chemical Engineering (including Bio Process, Environmental and Energy, Process and Computer Systems and Management)
 - (iii) Civil Engineering (including Environmental, Geotechnical, Structural engineering; Construction Management)
 - (iv) Computer Engineering
 - (v) Electrical Engineering (including Management)
 - (vi) Mechanical Engineering (including Management)
 - (vii) Mechanical Engineering (Mechatronics) (including Management)
 - (viii) Mechanical (Biomedical) Engineering
 - (ix) Project Engineering and Management (Civil)
 - (x) Software Engineering
 - (xi) Telecommunications Engineering
- (2) (i) Each specialisation may, with the permission of the Faculty, be undertaken as part of a combined degree program with the Bachelor of Commerce (BCom), Bachelor of Arts (BA) or Bachelor of Science (BSc).
(ii) Resolutions governing the combined degree programs are set out in the Joint Resolutions of the Faculty of Engineering and the Faculties of Science, Economics and Business and Arts.
- (3) The testamur for the degree of Bachelor of Engineering shall specify the specialisation for which it is awarded.
- (4) (i) Graduates in Engineering in any specialisation may be admitted to the program for another specialisation on conditions to be determined by the Faculty.
(ii) Upon satisfactory completion of the program, the candidate shall receive a certificate relating to the additional specialisation.
- (5) A candidate for the BE degree in any specialisation may apply to the Faculty for permission to transfer candidature to any other specialisation.

2. Definitions

For the purposes of these resolutions:

- (1) A "unit of study" shall comprise such lectures, tutorial instruction, essays, exercises and practical work as the Faculty may prescribe.
- (2) To complete a unit of study means:
 - (i) to attend the lectures and any tutorials; and
 - (ii) to complete satisfactorily any essays, exercises and practical work and to pass any final examination; prescribed for that unit of study.
- (3) "Core" unit of study means a unit of study which must be completed in order to qualify for the award of the degree, unless exemption is granted by the Faculty.
- (4) "Elective" unit of study means a unit of study other than a core unit of study.
- (5) "Prerequisite" means a unit of study which must be completed before enrolment in any unit of study for which that unit of study has been prescribed as a prerequisite.

- (6) "Corequisite" means a unit of study in which, unless previously completed, a candidate must enrol concurrently with any unit of study for which that unit of study has been prescribed as a corequisite.

3. Units of Study

- (1) The units of study for the degree shall each have a credit point value.
- (2) The units of study which may be taken for the degree are:
 - (i) the units of study set out in the tables appended to these resolutions; and
 - (ii) such other units of study as are approved by the Faculty.
- (3) The Faculty may prescribe units of study as acceptable alternatives to one or more of the units of study set out in the tables appended to these resolutions.
- (4) The head of the department concerned may accept other work completed by a candidate as the equivalent of a corequisite or prerequisite for any unit of study provided by that Department.
- (5) A candidate may only enrol in units of study in accordance with these resolutions and subject to the constraints of the timetable, unless approval is given by the head of department.

4. Credit

A candidate who has completed a unit of study shall be credited with the credit point value of that unit of study except that:

- (a) a candidate may not receive credit for more than one of such units of study as the Faculty may deem to be mutually exclusive; and
- (b) a candidate may not receive credit for units of study which are deemed to be mutually exclusive with units of study credited toward the Bachelor of Science degree when enrolled in the Faculty of Science under Section 14 of the Resolutions of the Senate relating to the degree of Bachelor of Science.

5. Final Examination

- (1) A final examination shall be prescribed for each unit of study.
- (2) The final examination may consist of such written and/or oral examination(s), exercises, essays or practical work or any combination of these as the Faculty may determine.
- (3) A candidate who has been prevented by duly certified illness or misadventure from sitting for the whole or part of the final examination may be tested at such times and in such a way as the Faculty shall determine. This shall not be regarded as a re-examination.

6. Conditions of Enrolment

- (1) Except with the permission of the Faculty, a candidate in the first year of attendance shall enrol in First Year units of study with a total of not less than 48 credit points and not more than 54 credit points.
- (2) In each subsequent year of attendance after the first, a candidate may enrol in any of the units of study for which there is no prerequisite or for which the candidate has completed the prerequisites provided that:
 - (i) in the second year of attendance the candidate may enrol in First Year and/or Second Year units of study only;
 - (ii) the candidate shall enrol in any core units of study for which he/she was qualified to enrol in the previous year of attendance and for which credit has not yet been gained, and for which the candidate has not been granted exemption under subsection 7(2);
 - (iii) except with Faculty approval, the candidate shall not enrol for units of study totalling more than 60 credit points, nor enrol for units of study totalling less than 36 credit points, unless the candidate already has credit for 156 or more credit points.
- (3) The Faculty may in special circumstances grant dispensation from the requirements of subsections (1) and (2).

- (4) A candidate enrolled in a unit of study provided outside the Faculty of Engineering shall, in respect of that unit of study, be governed by the requirements of the department providing the unit of study.
- (5) A candidate who has been enrolled for the degree of Bachelor of Engineering but who has not re-enrolled for a period of one year or more shall complete the requirements for the degree under such conditions as the Faculty may determine.
- (6) A candidate who re-enrols in a unit of study which the candidate has previously failed to complete shall, unless exempted by the head of department concerned, attend all lectures and other classes and complete all written and other prescribed work.

7. Conditions for Advanced Standing and Credit

- (1) Graduates of other faculties of the University of Sydney, or graduates of other universities, who desire to proceed to the degree of Bachelor of Engineering may be admitted to candidature with credit for such of the units of study set out in the appended tables as the Faculty may determine, up to a maximum of 96 credit points, provided they have completed as part of their previous degree units of study considered by the Faculty to be equivalent.
- (2) Students who have completed units of study in other faculties of the University of Sydney may apply for permission to enrol as candidates for the degree of Bachelor of Engineering. If granted such permission, they may be given credit for any of the units of study set out in the appended tables which have been completed in the other faculties, or for any units of study considered by the Faculty to be equivalent, provided they have abandoned credit for such units of study in the other faculties.
- (3) Students who have completed units of study in another university or institution may apply for permission to enrol as candidates for the degree of Bachelor of Engineering. If granted such permission, they may be given credit for, or exempted from, such of the units of study set out in the appended tables as the Faculty may determine.
- (4) With regard to each of the previous subsections, where an applicant for candidature has completed units of study which are not comparable with any of the units of study set out in the tables appended to these resolutions, the Faculty may grant non-specific credit points. Such credit points will be designated by the Faculty as First Year, Second Year, Third Year or Fourth Year.

8. Levels of Award

- (1) The degree of Bachelor of Engineering shall be awarded in two grades, namely, the Pass degree and the Honours degree.
- (2) (i) There shall be three classes of Honours, namely, Class I, Class II and Class m.
(ii) Second Class Honours may be awarded in two divisions, namely Division 1 and Division 2.
- (3) If a candidate qualifies for the award of the degree with First Class Honours and the Faculty is of the opinion that the candidate's work is of outstanding merit, that candidate shall receive a University Medal.

9. Requirements for the Pass Degree

- (1) To qualify for the award of a Pass degree a candidate shall, unless granted exemption by the Faculty under subsection (2) of this resolution:
 - (i) satisfy the requirements prescribed in those tables appended to these resolutions pertaining to the specialisation which the candidate is pursuing, and
 - (ii) complete additional elective units of study as may be necessary to gain credit for a total of not less than 192 credit points.
- (2) In special circumstances, the Faculty may exempt a candidate from completion of any core unit of study. No credit shall be granted for any such exempted unit of study.
- (3) A candidate who, with the prior permission of the Faculty, completes units of study at another university or

appropriate institution may be given credit for such of the units of study set out in the tables attached to these resolutions as the Faculty may determine.

10. Honours and Prizes

- (1) To qualify for the award of an Honours BE degree a candidate shall:
 - (i) complete the Pass degree requirements;
 - (ii) complete such Honours units of study as may be determined by the head of the department in which the candidate is pursuing the degree; and
 - (iii) attain a level of performance acceptable to the head of department.
- (2) The Faculty may prescribe any Third Year or Fourth Year of study as being an Honours unit of study.
- (3) Where an Honours unit of study and a core unit of study are deemed by the Faculty to be mutually exclusive, completion of the Honours unit of study will be taken as satisfying the core unit of study.
- (4) Except with the permission of the Faculty, a candidate shall not be eligible for the award of an Honours degree unless the candidate has completed all the requirements in minimum time, namely, four years for the BE degree and five years for the combined BE/BSc, BE/BCom or BE/BA degrees.
- (5) A candidate for an Honours degree who has failed to be placed in any Honours classification may be awarded a Pass degree.
- (6) A candidate who has previously failed any unit of study shall not be eligible for any prize or scholarship awarded in connection with that unit of study.

11. Transitional Arrangements

The provisions of these resolutions came into force on 1 January 1998. All candidates who commenced candidature prior to this date shall complete the degree requirements under such conditions as the Faculty may determine.

Combined Degrees of Bachelor of Engineering with Bachelor of Science, Commerce or Arts Resolutions of the Faculty

Minimum and maximum completion times

1. That the minimum time for completion of the BE degree shall be two years and the maximum shall be eight years.

Joint resolutions of the Faculties of Engineering and Arts (BE/BA)

1. Candidature for this combined degree program is a minimum of 5 years of full-time study.
2. Candidates qualify for the award of the two degrees of the combined program (a separate testamur being awarded for both the BE and the BA) by completing the following:
 - (a) The units of study prescribed for the BE specialisation undertaken (totalling 160-162 credit points, depending on the specialisation). These units of study are set out in the tables appended to the Senate Resolutions relating to the BE degree.
 - (b) BA units of study totalling at least 80 credit points, of which at least 56 must be Second or Third Year credit points from Part A of the Table of Units of Study for the BA degree, including a major as defined in the resolutions relating to the BA degree.
3. Candidates may not enrol in any unit of study which is substantially the same as one they have already passed (or in which they are currently enrolled).
4. Candidates will be under the general supervision of the Faculty of Engineering. General supervision covers all areas of policy and procedures affecting candidates, such as combined degree program rules and enrolment procedures. Candidates will be under the supervision of the Faculty of Arts regarding enrolment and progression within the BA

component of the combined degree program, as defined in subsection 2(b).

5. Candidates may qualify for the award of the BE degree with Honours.
6. Candidates who complete the combined degree program may qualify for admission to an honours year in the Faculty of Arts.
7. Candidates who abandon the combined degree program may elect to complete the BE degree or BA degree in accordance with the appropriate Senate Resolutions.
8. The Deans of the Faculties of Engineering and Arts shall jointly exercise authority in any matter concerning this combined degree program not otherwise dealt with in the Senate Resolutions or these joint resolutions.

Joint resolutions of the Faculties of Engineering and Economics and Business (BE/BCom)

1. Candidature for this combined degree program is a minimum of 5 years of full-time study.
2. Candidates qualify for the two degrees of the combined program (a separate testamur being awarded for both the BE and the BCom) by completing the following:
 - (a) The units of study prescribed for the BE specialisation undertaken (totalling 160-162 credit points, depending on the specialisation). These units of study are set out in the tables appended to the Senate Resolutions relating to the BE degree.
 - (b) Units of study in the Faculty of Economics and Business worth at least 108 credit points including:
 - (i) 12 credit points in Accounting;
 - (ii) 12 credit points in Economics or Political Economy;
 - (iii) 12 credit points in Econometrics;
 - (iv) no more than 48 credit points at first-year level; and
 - (v) a major in each of two subject areas as given in Table A of the Bachelor of Commerce degree, or one major and one minor from subjects listed in Table A.

Note that a major is a sequence of 44 credit points as described for each subject in Table A; a minor in a subject comprises a sequence of not less than 28 credit points, including 12 credit points in the subject at first-year level and 16 credit points from later year units of study required to complete a major in that subject.

Candidates will be exempt from taking first-year level Econometrics for the purpose of taking a major or minor sequence in this subject by taking a combination of First Year and Second Year Mathematics and Statistics units of study as prescribed by the Faculty of Economics and Business.
3. Candidates may not enrol in any unit of study which is substantially the same as one they have already passed (or in which they are currently enrolled).
4. Candidates will be under the general supervision of the Faculty of Engineering. General supervision covers all areas of policy and procedures affecting candidates, such as combined degree program rules and enrolment procedures. Candidates will be under the supervision of the Faculty of Economics and Business regarding enrolment and progression within the BCom component of the combined degree program, as defined in subsection 2(b).
5. Candidates may qualify for the award of the BE degree with Honours.
6. Candidates who complete the combined degree program may qualify for admission to an honours year in the Faculty of Economics and Business.
7. Candidates who abandon the combined degree program may elect to complete the BE degree or the BCom degree in accordance with the appropriate Senate Resolutions.
8. The Deans of the Faculties of Engineering and Economics and Business shall jointly exercise authority in any matter concerning this combined degree program not otherwise dealt with in the Senate Resolutions or these joint resolutions.

Previous joint resolution

The previous joint resolutions, which apply to those entering the combined degree as second year students up to and including 1998, appear in Volume 1 of the 1996 Calendar.

Joint resolutions of the Faculties of Engineering and Science (BE/BSc)

1. Candidature for this combined degree program is a minimum of 5 years of full-time study.
2. Candidates qualify for the two degrees of the combined program (a separate testamur being awarded for both the BE and the BSc) by completing at least 240 credit points which must include the following:
 - (a) At least 160 credit points from the units of study prescribed for the BE specialisation undertaken. These units of study are set out in the tables appended to the Senate Resolutions relating to the BE degree.
 - (b) At least 80 credit points from units of study listed in Table 1 for the BSc degree other than those in the Science discipline area of Engineering Science, 32 of which must be from Second Year units of study and 24 of which must be from Third Year units of study in one Science discipline area.
 - (c) The same unit of study cannot be used to satisfy the requirements of (a) and (b) above.
3. Candidates may not enrol in any unit of study which is substantially the same as one they have already passed (or in which they are currently enrolled).
 - (b) The choice of units of study made by a candidate shall be limited by the exigencies of the timetable except that, where two units of study are given wholly or partly at the same time, the heads of the departments concerned may give permission for the candidate to attend equivalent units of study (or parts of units of study) at another time.
4. Candidates will be under the general supervision of the Faculty of Engineering. General supervision covers all areas of policy and procedures affecting candidates, such as combined degree program rules and enrolment procedures. Candidates will be under the supervision of the Faculty of Science regarding enrolment and progression within the BSc component of the combined degree program, as defined in subsection 2(b).
5. Candidates may qualify for the award of BE degree with Honours.
6. Candidates who complete the combined degree program may qualify for admission to an honours year in the Faculty of Science.
7. Candidates who abandon the combined degree program may elect to complete the BE degree in accordance with the appropriate Senate Resolutions.
8. Candidates in the combined degree program may apply for admission to the BSc degree and enrol in such units of study as are required to complete the requirements for the degree. Such candidates shall be deemed to have abandoned the BE/BSc combined degree program.
9. The Deans of the Faculties of Engineering and Science shall jointly exercise authority in any matter concerning this combined degree program not otherwise dealt with in the Senate Resolutions or these joint resolutions.

Student Guide to Regulations

A summary of many of the rules and regulations governing the undergraduate degrees in Engineering is set out below. This is intended to assist students in understanding the rules but is not intended to replace them in any way.

Summary of degree requirements

To become eligible for the award of the degree of Bachelor of Engineering, you must

- complete the core units of study (and satisfy any requirements on recommended electives) of your chosen branch of engineering,
- gain credit for a minimum of 192 credit points,
- complete a period of practical experience in engineering and

- be a candidate for a minimum of two years and a maximum of eight years.

Core and elective units of study

For each of the branches of engineering in which a degree is awarded there is a list of prescribed *core* and recommended *elective* units of study.

A core unit of study is one that must be passed to fulfil the requirements for the degree. An elective unit of study is one that is acceptable as part of the requirements but is not a compulsory unit of study.

The core and recommended elective units of study for each branch of engineering are listed in tables.

Descriptions of each unit of study, in numerical order, are also provided in this document.

Credit point value of Units of study

Each unit of study has a credit point value, which is an approximate measure of the time required for lectures, tutorials and practical classes.

When you pass a unit of study you are credited with its credit point value, except where it is mutually exclusive with a unit of study you have already passed.

Completion of Units of study

In order to complete a unit of study you must: attend the lectures, tutorials and laboratory and practical classes prescribed for the unit of study; complete the exercises, practical work and assignments prescribed; and pass the examination(s) set for the unit of study.

If you have been absent without leave from more than ten percent of the classes in any one semester in a particular unit of study, you may be asked to show cause why you should not be deemed to have failed to complete that unit of study. Should you fail to show cause, you shall be deemed not to have completed that unit of study.

Absence from lectures and other classes

If you are unable to attend lectures and/or practical classes because of illness, accident or for any other reason, you must submit an 'Application for Special Consideration' form. When applicable, a medical certificate or other supporting evidence should be attached. Notification forms for this purpose are available at the Engineering Faculty Office. The forms must be submitted to the Student Centre (Carslaw) within 7 days of the incident, and a copy given to the Department. The Faculty's policy on its handling of Special Consideration applications is available from the Student Enquiry Office.

Minimum number of credit points and rates of progress

To satisfy the requirements for a pass degree you must gain not less than 192 credit points, and satisfy all requirements on core and recommended elective units of study.

The minimum time in which you can qualify for the degree is four years. Some candidates, however, plan to progress at a slower rate, sometimes so that they can take a number of elective units of study.

At present, the BE degree is available on a full-time basis only and students cannot complete the degree requirements on a part-time basis or externally.

Classification into years

Students are classified as being in First Year, Second Year, Third Year or Fourth Year according to the year from which the majority of their credit points are being taken.

Changing your specialisation

Students who wish to change their specialisation (eg from Chemical to Mechanical) must obtain written Faculty approval. Such a change may entail an extra year (or more) of study.

First year enrolment

In your first year of attendance you must enrol in at least 48, and no more than 54, credit points.

Second and later year enrolments

The minimum enrolment for re-enrolling students is normally 36 credit points and the maximum is normally 60 credit points (unless the Faculty has imposed any special conditions on your re-enrolment because of unsatisfactory progress in the previous year).

Enrolments outside the 36 to 60 credit points limit require written Faculty permission.

Second Year students must include in their enrolment any outstanding First year core units of study for their chosen branch of engineering. (Outstanding core units of study are units of study which a student either did not attempt in the previous year, or attempted but did not complete satisfactorily.) Similarly, Third Year students must include in their enrolment any outstanding First Year and Second Year core units of study, etc.

Your enrolment in any outstanding core units of study must generally take priority over your enrolment in higher year units of study and you must not enrol in units of study with timetable clashes.

If you wish to take the opportunity of transferring to the Faculty of Science at the end of your Second (or Third) BE year, you should consult the appropriate Faculty of Science resolutions relating to this double degree.

Advice for students

An academic Year Adviser is appointed for each year in each branch of Engineering. You should consult the noticeboards in your Department and the Student Enquiry Office to find the name and location of your Year Adviser.

Result grades

The Board of Examiners of the Faculty of Engineering is the body which determines BE students' examination results. The Board meets after each semester when it considers the results recommended by the examiners of each unit of study for each student. Official examination result notices are then sent to students.

Satisfactory performance in a unit of study is recognised by the award of the grade of Pass (P). Performance at levels higher than this is recognised by the award of a Credit (Cr), Distinction (D) or High Distinction (HD). If the requirements for a unit of study are not completed then a grade of Fail (XX) may be awarded.

Grade	%
• Pass	50-64
• Credit	65-74
• Distinction	75-84
• High Distinction	85-100
• Fail	below 50

If a student failed a unit of study but the failure was borderline, then the Board of Examiners may award a concessional pass (PCON) instead of a Fail. A PCON is treated as a full pass for progression purposes.

Students awarded supplementary examinations should consult the department that teaches the unit of study for information about the form and content of the supplementary examination.

Students who have been awarded a Result to Come (V) should consult the Department.

A grade of R denotes that a unit of study has been satisfactorily completed.

Exemption from attendance at classes

If you enrol in a unit of study which you have previously attempted you may be granted exemption by the Department from attendance at laboratory or practical classes.

Deferment of enrolment

Deferment of enrolment is only possible from Second Year onwards. To ensure your place is kept open, you must apply in

writing to the Faculty stating the reasons for your requested deferment. Deferment is normally granted for only one year, although this may be extended in exceptional circumstances which must be detailed in your letter of application.

Practical experience

At an appropriate stage of your training you are required to work as an employee of an approved engineering-related organisation and submit a satisfactory written report of your work. This period of experience, usually about 10 weeks, is normally undertaken after you complete some or all of the prescribed Third Year units of study and before you enrol for your final year of study. It is possible to undertake all of the work experience at the end of Third Year, or undertake a part at the end of Second Year and complete the work experience at the end of Third Year. There is a core unit of study prescribed for each of the branches of engineering which comprises this practical experience requirement. Please refer to the unit of study descriptions later in this Handbook for specific conditions applying in each department in relation to when the work experience can be undertaken and what type of experience is suitable.

If you are not committed to employment as a cadet or scholarship holder the Careers and Appointments Service of the University is available to help you obtain suitable employment.

Honours degree

Conditions for the award of Honours are described elsewhere. Note that there is no special admission procedure to an Honours program.

An alternative to the combined BE/BSc degree program

Many Engineering students take the opportunity of gaining the BE and BSc degrees over five years. As well as the combined BE/BSc degree (described previously), there is a second option (henceforth referred to as the double degree BSc/BE program).

If you satisfy certain requirements you may be permitted to transfer to the Faculty of Science for one year in order to complete the requirements for the BSc degree. This one year is additional to the four years required to complete the BE degree. Students who proceed towards the 'double degree' usually transfer to the Faculty of Science after they have completed two years of Engineering, but there is provision for students to do so after they have completed the Third Year of the BE degree. There is also provision for students to remain in the Faculty of Science for an extra year in order to complete an Honours BSc degree.

After completion of the Science year(s), students then transfer back to the Faculty of Engineering in order to complete their BE degrees.

If you wish to take the opportunity of transferring to the Faculty of Science at the end of your Second Year (or Third Year) BE year, you should consult the appropriate Faculty of Science resolutions relating to this double degree.

If you are interested in proceeding towards the 'double degree' it is essential that you plan your units of study carefully in your First Year, so that you fulfil prerequisite requirements for the Second Year Science units of study which you must take in your Second Year.

Application to transfer to the Faculty of Science should be made at the end of your second (or third) year of studies.

Applications for transfer to the Faculty of Science are available at the Student Centre and the Faculty of Science and Faculty of Engineering Offices.

Admission of BSc graduates

If you are enrolled in the Bachelor of Science degree unit of study at this University and wish to transfer to the Bachelor of Engineering degree unit of study, you must make application through the Universities Admissions Centre by the advertised closing date.

Your application will be considered on the basis of academic merit. Consideration will be given to your HSC examination results and to your examination results in the Faculty of Science (and to your results in any other tertiary units of study you may have completed). The offer of a place in the Faculty of Engineering is NOT automatic and the competition for entry is keen.

If you are a graduand/graduate in the Faculty of Science and if you are offered a place in the Faculty of Engineering, you may be able to complete the BE degree requirements in two further years of full-time study. You would need to have completed appropriate units of study in the Faculty of Science so that you could be given credit for/exemption from all or most of the First Year and Second Year core units of study prescribed for that branch of Engineering in which you wish to proceed.

You should seek advice from the Engineering Department in which you wish to study regarding their requirements in order that you might complete the BE degree requirements in two years.

Advanced Engineering Program

The Faculty makes special provision for First Year students who have achieved outstanding academic results before coming to the Faculty. For students who achieve a UAI of 98+ with 4 Unit Mathematics and Science (4 Units from Physics, Chemistry, Engineering Science or Science). HSC students in this category will be granted exemption for half of their Semester 1 material, and may choose to commence study in the July Semester or undertake a special interdisciplinary engineering project in a group with other Advanced Students. Students can apply to enter this arrangement on enrolment in their first year by discussing their options with the Dean or Head of Department.

The optional Advanced Engineering Program continues through years 2 and 3 with special subjects available only to those students named on the Dean's List for Excellence in the previous year.

Discontinuation and variation of enrolment

Please note that **your enrolment is your responsibility**. It is in your best interests to ensure that the formal record of your unit of study enrolment is correct.

If you wish to cease attending a unit of study (or all your units of study), you are discontinuing your enrolment in those units of study. You must notify the University of your intention to discontinue by submitting the appropriate form to the Engineering Faculty Office.

There are three categories of discontinuation results used to record discontinuations: 'Withdrawn', 'Discontinued with Permission', and 'Discontinued'. *These results are dependent upon the time of year you choose to discontinue (see below).*

If your enrolment is '**Withdrawn**' (W), then your enrolment is cancelled as though you had never enrolled. This enrolment does not appear on an official transcript of your academic record.

If your enrolment is '**Discontinued with Permission**', it means that you commenced the unit(s) of study and were given permission to discontinue without any academic penalty or implication of failure whatsoever. However, HECS or fees are still liable for these subjects. The enrolment and the result of 'Discontinued with Permission' (DP) appear on an official transcript of your academic record.

If your enrolment is '**Discontinued**' (Disc), then it means that the discontinuation counts as a failure. HECS or fees are still liable for these subjects. On an official transcript of your academic record, your enrolment appears with the result of 'Discontinued'. As this result implies failure, you will be allocated a 0% unit value for this subject in the calculation of your weighted average mark. The Faculty takes student WAMs into consideration when determining whether or not students have made satisfactory progress.

Total discontinuation

If you wish to discontinue all your units of study, then you must notify the University of this intention by submitting a

'Variation of Enrolment' form to the Engineering Faculty Office. You should note your reasons for discontinuing on this form.

Variation of enrolment

Any change to your enrolment, including total withdrawal from the degree, can only be done through the Engineering Faculty Office. This includes units of study taken outside this Faculty. Collect a 'Variation of Enrolment' form from the Faculty Office, have the changes approved by your Year Adviser/Supervisor and hand the completed form back to the Faculty Office.

You may enrol in a unit of study given in first semester (or full-year) prior to March 31. You may enrol in a unit of study given in second semester prior to August 31.

Discontinuations from units of study are described below.

Before March 31 (First Semester HECS deadline)

You may withdraw from any unit of study without academic or financial penalty. Your discontinuation result will be 'Withdrawn'.

After March 31

- You may withdraw from Second Semester units of study without academic or financial penalty.
- If you drop a First Semester (or full-year) unit of study between March 31 and the seventh teaching week of First Semester, you will automatically receive a 'Discontinue with Permission' result;
- If you drop any unit of study after the seventh teaching week, you will receive a result of 'Discontinue'. If, however, you believe you have good reason for discontinuing at this late stage, discuss this with your Year Adviser, who may recommend a result of 'Discontinue with Permission';
- You remain liable for the HECS payment for these units of study.

After August 31 (Second Semester HECS deadline)

- You cannot drop any unit of study without penalty;
- If you drop a Second Semester unit of study between August 31 and the seventh week of teaching of Second Semester, you will automatically receive a 'Discontinued with Permission' result;
- If you drop any unit of study after the seventh teaching week, you will receive a result of 'Discontinued'. If, however, you believe you have good reason for discontinuing at this late stage, discuss this with your Year Adviser, who may recommend a result of 'Discontinue with Permission';
- You remain liable for the HECS payment for these units of study.

There is no way these rules can be varied, so it is in your best interests to ensure that your enrolment is correct.

You should note that variations of enrolment are subject to all the other rules relating to enrolment in the BE degree unit of study.

Weighted Average Mark (WAM)

The Faculty uses students' weighted average marks (or WAMs) when considering a number of aspects of students' candidatures: Engineering departments use WAM calculations when determining students' eligibility for the award of Honours degrees. The Faculty uses WAM calculations when ranking applicants for scholarships for postgraduate study and for undergraduate prizes and scholarships. The Faculty also takes account of students' WAMs when determining whether or not students have made satisfactory progress with their studies. A WAM is calculated for every student for every year of enrolment by adding together the products of the marks achieved with the unit value of each unit of study attempted (including units of study which have been failed or 'Discontinued') and dividing by the total number of credit points attempted.

Units of study which have been 'Withdrawn' or 'Discontinued with Permission' are not included in the WAM calculation.

Application procedure to re-enrol in the BE degree after total discontinuation

New first year students

If you are a new First Year student who totally discontinues his/her enrolment and you now wish to re-enrol in the BE degree unit of study, then generally speaking you will need to apply for re-enrolment through the Universities Admissions Centre (unless you were recorded as 'Discontinued with Permission' and were given 'Repeat status'). ('Repeat status' means that you may enrol in the BE degree unit of study in the next calendar year by completing an internal University 'General application for enrolment' form and that you will not need to compete for a place through UAC for that one calendar year only. If you do not take up that option and then wish to re-enrol in the BE degree unit of study in a future year, you will need to apply for re-admission through UAC.)

UAC applications must be lodged by the closing date late in September/early in October in the year prior to that in which you wish to re-enrol.

Re-enrolling students

If you are a re-enrolling student in the BE degree unit of study who totally discontinues his/her enrolment and wish to re-enrol in the BE degree unit of study, then generally speaking you should apply for re-enrolment by completing an internal University 'General application for enrolment' form by 1 October in the year prior to that in which you wish to re-enrol.

Failure to make satisfactory progress and exclusion

If the Faculty considers that you have failed to make satisfactory progress with your studies, the Faculty may exclude you from re-enrolment in the Faculty of Engineering. This process of excluding students is designed to ensure that the resources available in the Faculty are used to teach those students who make the best use of them. Failure to make satisfactory progress cannot be defined precisely in all cases in advance, but generally you will be considered not to have made satisfactory progress if:

- your weighted average mark (WAM) for the year is poor; and/or
- you do not gain at least half of the credit points for which you are enrolled; and/or
- you fail a major unit of study more than once; and/or
- you had special conditions imposed on your re-enrolment (usually because of lack of satisfactory progress in the previous year of enrolment) and you fail to meet these conditions.

If the Faculty considers that your annual progress has not been satisfactory, it may decide that you should be sent a 'Warning Letter', in which you are advised of this and also of certain conditions that you would need to meet in your next year of enrolment in the Faculty. These conditions would normally specify the number of credit points and particular credit points of study that you would need to pass in the next year of enrolment in the Faculty. Failure to meet such conditions would normally result in you being asked to show cause as to why you should be allowed to re-enrol in the Faculty of Engineering.

If the Faculty considers that your progress has been particularly unsatisfactory, then it may decide that you should be asked to show cause as to why you should be allowed to re-enrol in the Faculty of Engineering. This means that you are being asked for an explanation for your failure to make satisfactory progress in your studies. When the Faculty considers students' statements purporting to show good cause, it takes account of illness, accident and/or personal problems.

If the Faculty accepts your explanation, then it will allow you to re-enrol. In doing so, the Faculty will probably impose certain conditions on your re-enrolment (such as specifying the number of credit points and particular credit points of study that you must pass in your next year of enrolment). Should you fail to meet these conditions you may be called upon again to show cause as to why you should be allowed to re-enrol in the Faculty of Engineering.

If the Faculty considers that you have failed to show good cause on this occasion (or if no statement is received from you), then the Faculty may exclude you from enrolment. If you are excluded, you have the right of appeal to the Senate. The Senate may either uphold your appeal and allow you to re-enrol in the Faculty of Engineering or it may disallow your appeal and confirm your exclusion.

A student who is excluded from re-enrolment in the Faculty may apply for re-admission to the Faculty after two academic years have elapsed. When considering an application for re-admission, the Faculty takes account of the following: the circumstances that led to the student's failure to make satisfactory progress; how these circumstances have changed; and the student's activities since being excluded. The Faculty would normally expect a student to have undertaken relevant tertiary studies successfully during this period.

Postgraduate study

The Faculty of Engineering offers a wide range of postgraduate research and coursework programs within the Departments of Aeronautical, Chemical, Electrical and Mechanical and Mechatronic Engineering and the specialisation, Environmental Engineering.

Full details of the postgraduate degrees and diplomas are contained in a graduate brochure which is updated annually and is available from the Faculty Office.

Doctor of Engineering

The senior of the higher degrees in the field of engineering is the DEng degree. Originally called Doctor of Science in Engineering, DScEng, the name was changed to Doctor of Engineering in 1981. The degree is awarded for distinguished published work. The first doctorate in engineering was conferred in 1924.

DScEng

John Job Crew Bradfield, 1924
 William George Baker, 1932
 David Milton Myers, 1938
 David Lipscombe Hollway, 1954
 Bernard Yarrton Mills, 1959
 Robert Thomas Fowler, 1960
 James Brydon Rudd, 1962
 John Ernest Benson, 1975
 Harry George Poulos, 1976
 George Kossoff, 1981
 Robert Henry Frater, 1982

DEng

John Robert Booker
 Bhushan Lai Karihaloo
 Yui-Wing Mai
 Kerry Rowe
 Nicholas Snowden Trahair
 Kenneth J. Waldron
 Keith Kingsford Watson

Doctor of Philosophy

The degree of Doctor of Philosophy is a research degree awarded for a thesis considered to be a substantially original contribution to the subject concerned. This degree is becoming a prerequisite for research appointments in government and industrial research and development laboratories.

Applicants should normally hold a master's degree or a bachelor's degree with first or second class honours of the University of Sydney, or an equivalent qualification from another university or institution.

The degree may be taken on either a full-time or part-time basis.

In the case of full-time candidates, the minimum period of candidature is six semesters (3 years). The maximum period of candidature is normally ten semesters.

Part-time candidature may be approved for applicants who can demonstrate that they are engaged in an occupation or other activity which leaves them substantially free to pursue their candidature for the degree. Normally the minimum period of candidature will be determined on the recommendation of the Faculty but in any case will not be less than six semesters; the maximum period of candidature is normally 14 semesters.

The Faculty may admit some applicants on a probationary basis for a period not exceeding twelve months.

Master of Engineering

Graduates in engineering of the University of Sydney who have had at least three years' experience after graduation may be admitted as candidates for the ME degree. The award is made for a thesis or a design of special merit, and may be looked upon as an external degree reserved by the Faculty for its own graduates.

Master of Engineering (Research)

The Master of Engineering (Research) degree provides candidates with opportunities to develop specialist interests through a program of supervised research (theoretical or applied), shorter than the three years usually required for the PhD degree. Candidature is normally on a full-time basis but may also be undertaken part-time. The ME(Res) degree may be undertaken in the Departments of Aeronautical, Chemical, Electrical and Information Engineering, Mechanical and Mechatronic Engineering and Civil Engineering

The minimum academic entry requirement is normally the 4-year Bachelor of Engineering degree from the University of Sydney with first or second class honours in the same branch of engineering as that in which the ME(Res) degree is to be undertaken, or an equivalent qualification from another university or tertiary institution. In exceptional circumstances a graduate in engineering with a pass degree or a graduate with an honours degree in a different branch of engineering or from another Faculty may be admitted to candidature but such an applicant may be required to undergo a preliminary examination.

The Faculty may admit some applicants on a probationary basis for a period not exceeding twelve months.

The minimum period of candidature is one year full-time and two years part-time and the maximum period of candidature is two years full-time and three years part-time. If a candidate is required to undertake a preliminary examination then the candidature commences after the completion of the preliminary examination.

Special attention is drawn to the need for applicants to provide concise details of their proposed research program including aims and methodology and evidence of their ability to carry out intensive research and advanced study. Candidates who enrol for this degree with the object of later transferring to candidature for the PhD degree should select a research project that is suitable for this purpose.

Applicants admitted to candidature for the ME(Res) degree are expected to work individually on advanced study and research under the direction of a supervisor, with whom regular consultation about their work and the general planning of their thesis is required. On completion of their candidature a thesis must be submitted embodying the results of their work.

Master of Engineering Studies

The MES degree provides candidates with programs of formal coursework alone or coursework and applied research aimed at meeting the professional development needs of engineers and scientists in the private and public sectors of industry and in private practice. The degree is offered on a full-fee paying basis.

The minimum academic entry requirement is the 4-year Bachelor of Engineering degree from the University of Sydney, or an equivalent qualification from another university or tertiary institution.

The minimum period of candidature is one year full-time and two years part-time and the maximum period of candidature for all candidates is two years full-time and three years part-time.

Candidates for the MES have two alternative methods of candidature, by coursework alone or by coursework and project. They are required to complete either 48 credit points of coursework or at least 36 credit points of coursework and a design or research project valued at 12 credit points.

Candidates may choose to complete the units of coursework from the same subject area or from related subject areas, in the same department or school, or they may choose to complete

all subjects from departments other than the one in which they are primarily studying. Candidates may also be given permission to take subjects from another Faculty at this University or from another tertiary institution such as the University of New South Wales or the University of Technology, Sydney. If you wish to apply to count subjects from another tertiary institution, you would of course need approval from that institution to enrol there and the permission of the University of Sydney.

For their projects, candidates are encouraged to select problems based on their professional experience or their research interests. Many projects will be closely related to the research activity within the Faculty, and in some cases it may be possible for original work to be reported in the project report. A design study or a critical examination of a professional problem may also be acceptable as a project. The work on the project is expected to occupy about one-third of a candidate's total program - ie, a maximum of 12 credit points.

Aeronautical Engineering

There is no coursework program currently available.

Chemical Engineering

The Department of Chemical Engineering offers the MES course and the MEEP (Master of Environmental Engineering Practice)

Civil Engineering

The Department of Civil Engineering offers the MES coursework program in the areas of Geotechnical Engineering, Structural Engineering and Structural and Foundation Engineering.

You should note, however, that the Department of Civil Engineering may not be able to offer all its courses each year, so that even a full-time candidate may take 18 months or two years to complete the degree requirements in that School.

Electrical and Information Engineering

The Department of Electrical and Information Engineering offers an MES drawing its coursework from each of the Graduate Diploma areas and permits a flexible program of study to suit the individual needs. All areas of specialisation apply to both Master's and Graduate Diploma programs. If you are completing the MES it is 48 credit points whereas a Graduate Diploma is 36 credit points. Engineers planning to increase their management component of their work can take up to 24 credit points of business subjects within their MES.

Mechanical and Mechatronic Engineering

The coursework program is available on both a full- and part-time basis in Mechanical Engineering. There is no Masters program in Mechatronic Engineering available at present.

In order to complete the degree requirements in one year, however, a candidate would need to take subjects from those offered by other departments or by another tertiary institution.

Environmental Engineering

The Faculty of Engineering offers a coursework program in Environmental Engineering for the MES degree and DipEnvironEng. While the program is managed by the Department of Chemical Engineering, teaching is by Chemical, Civil and Mechanical Engineering, as well as by other departments in the University.

Master of Project Management

The Master of Project Management is awarded after completing 8 course modules (48 credit points), of which 3 (18 credit points) are core subjects. The remainder are selected from a range of elective modules. This course is available through PM Outreach, a global Internet based program in project management and is available to both Australian and international students through the Internet. Students wishing to obtain a qualification in project management have the option to take individual modules or add modules together to complete a graduate certificate in project management, graduate diploma of project management or the Master of Project Management degree.

The management of this program is through the Department of Civil Engineering.

Diplomas and certificates

Diplomas

Graduate Diplomas are offered on a full fee-paying basis. Courses leading to the award of a diploma are currently available in the following specialist areas:
Geotechnical Engineering - DipGeotEng
Structural Engineering - DipStructEng
Structural and Foundation Engineering - DipStructFoundEng
Project Management - GradDipPM
Power Engineering - DipPowEng
Computer Systems Engineering - DipCompSystEng
Technology Venture Creation
Telecommunications - DipTelecomm
Environmental Engineering - DipEnvironEng

Graduate Certificates are offered on a full fee paying basis. Courses leading to the award of a graduate certificate are available in the following specialist areas:

Electrical Energy Systems
Integrated Systems
Photonics
Project Management
Signal Processing
Technology Commercialisation
Wireless Communications

The minimum academic entry requirement is the 4-year Bachelor of Engineering degree from the University of Sydney, or an equivalent qualification from another university or tertiary institution.

The minimum period of candidature is one year full-time and two years part-time and the maximum period of candidature for all candidates is two years full-time and three years part-time.

Further information

To obtain further postgraduate information contact:

Postgraduate Advisor
Graduate School of Engineering
Faculty of Engineering J13
The University of Sydney NSW 2006
Australia

Phone: +61 2 9351 7084

Fax: +61 2 9351 7082

Email: J.Harty@eng.usyd.edu.au

For information on departmental research areas and contacts check the web page www.eng.usyd.edu.au/gse.

The brochure Graduate Programs Engineering 2000 is available from the postgraduate advisor.

Other Faculty information

The Faculty

Faculty adviser

You are most welcome to discuss with the undergraduate or postgraduate advisers any questions about your studies, difficulties in maintaining your studies for financial or personal reasons, or any other questions or problems that may arise. *As difficulties can usually be handled more easily in the early stages, you should seek help without delay.* Discussions are held in strict confidence - simply come to the Faculty Office, in Room 226, Engineering Faculty Building and make an appointment.

Special enrolment instructions

These are the special requirements for Engineering students.

To complete your enrolment in Engineering you proceed to the PNR Enrolment Centre in the Drawing Office, where you

- collect your enrolment form,
- complete a registration form,
- consult an adviser about your plan of units of study; and
- record your units of study on the computer and receive your timetable.

Examinations

Freedom of Information Act

Examination scripts, or copies of same, are available for viewing or collection from Departmental Offices for three months after final examinations each year, after which they will be shredded.

Enquiries

All examination result enquiries must be made with your Department. The Engineering Faculty Office is not equipped to handle examination enquiries.

Supplementary examinations

A supplementary examination may be granted by the Faculty:

- (a) to candidates whose performance in an examination has been significantly affected by duly certified illness or misadventure;
- (b) to candidates who have failed an examination but whose overall level of performance in the year's work is deemed sufficient to warrant the concession of a further test.

Supplementary examinations under category (b) are normally granted *only* to those candidates who are in their first year of attendance.

The award of supplementary examinations is a privilege and not a right.

Illness or misadventure

The Faculty of Engineering recognises that the performance of students may be adversely affected by illness or other misadventure, and makes provision for special consideration of such disabilities when examination results are considered.

Any student who believes that his/her performance has been or may be adversely affected by an occurrence of illness or misadventure may request the Faculty to make special consideration of same. All such requests must include a special consideration application on the form provided by the Faculty, supplied within one week of the occurrence and accompanied by an appropriate medical certificate or other relevant documentary evidence apart from the student's own submission. Such certificates or documentary evidence *should state not only the nature of the illness or misadventure but also (where relevant) the opinion of the issuer as to the extent of the disability involved.*

If the student has completed the assessment for which special consideration is requested, then further documentary evidence of the extent of the disability from a specialist medical practitioner/counsellor etc. must also be supplied. For example, if a student completes an examination but still wishes to request special consideration for it, this additional specialist evidence is required.

Finally, the Faculty intends only to compensate for substandard performance in assessments which do not reflect a student's true competence in a subject, and such provisions must not act to the disadvantage of other students. The Faculty will only compensate students when there is clear evidence that results have been adversely affected by the disability for which special consideration is requested.

Financial assistance

Special assistance

In certain circumstances assistance is available to students who encounter some unforeseen financial difficulty during their studies. The assistance is usually in the form of bursaries or interest free loans.

Students wishing to apply for financial assistance should make enquiries from either of the following:

- Financial Assistance Office, Student Services, +612 93512416.
- President of the Students' Representative Council, +61 2 9660 5222.

J.N. Ellis Memorial Fund

The J.N. Ellis Memorial Fund was established in 1969 following an appeal made to all graduates in engineering to honour the memory of Neil Ellis, who as Sub-Dean and later as Administrative Assistant to the Dean over a considerable period of years was able, by sympathetic counselling, to help many students who were having difficulties in completing their studies.

The object of the fund is to provide financial assistance to students in the Faculty of Engineering who are in such a position that without assistance they would not be able to continue their studies. Students seeking such assistance should apply to Financial Assistance, Student Services, phone 9351 2416. Awards are made on the recommendation of the Dean. Value: \$500. Applications may be made at any time.

Those who receive assistance from the fund are asked to make a contribution to it when they are financially able to do so. In this way the fund will be able to continue and grow in the extent to which it can help deserving students in future years.

Learning assistance

The University's Learning Assistance Centre offers a wide range of workshops and other activities to assist students develop the learning and language skills needed for academic study. The workshops are available free to all enrolled students of the University. Workshop topics include essay and assignment writing, oral communication skills, studying at university, conducting research.

The Learning Assistance Centre is located on Level 7 of the new Education Building next to Manning House (phone +61 2 9351 3853).

Staff

Faculty staff

Dean

Professor Judy A Raper, BE PhD U.N.S.W., CPEng, FIChemE FTEAust

Pro Dean

Professor Yiu-Wing Mai, BSc(Eng) PhD H.K., DEng, FTSE, FASME, FHKTE, FIE Aust

Associate Dean (Postgraduate and Research)

Associate Professor John C Small, BSc(Eng) Lond. Phd, MTEAustMASCE

Associate Dean (Undergraduate)
Associate Professor Geoffrey W. Barton, BE PhD

Advisers to undergraduate students

Aeronautical

Undergraduate Adviser: Dr Douglas Auld
First Year: Dr Kee Choon Wong
Second Year: Dr Osvaldo Querin
Third Year: Dr K Srinivas
Fourth Year: Dr Peter Gibbens

Chemical

Undergraduate Coordinator: Dr C A Mitchell
First Year: Mentor Groups
Second Year: Mentor Groups
Third Year: Dr T A G Langrish
Fourth Year: Dr LA. Furzer

Civil

First Year: Associate Professor R.J. Wheen
Second Year: Mr N i. Ings
Third Year: Dr D.W. Airey
Fourth Year: Associate Professor K.J.R. Rasmussen

Electrical and Information Engineering

First Year: Dr Ling Guan
Second Year: Dr Swamidoss. Sathiakumar
Third Year: Dr Jim Rathmell
Fourth Year: Dr Yash Shrivastava

Mechanical

Undergraduate Adviser: Associate Professor Assaad Masri
Postgraduate Adviser: Prof. Nhan Phan-Thien
First and Second Year: Mr Paul McHugh
Third Year: Dr Lin Ye
Fourth Year: Dr Steven Armfield
Secretary to the Faculty and Finance Officer
Mr Michael Whitley, BA(Hons) *EastAnglia*, MCom *U.N.S.W.*

ASA CIA FCIS FTCD Dip

Student Administration Staff

Postgraduate Adviser: Ms Josephine Harty, BA *Macq.*
Undergraduate Adviser: Mrs Annamaria Brancato
Office Manager: Mrs Annamaria Brancato
Executive Assistant to the Dean
Ms Kylie Williams, BSc
Development and Marketing Manager
Mr Eric van Wijk BSc (*ANU*) GradDipEd GradDipAppEcon
UCan

Chancellor's Scholarships in Engineering Program
Executive Officer: Ms Lee Glasson BA DipEd *Flinders*
Administrative Assistant

Ms Kay Fielding

Professional Officer

Didier Debuf, BE MEngSc *U.N.S.W.*

Industry Liason

Dr Maurice Barton, BSc(Hons) *Brighton C.O.T.*, MSc *Oxon.*,
PhdAston, FATM

Faculty Librarian

Irene Rossendell BA *Qld*, DipLib *UNSW*, ALIA

Aeronautical Engineering

Head of Department

Grant P. Steven, BSc *Glas.*, DPhil *Oxf.*

Lawrence Hargrove Professor

Grant P. Steven, BSc *Glas.*, DPhil *Oxf.* Appointed 1991

Senior Lecturers

Douglass J. Auld, BSc BE MEngSc PhD
Karkenahalli Srinivas, ME PhD *I.I.Sc.*
Liyong Tong, BSc MEngSc *Dalian*, PhD *B.U.A.A.*, MTEAust
MAIAA

Lecturers

Peter W Gibbens, BE PhD, MAIAA
Kee Choon Wong, BE PhD, MAIAA
Osvaldo M. Querin, BE ME(Res), PhD
David P. Boyle, BE, MAIAA

Professional Officer

Jehangir Madhani, MSc *Strath*, BSc *S'land UK*

Research Associates

Ping Tan, MEngSc *Melb*
Dr Hugh Stone, BE, BSc, PhD

Chemical Engineering

Head of Department

James G Petrie BSc, PhD *Capetown*

Professors

Brian S Haynes, BE PhD *U.N.S.W.*, FICHEM FIEAust
CPEng. Appointed 1997
Emeritus Professor Rolf G.H. Prince, AO, BE BSc *N.Z.*, PhD,
FICHEM HonFIEAust FTSE FEng. Appointed 1969
Jose Romagnoli, BE *N.delSur.Arg.*, PhD *Minn.* Appointed
1991

Shell Professor of Environmental Engineering

James G Petrie BSc, PhD *Capetown*. Appointed 1997

Professorial Fellow

Ric Charlton, BE MESC, FTS

Associate Professors

Geoffrey W. Barton, BE PhD

Senior Lecturers

Ian A. Furzer, DSc(Eng) PhD *Lond.*, MICHEM CEng
MAICHEM

Timothy A.G. Langrish, BE iVZ. DPhil *Oxf.*, MICHEM

Vincent G. Gomes, BTech MEng PhD *Montr.*

Cynthia A Mitchell, BE *Qld*, PhD *U.N.S.W.*

Kelly Thambimuthu, PhD *McGill*

Senior Research Fellow

David F Fletcher, BSc, PhD *Exeter*

Lecturers

Bruce Choy, BE, PhD

Marjorie Valix, BSc, PhD *U.N.S.W.*

Honorary Appointments

Honorary Research Associates

David F Bagster, BScApp BSc BE *Qld*, PhD *Camb*, FICHEM
FIEAust CEng

G. DeLeon, PhD *Belgrade*, MAIMM GSA

PDun, BEPhD, MICHE

Peter B. Linkson, BE PhD, FIECHEM FAUSIMM FGAA
Ceng

Barry W. Walsh, BE PhD, MICHEM CEng SPE

Honorary Professional Associate

Wayne A. Davies, BSc PhD, MIEAust

Civil Engineering

Head of Department

Robert J. Wheen, BSc BE MEngSc, FIEAust MASCE

Challis Professor of Civil Engineering

John P. Carter, BE PhD, MASCE FIEAust. Appointed
Professor 1990. Appointed Challis Professor 1999

Professors

Kenny C.S. Kwok, BE PhD *Monash*, FIEAust. Appointed
Professor 1999

Harry G. Poulos AM, BE PhD DScEng, FIEAust FASCE
FAA. Appointed Professor 1982

BHP Steel Professor of Steel Structures

Gregory J. Hancock, BE BSc PhD, FIEAust. Appointed
Professor 1990

Associate Professors

Andrew Abel, DipUng *T. U. Bud.*, MSc *McM.*, PhD *U.N.S.W.*,
CEngFTM

Peter Ansourian, BSc BE PhD, FIEAust

Ali Ja'afari, BSc ME *Tehr.*, MSc PhD *Sur.*

Kim J.R. Rasmussen, MEngSc *T. U. Denmark*, PhD

Smart G. Reid, ME *Cant.*, PhD *McG.*

John C. Small, BSc *Lond.*, PhD, FIEAust MASCE

Robert J. Wheen, BSc BE MEngSc, FIEAust MASCE

Senior Lecturers

David W. Airey, BA MPhil PhD *Camb.*

Logan W. Apperley, BE PhD *Auck.*

Murray J. Clarke, BSc BE PhD

Lecturers

Abbas ElZein, BE *American Uni Lebanon*, MSc PhD
Southampton, MS *ENPC Paris*, MIEAust
 Noel L. tags, BE MEngSc *U.N.S.W.*, MASCE MIEAust
 Tim Wilkinson, BSc BE MA
 Graeme Wood, BEng(Hons) PhD *Edin.*

Professional Officers

Nigel P. Balaam, BE PhD
 Roy O. Denoon, BEng(Hons) *Edin.*, ME(Res)
 Timothy S. Hull, BE PhD
 John P. Papangelis, BE PhD, MIEAust
 Craig M. Polley, BSc MSc *Wisconsin*

Emeritus Professor

Nicholas S. Trahair, BSc BE MEngSc PhD DEng, FIEAust

Adjunct Associate Professor

Ian S.F. Jones, BE *U.N.S.W.*, PhD *Wat.*, MIEAust

Honorary Research Associates

Russell Q. Bridge, BE(Hons) *U.N.S.W.*, PhD, FIEAust
 Howard B. Harrison, BE PhD, MIEAust
 Harold Roper, BSc, PhD *Witw.*, MEngSc, MAJMM
 Richard D. Watkins, BE *Qld*, PhD *Aberd.*, MIEAust

Honorary Teaching Associate

Ian G. Bowie, MSc *Mane*, MASCE MIEAust

Electrical and Information Engineering

Head of School

Stephen W. Simpson, BSc PhD, FIEAust

Manager, Resources

Paul Beed, BBus *UWS*, ASA

Manager, Academic Support Services

Peter Finneran, BA

Executive Officer, Electrical Engineering Foundation

Stuart Glanfield, BA DipEd MA

Administrative Assistants

Maree Belleli
 Carol Ible, BBus *UTS*
 Colleen Moore
 Sylvia Pyman
 Katherine Smith
 Rita Wong

Ping Zhang, BA *Fudan*

P.N. Russell Professor

Trevor William Cole, BE *W.Aust.*, PhD *Camb.*, FIEAust.
 Appointed 1980

Professors

David Hill, BE BSc *Qld*, PhD *N'cle(N.S.W.)*, FIEAust FJEEEE.
 Appointed 1994

Marwan A. Jabri, Maitrise de physique *Paris* PhD. Personal
 Chair 1996

Branka S. Vucetic, MSc PhD *Belgrade*. Personal Chair 1999

Hong Yan, BS *Nanking I.P.T.* MSEM *Mich* PhD *Yale*. Personal
 Chair 1997

Associate Professors

Robert A. Minasian, BE PhD *Melb.*, MSc(Dist) DipMicrowave
 Eng(Dist) *Lond.*, MIEE SMIREE FIEAust

Stephen W Simpson, BSc PhD, FIEAust

Anthony D. Stokes, BSc BE PhD, FIEAust

Senior Lecturers

Iain Collings, BE *Melb.*, PhD *ANU*

Ling Guan, BSc *Tianjin* MSc PhD *Waterloo*, SMIEEE

Xiheng Hu, DipElecEng *Chongqing Indust. Uni.*

MElecCompEng *China*, PhD

Abbas Jamalipour, BSc *Isfahan Iran*, MSc *Sharif Iran*, PhD
Nagoya

David Levy, BSc, MSc (Engl), PhD *Natal*, MIEE

James G. Ratnmell, BSc BE PhD, SMIREE

Graham E. Town, BE *N.S.W.I.T.*, PhD, MIEEE MIREE

Andre van Schaik, MSc *Twent*. PhD *SwissFed.Inst.Tech.*

Yash Shrivastava, BTech ITT *Kanpur India*, PhD *Iowa*

Hansen Yee, BSc BE PhD, MTEEE

Lecturers

Jamie Evans, BSc BE *Newcastle*, MEngSci PhD *Melb.*
 Swamidoss Sathiakumar, BSc *American Coll.India*, BE ME
 PhD *LI.Sc.*

Professional Officers

William Fong, BE *WesteniAustralia*, MEngSci
 Ebrahim Gogani, ME *Tehr.Polytechnic*, PhD *Brunei*
 Ross Hutton, BE 2./I
 Van Dong Pham, BE *SoutliAustralia*, MEngSci *UNSW*
 Michael Rados, BSc BE MEngSc
 Ali Raghemi-Azar, BSc *Tehr.Polytechnic*, MSc PhD *S'ton*
 Robert G. Sutton, ME *UNSW* (on leave)

Research Fellows

Kamal Alameh, BE *Beirut*, MEngSci *Melb.* PhD
 Richard Coggins, BE BSc PhD
 Jinhong Yuan, MSc PhD *BeijingInstTech*

Honorary Appointments

Emeritus Professors

W.N. Christiansen, DSc *Melb.*, FfastP FAJP FEE FIEAust
 FAA FTREE(Aust)
 Hugo K. Messerle, MEngSc DSc *Melb.* PhD, FTS FTJEE
 FIEAust FIREE FTEEE FAIP

Adjunct Associate Professor

Peter M. Nickolls, MB BS BSc BE PhD

Senior Lecturer

Brian Campbell, ME

David F. Gosden, ME *UNSW*. MBA, *AGSM.*, MIEAust

Research Associate

Julie Vonwiller, BA(Hons) *Macquarie*, PhD *Macquarie*

Research Affiliate

J.J. Lowke, BSc PhD DipEd *Adel.*

Mechanical and Mechatronics Engineering

Head of Department

John H. Kent, BE MEngSc PhD FIEAust

P.N. Russell Professor

Roger I. Tanner, BSc *Brist.* MS *Calif.* PhD *Mane.* FAA FTS
 FIEAust MASME MAChE. Appointed 1975

Professors

Robert W. Bilger, BSc BE *NZ*, DPhil *Oxf.* FTS FIEAust.
 Appointed 1976

Hugh F. Durrant-Whyte, BSc(Eng) *Lond.*, MSE PhD *Penn.*
 Appointed 1995

Yiu-Wing Mai, BSc(Eng) PhD *HK*, DEng *Syd.* FTSE FASME
 FHKIE FIE Aust. Appointed 1987

Nhan Phan-Thien, BE PhD, FAA FIEAust. Appointed 1991

Michael V Swain, BSc, PhD *U.N.S.W.* Appointed 1997

Associate Professors

John H. Kent, BE MEngSc PhD FIEAust

Assaad R. Masri, BE PhD

Liangchi Zhang, BSc MEng *Zhejiang*, PhD *Peking*, MASME
 MASPE MJSPE MJSME

Reader

Lin Ye, BS *Harbin*, MS PhD *BeijingIAA*

Senior Lecturers

Steven W Armfield, BSc *Flinders*, PhD

John D. Atkinson, PhD *Cal.Tech.*, BSc BE

Lynne E. Bilston, MSE PhD *Penn.*, BE

M.W.M.G. Dissanayake, BSc(Eng) *Peradeniya*, MSc
 PhD *Birm.*

Andrei Lozzi, BSc *UNSW*, MEngSc PhD

Paul J. McHugh, BSc BE

Eduardo M. Nebot, BS *BahiaBlanca*, MS PhD *Colorado State*

David C. Rye, BE *Adel.*, PhD

Visiting Professor

J. Dennis Bobyn, BSc MSc *McGill*, PhD *Toronto*

Adjunct Associate Professor

Robin J. Higgs, MBBS *Lond*, ME(Res) *Syd*, FRCS *Edin*,
 FRACSFAOrthA

Scholarships and prizes

Many students enrolling in the Faculty of Engineering obtain financial assistance by way of a cadetship or scholarship, either at the time of enrolment, or at a later stage in their studies.

Information about the Australian government *Austudy Scheme* is available from the State Director, Department of Employment, Education and Training, 477 Pitt Street, Sydney 2000.

Scholarships are also awarded by a number of industrial organisations. Many of these do not require the student to enter into a financial bond.

Some government departments and public authorities provide cadetships or traineeships which require the student to enter into an agreement to work for the employer for a specified number of years after graduation.

Before accepting a bonded cadetship or traineeship students should give careful consideration to the conditions of the award and in particular the obligations which they will incur should they decide to relinquish the award for any reason.

A list of currently available prizes and scholarships is available from the University's Scholarships Office in the Main Quadrangle, phone +61 2 9351 3250.

Engineering scholarships

UNISEN Scholarships represent an expanded choice of scholarships offering a wide range of cooperative education choices. UNISEN comprises the **Chancellor's Industry Scholarship** (CISE, ordinary degree only, \$11000 pa), the **Dean's Industry Scholarship** (DISE, ordinary and combined degrees, \$4000 pa + \$3500 for 10 weeks paid work experience) and the **Industrial Experience Placement Scholarship** (TEPS, ordinary and combined degrees, \$1000 pa + \$3500 for 10 weeks paid work experience).

Web site is at http://www.eng.usyd.edu.au/scholarships/WMNeirous_Scholarship

For women enrolling in structural (civil) engineering, valued at \$3000 pa for 4 years

EnergyAustralia Scholarship in Engineering

For school leavers undertaking a standard electrical engineering program, with a complete year in industry, valued at \$44,500 for 5 years.

Contact: Faculty Scholarships Office

Lee Glasson, Executive Officer

Phone: +61 2 9351 2834/2131

Fax: +61 2 9351 3885

Email: l.glasson@eng.usyd.edu.au

Student facilities and societies

Noticeboards

Faculty noticeboards, one for First year courses and one for Second year courses, located outside the Student Enquiry Office, 2nd level, Faculty Building. Each of the Engineering departments has a noticeboard for Third and Fourth year students.

Noticeboards are also in the various Science departments, and information concerning the courses given by those departments will be posted on these boards.

Details of class lists, timetable variations, examination times and other information relating to courses of study will be posted on the relevant noticeboards. Students are expected to inspect the noticeboards at frequent intervals.

Notices referring to cadetships, scholarships, vacation employment and career opportunities and other matters of this nature are also displayed on the noticeboards in and around the Student Enquiry Office, 2nd level, Engineering Faculty Building.

The Faculty library

The University of Sydney Library consists of a central library - called Fisher Library - and a number of branch libraries of which Engineering is one. The Engineering Library is on the

ground floor of the PNR Building in the Engineering Precinct. Other branch and department libraries within the University contain relevant material - eg. Architecture, Physics, Mathematics, Chemistry, Wolstenholme and Badham Libraries. Engineering students may use all the libraries of the University.

Multiple copies of reference books for Junior and Intermediate courses are held in the undergraduate section of Fisher Library. Students in the senior years in Engineering will find most of their reference material in the Engineering Faculty Library. Books may be borrowed for two weeks with two loan renewals permitted. Journals may not be borrowed but photocopying facilities are available.

The Engineering Library opens from 8.45 am to 6.00 pm Monday to Friday during term. Vacation hours are 9.00 am to 5.00 pm Monday to Friday.

Dewey Decimal Classification numbers are given for some units of study in Chapter 2. These are not meant to be exhaustive lists and reference should also be made to the subject catalogue in the library.

Engineering associations

SUCEA

The Sydney University Chemical Engineering Association (SUCEA) is a body representing the graduates of the Department of Chemical Engineering. Established in the 1950 s, it is one of the oldest alumni associations at the University of Sydney. With 1326 members living in over 20 countries around the world, it is also one of the largest.

SUCEA holds a number of social events and a technical symposium each year with the aim of maintaining strong contact between the Department and its graduates (some of whom are well into their sixties). So, via SUCEA, you will still be part of the 'Chem Eng' family even after you graduate.

SUEUA

The objects of SUEUA, the Sydney University Engineering Undergraduates' Association, are:

- to perform such actions and to organise such functions as the committee may deem necessary and desirable in the interests of the Faculty of Engineering, University of Sydney, and the students thereof;
 - to act as an intermediary body between the teaching staff on the one hand and the members of the Association on the other;
 - to organise Engineering teams for inter-faculty sport.
- The office of the SUEUA is on the ground floor of the PNR Building close to the Faculty library.

In this office the association conducts a bookshop where many items of stationery, and some textbooks and codes of practice, are available at competitive prices.

The SUEUA normally holds an election for the president and other office bearers in March each year and all financial members of the association are eligible to vote. The president becomes a member of the Faculty by virtue of this office. The bylaws of the University provide for the undergraduates in Engineering to elect two others of their number to be members of Faculty and an election for this purpose is conducted in October each year. All Engineering undergraduates, including those enrolled in the Faculty of Science as candidates for the double degree, are eligible to vote.

Institution of Engineers, Australia

The professional body for Engineering in Australia is the Institution of Engineers, Australia, whose first objective is to 'promote the science and practice of engineering in all its branches'.

The institution functions through a series of divisions, the local one being the Sydney Division. Within each division are branches representing the main interests within the profession - eg. civil, electrical, mechanical, chemical and transportation to name a few.

Any student of an approved School of Engineering can join the Institution as a student member (StodTE Aust).

As a student member you will receive the fortnightly magazine *Engineers Australia*, containing articles of general

engineering interest and advising you of site tours, conferences, technical meetings of all branches, harbour cruises, film nights, and so on.

Student members may freely use the comprehensive library and reference facilities maintained by the Institution - a handy place to obtain a hard-to-get book or periodical.

Within most divisions is a Graduates and Students Section, known as GAS, and all graduates of, or students at, approved engineering schools are eligible for membership.

The Graduates and Students Sections organise film nights, site tours and other activities of general interest. The Malcolm Stanley Speakers' Competition for public speaking is held each year, usually in September, and prizes are awarded for the best speeches.

For membership information and application forms enquire at the Faculty Office or at the Sydney Division Office, 118 Alfred Street, Milsons Point 2061 (PO Box 138). Phone +61 2 9929 8544.

The Institution of Chemical Engineers

An alternative organisation for Chemical Engineering students is the Institution of Chemical Engineers. The Institution welcomes and values student members, offering special rates for technical meetings, together with Institution literature and guides to gaining employment. For further information contact the General Office in Chemical Engineering, phone +612 9329 3046.

The Association of Professional Engineers, Scientists and Managers, Australia

APESMA is a professional organisation that represents the industrial interests of its members. Its major focus is on providing advice and assistance on employment-related matters, including individual representation and improving salaries and conditions for professional engineers, scientists and managers. The Association also provides members with legal, financial and insurance services and runs an extensive management education program.

APESMA has some 19,000 members in all areas of public and private sectors in Australia. In addition, 6500 university students in engineering and science-related disciplines are student members.

The Association invites students to become affiliate members for no charge while they are studying. This membership gives students access to information and advice on industrial experience, salary rates for graduates and contracts of employment. Student members receive *The Student Update*, a publication designed specifically for students, three times a year. This gives students some practical insight into aspects of the workplace to which they may not have given much thought, in particular the employment issues that affect them as professional engineers.

For more information and student membership application forms, contact Felicity Ryan, Membership Liaison Officer, phone +61 2 9264 9500.

A short history of the Faculty

A hundred and seventeen years of engineering education

In 1983 the Faculty of Engineering celebrated one hundred years of engineering education at the University of Sydney.

At the beginning of March 1883 the first classes in engineering were held in the Main Building. Engineering then formed part of the newly created Faculty of Science (1882). The classes were attended at the opening by three matriculated students who were candidates for the engineering certificate and by seven non-matriculated students.

The lecturer in engineering was Mr W.H. Warren, who had been appointed in December 1882 following a decision by the University Senate to carry out significant revisions to the teaching of the University. These revisions, which provided for the establishment of Schools of Medicine, Science and Engineering, were unable to be implemented in 1881 for lack of staff, accommodation, and facilities.

In 1883, when the new engineering curriculum was introduced, the Senate reported that 'great inconvenience [had]

been felt during the year, both by the lecturers and the students, through the deficiency in accommodation for lecturing purpose ... the room occupied by the Lecturer in Engineering [was] much too small to contain the apparatus required for the illustration of his lectures ...' A temporary structure was erected at the rear of the Main Building, and in 1885 classes moved to a fairly commodious low white building with a verandah facing Parramatta Road, on a site now partly occupied by the Holme Building.

In 1909 the new building for the P.N. Russell School of Engineering was sufficiently completed early in the year for the work of the school to be conducted within its walls. This building - an outcome of the extraordinary benefaction of Peter Nicol Russell - was formally opened by the Governor on 20 September 1909 at the same time as he opened the new Fisher Library building (now MacLaurin Hall). During the course of the next few decades extensions were made to the PNR Building until, with the expansion in student numbers in the 1950 s and early 1960 s, new facilities were constructed in the Darlington extension area across City Road. Since the mid seventies all departments have been accommodated in this area, although a wind tunnel in the Woolley Building is still in use by Aeronautical Engineering.

Foundations

Chemical Engineering Foundation

The Chemical Engineering Foundation within the University of Sydney was established in 1981 with the following objectives:

- to foster good communications between industry and commerce and the Department of Chemical Engineering,
- to advise on courses of instruction in Chemical Engineering,
- to encourage students of high calibre to work in the Department,
- to assist graduates in Chemical Engineering to make appropriate contributions to industry,
- to facilitate and develop research in Chemical Engineering with particular reference to industry oriented projects.

The Chemical Engineering Foundation provides an opportunity for executives in Australian industry to assess and discuss what is taught in the undergraduate course in chemical engineering.

Activities include financial support to the undergraduate program and to research by both postgraduates and staff. Continuing education courses for practising engineers are regularly arranged, publication of updates on the Department's research activities is undertaken twice yearly, and emphasis is placed on expanding industry-university collaboration.

Executive Officer: Ms Trish Powers

Phone: +61 2 9351 6743

Fax: +61 2 9351 7180

Email: t.powers@chem.eng.usyd.edu.au

The Civil Engineering Foundation

The Civil Engineering Foundation exists to assist postgraduate and undergraduate students to achieve their goals in the civil engineering industry. The Foundation acts in all areas non-academic and is a conduit between academic staff, parents and industry. In addition, the Foundation supports department activities and is an integral part of the department's function.

The Foundation is the arm of the civil engineering industry within the University receives all its funding from the industry. The Foundation has gained a reputation for holding unusual fund raising activities being widely supported by industry.

This funding is used to foster education and research and to ensure the department is fully equipped to engage in such civil engineering research and development. Many civil engineering consultants, contractors and architects use the department's research capabilities before any major works are commenced.

The Foundation also promotes lectures, seminars, short courses, Masters programs and technical notes to ensure the Australian civil engineering industry is kept at the fore front of world practice.

Management of the Foundation is through a council of civil engineering industry representatives and department staff who meet regularly to monitor the progress of the department and its students. The Foundation can be contacted through the Executive Officer.

Phone: +61 2 9351 2127

Fax: +61 2 9351 6284

Email: foundation@civil.usyd.edu.au.

Electrical Engineering Foundation

The mission of the Electrical Engineering Foundation is to build a successful partnership between Sydney University Electrical Engineering, industry and the profession which facilitates, in Australia, the achievement of world-class performance through education, research and development.

The Foundation is managed by a Board made up of representatives from industry, University staff, students and graduates.

The Foundation pursues its mission through activities in the following areas:

- Forward Planning for the Department
- Presenting University Research
- Identifying Industry's Research needs
- Industry Funding of new Research and Teaching
- Bringing Industry and Students together
- Encouraging Student and Teaching Excellence
- Professional Development for Industry
- Marketing to potential Students
- Alumni Relations

President: Mr Allan Gillespie, Chief Executive Officer of AUSTA Electric. Director: Professor Trevor Cole.

Executive Officer: Mr Stuart Glanfield

Phone: +61 2 9351 7172

Email: eef@ee.usyd.edu.au.

General University information

See also the Glossary for administrative information relating to particular terms.

Admissions Office

Student Centre
Ground Floor, Carlaw Building, F07
The University of Sydney
NSW 2006 Australia
Phone: +61 2 9351 4117 or +61 2 9351 4118
Fax: +61 2 9351 4869
Email: admissions@records.usyd.edu.au

The Admissions Office is responsible for overseeing the distribution of offers of admission and can advise prospective local undergraduate students regarding admission requirements. Postgraduate students should contact the appropriate faculty. If you are an Australian citizen or a permanent resident but have qualifications from a non-Australian institution, phone +61 2 9351 3611 for more information. For enquiries regarding Special Admissions (including Mature-Age Entry), phone +61 2 9351 3615. Applicants without Australian citizenship or permanent residency should contact the International Office.

Applying for a course

Prospective (intending) students must lodge an application form with the Universities Admissions Centre (UAC) by the last working day of September of the year before enrolment. Note that some faculties, such as Dentistry, the Sydney Conservatorium of Music and Sydney College of the Arts, have additional application procedures.

Assessment

For matters regarding assessment, refer to the relevant Department.

Careers information

Courses and Careers Unit
Ground Floor, Mackie Building, KO1
The University of Sydney
NSW 2006 Australia
Phone: +61 2 9351 3481
Fax: +61 2 9351 5134
Email: info@careers.usyd.edu.au
<http://www.careers.usyd.edu.au>

Provides careers information and advice, and help in finding course-related employment both while you're studying and when you commence your career.

Continuing Education

Centre for Continuing Education
Mackie Building, KO1
The University of Sydney
NSW 2006 Australia
Phone: +61 2 9351 2585
Fax: +61 2 9351 5022
Email: info@cce.usyd.edu.au
<http://www.usyd.edu.au/cce>

Bridging courses; Study skills courses; essay writing courses.

Co-op Bookshop

Sydney University Sports and Aquatic Centre, G09
The University of Sydney
NSW 2006 Australia

Phone: +61 2 9351 3705 or +61 2 9351 2807
Fax: +61 2 9660 5256
Email: sydu@mail.coop-bookshop.com.au
<http://www.coop-bookshop.com.au>

Sells textbooks, reference books, general books and software. Special order services available.

Enrolment and pre-enrolment

Students entering first year

Details of the enrolment procedures will be sent with the UAC Offer of Enrolment. Enrolment takes place at a specific time and date, depending on your surname and the Faculty in which you are enrolling, but is usually within the last week of January. You must attend the University in person or else nominate, in writing, somebody to act on your behalf. On the enrolment day, you pay the compulsory fees for joining the Student Union, the Students' Representative Council and sporting bodies. You also choose your first-year units of study, so it's important to consult the Handbook before enrolling.

All other students

A pre-enrolment package is sent to all enrolled students in late September, and contains instructions on the procedure for pre-enrolment.

Examinations

Examinations and Exclusions Office
Student Centre
Level 1, Carlaw Building, F07
The University of Sydney
NSW 2006 Australia
Phone: +61 2 9351 4005 or +61 2 9351 4006
Fax: +61 2 9351 7330
Email: exams.office@exams.usyd.edu.au

The Examinations and Exclusions Office looks after the majority of exam papers, timetables and exclusions. Some faculties, such as the Sydney Conservatorium of Music, make all examination arrangements for the units of study that they offer.

Fees

Fees Office
Margaret Telfer Building, K07
The University of Sydney
NSW 2006 Australia
Phone: +61 2 9351 5222
Fax: +61 2 9351 4202

For information on how to pay, where to pay, and if payments have been received.

Graduations

Student Centre
Ground Floor, Carlaw Building, F07
The University of Sydney
NSW 2006 Australia
Phone: +61 2 9351 3199, +61 2 9351 4009
Protocol +61 2 9351 4612
Fax: +61 2 9351 5072
Email: k.fizzell@records.usyd.edu.au

Grievances Appeals

Many decisions about academic and non-academic matters are made each year and you may consider that a particular decision affecting your candidature for a degree or other activities at the University may not have taken into account all the relevant matters. In some cases the by-laws or resolutions of the Senate (see Calendar Volume 1) specifically provide for a right of appeal against particular decisions; for example, there is provision for appeal against academic decisions, disciplinary decisions and exclusion after failure.

A document outlining the current procedures for appeals against academic decisions is available at the Student Centre, at the SRC, and on the University's web site at <http://www.usyd.edu.au/su/planning/policy/index.htm>.

General university information

If you wish to seek assistance or advice regarding an appeal, contact: SRC, Level 1, Wentworth Building, G01, The University of Sydney, NSW 2006. Phone +61 2 9660 5222. Parking appeals should be addressed to the Manager, Campus Services.

Health Services

Provides full general practitioner services and emergency medical care to the University community.

Email: Director@unihealth.usyd.edu.au

<http://www.unihealth.usyd.edu.au/>

University Health Centre (Wentworth)

Level 3, Wentworth Building, G01

The University of Sydney

NSW 2006 Australia

Phone: +61 2 9351 3484

Fax: +61 2 9351 4110

University Health Centre (Holme)

Ground Floor, Holme Building, A09

The University of Sydney

NSW 2006 Australia

Phone: +61 2 9351 4095

Fax: +61 2 9351 4338

HECS

Student Centre

Ground Floor, Carlaw Building, F07

The University of Sydney

NSW 2006 Australia

Phone: +61 2 9351 2086, +61 2 9351 5659, +61 2 9351 5062

Fax: +61 2 9351 5081

International Student Centre

International Office

Level 2, Margaret Telfer Building, K07

The University of Sydney

NSW 2006 Australia

Phone: +61 2 9351 4161, +61 2 9351 4079

Fax: +61 2 9351 4013

Email: info@io.usyd.edu.au, reception@io.usyd.edu.au

http://www.usyd.edu.au/homepage/exterel/internat/int_student_centre.html

Provides assistance with application, admission and enrolment procedures for international students.

International Student Services Unit

Level 2, Margaret Telfer Building

The University of Sydney, K07

NSW 2006 Australia

Phone: +61 2 9351 4749

Fax: +61 2 9351 4013

Email: info@issu.usyd.edu.au

<http://www.usyd.edu.au/su/issu/>

Provides an advisory and counselling service to international students.

Koori Centre

Ground Floor, A22 Old Teachers' College

The University of Sydney

NSW 2006 Australia

Phone: +61 2 9351 2046 General Enquiries

+61 2 9351 7003 Liaison Officer

+61 2 9351 7073 Student Counsellor

Fax: +61 2 9351 6923

Email: adminoff@koori.usyd.edu.au

<http://www.koori.usyd.edu.au/>

Tutorial assistance: access to computers, Indigenous counsellor, Aboriginal Studies library study rooms, Orientation program at the beginning of the year, and assistance in study and learning skills. Education Unit: courses in Educations for ATSI students. Indigenous Studies Unit: aims to increase the awareness of Indigenous Australian issues through courses across the University.

Language Centre

Level 2, Christopher Brennan Building, A18

The University of Sydney

NSW 2006 Australia

Phone: +61 2 9351 2371

Fax: +61 2 9351 4724

Email: Langcent.enquiries@language.usyd.edu.au

<http://www.arts.usyd.edu.au/langcent>

Provides self-access course materials in over 100 languages; beginners and intermediate courses in Spanish language and Culture; beginners and advanced courses in Celtic languages and cultures.

Library

Fisher Library, F03

The University of Sydney

NSW 2006 Australia

Phone: +61 2 9351 2993 Enquiries/Information Desk

+61 2 9351 3711 Library Hours

+61 2 9351 7273 Borrowers' Cards

+61 2 9351 6692 Holds Enquiries

+61 2 9351 7277 Inter-library Loans

+61 2 9351 2265 Loans, overdues enquiries

Fax: +61 2 9351 2890 Administration

+61 2 9351 7278 Renewals

Email: fishinf@hbrary.usyd.edu.au (gen enquiries)

loaneng@hbrary.usyd.edu.au (loan enquiries)

reqill@library.usyd.edu.au (inter-library loans)

<http://www.Ubrary.usyd.edu.au>

In addition to Fisher Library, there are over 20 branch and departmental libraries. Branch and departmental libraries should be contacted direct.

Mathematics Learning Centre

Fourth floor, Room 455, Carlaw, F07

The University of Sydney

NSW 2006 Australia

Phone: +61 2 9351 4061

Fax: +61 2 9351 5797

Email: MLC@mail.usyd.edu.au

<http://www.usyd.edu.au/su/mlc/>

Runs bridging courses in Mathematics at the beginning of the academic year (fees apply), and provides on-going support during the year through individual assistance and small group tutorials.

Part-time, full-time

Students are normally considered as full-time if they have a HECS weighting of at least 0.375 each semester. Anything under this amount is considered a part-time study load. Note that some faculties have minimum study load requirements for satisfactory progress.

Privacy and Freedom of Information

The NSW Freedom of Information (FOI) Act 1989 provides the public with a legally enforceable right of access to University documents, subject to particular exemptions. The Act also enables individuals to ensure that information held about them is accurate, up-to-date, and complete. The University has a number of policies permitting access by individuals to information about themselves without recourse to the Freedom of Information Act.

The University necessarily accumulates a great deal of information on individuals; within the University, access to this is restricted to staff who need the information to carry out their duties. As regards external requests for personal information, it is current policy that the University will disclose information to a third party if the subject of the information has consented in writing to the disclosure, or if the University has a legal obligation to respond to a request, including a subpoena, and the request is in the appropriate written form.

The University's Privacy Policy is to be reviewed in the light of the recent NSW Privacy and Personal Information Protection Act. Enquiries should be directed to the: Freedom of Information Coordinator and Privacy Officer c/-Archives, Main Quadrangle, A14
 Phone:+61 2 9351 4263
 Fax:+61 2 9351 7304
 Email: trobins@mailto.usyd.edu.au
<http://www.usyd.edu.au/su/foi>

Scholarships

Research and Scholarships Office
 Room K4.01, Main Quadrangle, A14
 The University of Sydney
 NSW 2006 Australia
 Phone:+61 2 9351 3250
 Fax: +61 2 9351 3256
 Email: scholars@reschols.usyd.edu.au
<http://www.usyd.edu.au/su/reschols/scholarships>
 The Sydney Conservatorium of Music administers all awards designated exclusively for Conservatorium students.

Student Centre

Ground Floor, Carslaw Building, F07
 The University of Sydney
 NSW 2006 Australia
 Phone: +61 2 9351 3023 General Enquiries
 +61 2 9351 4109 Academic Records
 +61 2 9351 3023 Discontinuation of Enrolment
 +61 2 9351 5057 Handbooks
 +61 2 9351 5060 Prizes
 Fax: +61 2 9351 5081; +61 2 9351 5350 Academic Records

Student identification cards

In 1999 the University incorporated a photograph into the student identification card. This means that all students have to provide a colour, passport-sized, head and shoulders photograph when they attend on campus sites to have their student 1D card laminated. University student 1D cards also function as transport concession cards for eligible students, thus eliminating the need for a separate concession card. The endorsement for concession travel will take the form of a hologram sticker attached to the front of the student 1D card.

Student organisations

Students' Representative Council
 Level 1, Wentworth Building, G01
 The University of Sydney
 NSW 2006 Australia
 Phone: +61 2 9660 5222
 +61 2 9660 4756 Secondhand Bookshop
 Fax: +61 2 9660 4260
 Email: postmaster@src.usyd.edu.au
<http://www.sec.usyd.edu.au>
University of Sydney Union
 Box 500, Holme Building, A09
 The University of Sydney
 NSW 2006 Australia
 Phone: +61 2 9563 6000 Switchboard/Enquiries
 Fax: +61 2 9563 6239
 Email: email@usu.usyd.edu.au
<http://www.usu.usyd.edu.au/>
 Main provider of catering facilities, retail services, welfare programs, and social and cultural events for the University community on the Camperdown and Darlington campuses, and at many of the University's affiliated campuses.
Sydney University Sports Union
 University Sports and Aquatic Centre, G09
 The University of Sydney
 NSW 2006 Australia

Phone:+61 2 9351 4960
 Fax: +61 2 9351 4962
 Email: sports_union@susu.usyd.edu.au
 Services, facilities and clubs for sport, recreation and fitness.
Women's Sports Association
 Sports Centre, A30
 The University of Sydney
 NSW 2006 Australia
 Phone: +61 2 9660 6355, +61 2 9351 2057
 Fax: +61 2 9660 0921
 Email: secretary@suwsa.usyd.edu.au
<http://www.usyd.edu.au/su/suwsa/welcome.html>
 Provides for students, predominantly women, to participate in sport and recreation through the provision of facilities, courses and personnel.

Student Services

<http://www.usyd.edu.au/su/stuserv/>
Accommodation Service
 Level 7, Education Building, A35
 The University of Sydney
 NSW 2006 Australia
 Phone:+61 2 9351 3312
 Fax:+61 2 9351 8262
 Email: accomm@stuserv.usyd.edu.au
<http://www.usyd.edu.au/su/accomm/>
Casual Employment Service
 Level 4, Holme Building, A09
 The University of Sydney
 NSW 2006 Australia
 Phone: +61 2 9552 2589
 Fax: +61 2 9552 4713
 Email: ces@stuserv.usyd.edu.au
http://www.usyd.edu.au/su/cas_emp/
Counselling Service
 Level 7, Education Building, A35
 The University of Sydney
 NSW 2006 Australia
 Phone:+61 2 9351 2228
 Fax:+61 2 9351 7055
 Email: lpoerio@mail.usyd.edu.au
www.usyd.edu.au/su/counsel/
Disability and Welfare Services
 Level 7, Education Building, A35
 The University of Sydney
 NSW 2006 Australia
 Phone: +61 2 9351 4554
 Fax:+61 2 9351 7055
 Email: cstuckin@mail.usyd.edu.au
<http://www.usyd.edu.au/su/disability/>
Financial Assistance
 Level 7, Education Building, A35
 The University of Sydney
 NSW 2006 Australia
 Phone:+61 2 9351 2416
 Fax: +61 2 9351 7055
 Email: psweet@mail.usyd.edu.au
http://www.usyd.edu.au/su/fin_assist
Learning Assistance Centre
 Level 7, Education Building, A35
 The University of Sydney
 NSW 2006 Australia
 Phone:+61 2 9351 3853
 Fax: +61 2 9351 4865
 Email: lac@stuserv.usyd.edu.au
<http://www.usyd.edu.au/su/lac/>
 Holds free workshops to assist undergraduate and postgraduate students wanting to improve their academic writing and communication skills at university.

Glossary

This glossary both defines terms in common use in the University and gives some useful administrative information.

Enrolment and general terms

Academic year

The period during which teaching takes place, from March to November. The academic year is divided into two semesters.

Advanced standing

(See also: Credit) Recognition of previous experience or studies, meaning that the candidate has satisfied the entry requirements for a unit. Advanced standing does not reduce the number of credit points required to complete the degree course.

Associate Diploma

The undergraduate award granted following successful completion of Associate Diploma course requirements. An Associate Diploma course usually requires less study than a Diploma course.

Assumed knowledge

The level of knowledge expected for entry to a Unit of Study. Unlike prerequisites, levels of assumed knowledge are not compulsory for entry to a Unit. Students who do not have the assumed knowledge may, however, be at a considerable disadvantage and may consider completing a bridging course prior to enrolment. Contact the Learning Assistance Centre, Mathematics Learning Centre, Language Centre or Centre for Continuing Education for further information.

Bachelor's degree

The highest undergraduate award offered at the University of Sydney (other undergraduate awards are Associate Diploma and Diploma). A Bachelor's degree course normally requires three or four years of full-time study (or the part-time equivalent).

Campus

The grounds on which the University is situated. There are eleven campuses of the University of Sydney: Burren Street (Australian Graduate School of Management), Camperdown and Darlington ('Main campus'), Camden (Agriculture and Veterinary Science), Conservatorium (Sydney Conservatorium of Music), Cumberland (Health Sciences and Nursing), Mallett Street (Nursing), Orange Agricultural College, Rozelle (Sydney College of the Arts), St James (Law) and Surry Hills (Dentistry).

Chancellor

(See also: Vice-Chancellor) The non-resident head of the University.

Combined degree course

A program consisting of two degree courses taken together, which usually requires less time than if the courses were taken separately.

Core

(See also: Elective/Option) A Unit of Study that is compulsory for the course or subject area.

Corequisite

A Unit of Study that must be taken with a given Unit. If a corequisite is not successfully completed, it becomes a prerequisite for further study in that subject area.

Course

A complete degree or diploma program.

Credit

(See also: Advanced standing) Recognition of previous studies or studies completed at another institution. If credit is granted then the number of credit points required for completion of the degree course is reduced.

Creditpoint

A measure of value indicating the contribution each Unit of Study provides towards meeting course completion requirements stated as total credit point value.

Dean

The head of a faculty.

Deferment of enrolment

People who have not previously attended a recognised tertiary institution are normally able to defer commencement of their candidature for one year. Applications are handled by the Admissions Office of the University. Application for deferment must be made during the UAC enrolment week at the 'Deferment' desk in MacLaurin Hall and be accompanied by the 'offer of enrolment' card.

Degree

The award conferred following successful completion of a degree course (for example Bachelor's degree or Master's degree).

Department/School

The academic unit responsible for teaching in a given subject area.

Diploma

The award granted following successful completion of Diploma course requirements. A Diploma course usually requires less study than a degree course. Graduate Diploma courses are for graduates only.

Doctorate

(See also: PhD) The Doctorate and the PhD are the highest awards available at the University of Sydney. A Doctorate course normally involves research and coursework; the candidate submits a thesis that is an original contribution to the field of study. Entry to a Doctorate course often requires completion of a Master's degree course. Note that the Doctorate course is not available in all Departments of the University of Sydney.

Elective/Option

(See also: Core) A Unit of Study that may be taken towards, but is not compulsory for, a course or subject area.

Enrolment

The process whereby an applicant officially accepts the offer of a place in a particular course. If UAC application is successful, an 'offer of enrolment' card is mailed to the applicant, along with instructions for enrolment. In most cases, the applicant must attend the University on a particular enrolment day or, if unable to attend, must appoint somebody to enrol on his or her behalf. Units of Study (for March Semester or whole of First Year) must be nominated on enrolment day. Academic records and HECS liability calculations are based on the enrolment details, so students must ensure that the Faculty holds correct enrolment information (see also: Variation of enrolment).

Entry requirement

The level of knowledge and/or experience required for entry to a particular Unit of Study.

Faculty

The administrative unit responsible for overseeing satisfactory progress during a degree or diploma course.

Full-time

A study load usually defined in terms of HECS weighting of at least 0.375 each semester.

Intermediate

Faculty of Science: Second-year level.

Junior

First-year level.

Laboratory practical

See: Practical.

Lecture

(See also: Tutorial) A class given to a large group of students, during which the lecturer speaks or presents audiovisual material and students take notes.

Major

The subject area(s) in which a student specialises at Senior level. Students usually specialise in one (single major) or two (double major) subject areas. The major is usually recorded on the testamur.

Master's degree

A postgraduate award. Master's degree courses may be offered by coursework, research only or a combination of coursework and research. Entry to the course often requires completion of an Honours year at undergraduate level.

Mature age

A category of Special Admission applicants who are 21 years or older on 1 March of the year in which they want to study and who do not have the high school qualifications normally required for entry into a course.

Minor

Subject areas in which a student studies, but does not specialise at Senior level.

Orientation period

'O Week' takes place during the week prior to lectures in March semester. During O Week, students can join various clubs, societies and organisations, register for courses with Departments and take part in activities provided by the University of Sydney Union.

Part-time

A study load usually defined in terms of HECS weighting of less than 0.375 each semester.

PhD

(See also: Doctorate) The Doctor of Philosophy (PhD) and other Doctorate awards are the highest awards available at the University of Sydney. A PhD course is normally purely research-based; the candidate submits a thesis that is an original contribution to the field of study. Entry to a PhD course often requires completion of a Master's degree course. Note that the PhD course is available in most Departments of the University of Sydney.

Postgraduate

The term used to describe a course leading to an award such as Graduate Diploma, Master's degree or PhD, which usually requires prior completion of a relevant undergraduate degree (or diploma) course. A 'postgraduate' is a student enrolled in such a course.

Practical

Similar to a tutorial, during which experiments or other relevant applied activities are carried out.

Prerequisite

A Unit of Study that must be taken prior to entry to a given Unit.

Prohibition

A Unit of Study that cannot be taken with a given Unit.

Recommended reading

Reading material that is suggested but not compulsory for a Unit of Study.

Registrar

The head of the administrative divisions of the University.

Registration

In addition to enrolling (with the Faculty) in Units of Study, students must register with the Department responsible for teaching each Unit. This is normally done during the Orientation period (O' Week). Note that unlike enrolment, registration is not a formal record of Units attempted by the student.

Resolutions of Senate

Regulations determined by the Senate of the University of Sydney that pertain to degree and diploma course requirements and other academic matters.

School

Similar to a large Department, otherwise a grouping of Departments.

Semester

A period of 14 weeks during which teaching takes place. There are two semesters each year for most faculties. Semesters are named by the month in which they start, typically 'March' and 'July'

Senior

Second-year level or higher.
Faculty of Science: third-year level.

Special Admission

Certain categories of applicants, such as mature-age applicants, students who have experienced educational disadvantage or Aboriginal or Torres Strait Islander applicants, may apply for admission to the University under one of several Special Admission schemes. Contact the Special Admissions office for further information.

Subject area

One or more Units of Study that comprise a particular field of study (eg Japanese or Chemistry).

Textbook

Reading material that the student is expected to own.

Tutorial

(See also: Lecture) A small class consisting of a tutor and up to about 25 students, during which concepts raised in lectures are discussed in detail and may be supplemented with readings, demonstrations and presentations.

UAI

The University Admissions Index (UAI) is the numerical expression of a student's performance in the NSW Higher School Certificate (HSC), which takes into account both assessment and examination results.

UAI cut-off

The UAI of the last student admitted to a course. Some courses have a minimum UAI as an entry requirement.

Undergraduate

The term used to describe a course leading to a diploma or Bachelor's degree. An 'undergraduate' is a student enrolled in such a course.

Unit of Study

A stand-alone component of a degree or diploma course that is recordable on the academic transcript.

Universities Admissions Centre (UAC)

The organisation that processes applications for most NSW undergraduate university and TAFE courses.

Variation of enrolment

The process whereby students officially notify the Faculty of changes regarding the Units of Study they are attending. This must be done by a certain deadline in each semester, to avoid penalties such as 'discontinued' results on the academic transcript (see: Results) or unnecessary HECS charges.

Vice-Chancellor

(See also: Chancellor) The administrative head of the whole University, including academic and administrative divisions.

Costs

Bursary

A sum given to a student who has limited resources or is experiencing financial hardship, ranging from \$100 to \$1000.

Fees (full-fee undergraduate/postgraduate)

Tuition, examination or other fees payable to the University by an enrolled or enrolling student in connection with a course of study or attendance at the University and includes fees payable in respect of the granting of a degree, diploma, associate diploma or other award. It does not include annual

subscription to organisations such as the Union or SRC, or fees payable in respect of residential accommodation.

HECS

All Australian undergraduate students are currently required to contribute to the cost of tertiary education through the Higher Education Contribution Scheme (HECS), which is administered under the Higher Education Funding Act 1988. Under HECS students pay for part of the cost of their higher education and the Commonwealth pays the rest. The amount payable is determined by the units of study a student chooses to undertake in the case of coursework awards, or the attendance (full-time or part-time) in the case of research students.

Prize

Matriculation, undergraduate and postgraduate funding automatically awarded on academic results in courses, yearly examinations or on the recommendation of the Head of Department. There are also prizes for essay writing and composition by anonymous application. Prize values range from \$100 to \$6250.

Scholarship

Matriculation and undergraduate funding by application awarded on UAI results for students enrolling in the first year of a degree course. Postgraduate funding for full-time candidates enrolled in a research degree course with scholarship conditions and benefits varying according to specific awards. The intention is to encourage and support scholarship at the University in general or in targeted areas.

Assessment, Examination, Satisfactory Progress and Graduation

Academic transcript/record

The official record of results for each student (see: Results).

Appeal

The process whereby a student may raise objections regarding results, Faculty decisions or other academic matters.

Assessment

(See also: Examination) The appraisal of a student's ability throughout the semester, by various means such as essays, practical reports or presentations, which counts towards the final mark or grade.

Candidate

Someone studying for a degree or diploma. The term may also be used to describe someone sitting for an examination.

Examination

(See also: Assessment) The appraisal of a student's ability, usually at the end of semester. Most examinations take place on campus under strictly supervised conditions but some Units make use of take-home or open-book examinations.

Exclusion

A ruling by the Faculty, which declares the student ineligible for further enrolment for reasons such as lack of satisfactory progress. Students who wish to re-enrol must show good cause why they should be allowed to re-enrol (see: Show cause and Satisfactory progress).

Grievances

See Appeals.

Grade

A category into which a student's final mark falls (see: Results).

Graduand

A person who has fulfilled the requirements of a degree but is yet to graduate.

Graduate

(See also: Postgraduate) A person who has graduated. Also a term used to describe a course leading to an award such as Master's degree or PhD or a student enrolled in such as course.

Graduation

The ceremony during which degrees are conferred and diplomas awarded.

Honours degree

A Bachelor's degree for which extra work (course work and/or thesis) has been completed, usually requiring an extra year of study.

Mark

(See also: Grade) The numerical result of assessments and/or examinations for a Unit of Study, which may be converted to a grade.

Pass degree

A Bachelor's degree.

Re-enrolment

The process by which continuing students enrol in Units of Study.

Results

The official statement of the student's performance in each Unit of Study attempted, as recorded on the academic transcript, usually expressed as a grade:

High Distinction

A mark of 85 % and above

Distinction

A mark of 75-84%

Credit

A mark of 65-74%

Pass

A mark of 50-64%

Pass (Concessional)

A mark of 46-49%. The student is deemed to have completed unit requirements but may not necessarily proceed to the next level.

Fail

A mark of less than 50%

Withdrawn

This is the same as if the candidate had not enrolled in the course concerned. Although the University has a record of the withdrawal, the course and result will not appear on the official academic transcript. There is no HECS liability either. In order to have a course recorded as 'withdrawn', notice must be given by the candidate to the Faculty office on or before the deadline. Refer to the section on degree regulations.

Discontinued with Permission

This does not count as an attempt at the particular course, but does appear on the candidate's academic record. A candidate may have enrolment recorded as 'discontinued with permission' where: (1) notice is given to the faculty office on or before the deadline or; (2) after the deadline, evidence is produced of serious illness or misadventure. Refer to the section on degree regulations for deadlines. Discontinuation with permission does not mean that the student's progress is considered to be satisfactory.

Discontinued

This counts as an unsuccessful attempt at the course concerned and appears on the candidate's academic record. Where notice is given after the deadline for 'discontinued with permission' but before the last day of lectures for the course, the result is 'Disc.'. Refer to the section on degree regulations for deadlines.

Absent Fail

If the candidate misses the deadline for 'discontinued' and does not sit the final exam, the result is 'absent fail'.

Satisfactory progress

A minimum standard of performance required for continuation of enrolment. Senate resolutions rule that if a student fails or discontinues a year of candidature or a Unit of Study more than once then he or she is ineligible for re-enrolment (see: Exclusion and Show cause). Note that some faculties may have alternative or additional requirements for satisfactory progress.

Show cause

The Faculty may require a student to show good cause why he or she may be allowed to continue in the degree or diploma

Glossary

course, where requirements for satisfactory progress have not been met (see: Exclusion and Satisfactory progress).

Special consideration

The process whereby enrolled students who have experienced significant educational disadvantage may have their assessment deadlines or grades revised.

Study Vacation (Stuvac)

The week prior to the examination period in each semester, during which no classes are held.

Supplementary examination

An extra or alternative examination taken by a student who has experienced significant educational disadvantage during semester or the examination period. Note that some faculties do not offer supplementary examinations (see also: Special consideration).

Suspension of candidature

A complete break in the studies of an enrolled student, usually for a period of one year. Applications are handled by the Faculty office. (Those wishing to postpone commencement of a course need to apply for deferment, see: Deferment of enrolment).

Testamur

The document given to the graduand at graduation.

Thesis

A substantial piece of written work (sometimes called a dissertation) by a student, normally a candidate for an Honours degree or a higher award (such as Master's degree or PhD).

Weighted Average Mark (WAM)

A numerical expression of a student's performance throughout his or her degree program, usually assigning more 'weight' to Senior or Honours years. Note that the WAM calculation may differ for purposes such as eligibility for various scholarships and will vary from faculty to faculty.

Index

A

Accommodation Service, 135
Adaptive Pattern Recognition ELEC 5604, 45
Advanced Aerospace Materials MECH 4315, 54
Advanced Aircraft Design AERO 4490, 12
Advanced Communication Networks ELEC 5501, 44
Advanced Computational Aerodynamics AERO 4291,11
Advanced Computer Architecture ELEC 5602, 45
Advanced Design and Analysis 1 MECH 4410, 55
Advanced Design and Analysis 2 MECH 4420, 55
Advanced Digital Engineering ELEC 5605, 45
Advanced Engineering Materials MECH 4310, 54
Advanced Engineering Project ENGG 2002, 59
Advanced Flight Mechanics AERO 4590, 13
Advanced Fluid Dynamics Modelling CHNG 4301, 22
Advanced Materials CIVL 4105, 31
Advanced Particle Mechanics CHNG 4601, 24
Advanced Power Electronics and Drives ELEC 5202,44
Advanced Real Time Computing ELEC 5601,45
Advanced Topics in Environmental Engineering A CHNG, 23
Advanced Topics in Environmental Engineering B CHNG, 23
Advances in Chemical Engineering A CHNG 4003, 19
Advances in Chemical Engineering B CHNG 4004, 19
Advances in Computer Science 1 COMP 4601, 37
Advances in Computer Science 2 COMP 4602, 37
Advances in Computer Science 3 CQMP 4603,38
Advances in Computer Science 4 COMP 4604, 38
Advances in Polymer Engineering CHNG 4103, 20
AERO 1400 Introduction to Aircraft Construction and , 5
AERO 1600 Workshop Technology, 5
AERO 1700 Introduction to Space Engineering, 6
AERO 1800 Computational Engineering 1D, 6
AERO 1900 Introductory Aeronautics, 6
AERO 2201 Fluid Mechanics, 6
AERO 2300 Mechanics of Solids 1, 7
AERO 2500 Introductory Flight Mechanics and Performa, 7
AERO 2700 Space Engineering 1, 7
AERO 2800 Aeronautical Engineering Computing, 7
AERO 3200 Aerodynamics 1,7
AERO 3250 Aerodynamics 2, 8
AERO 3300 Aircraft Structures 1, 8
AERO 3301 Aerospace Structures 1, 8
AERO 3350 Aircraft Structures 2, 8
AERO 3351 Aerospace Structures 2, 8
AERO 3400 Aircraft Design 1, 9
AERO 3401 Aerospace Design 1, 9
AERO 3450 Aircraft Design 2, 9
AERO 3500 Flight Mechanics 1, 9
AERO 3501 Hying Operations, 9
AERO 3600 Aviation Technology, 9
AERO 3601 Aviation Operation and Management, 9
AERO 3700 Space Engineering 2, 10
AERO 4200 Aerodynamics 3, 10
AERO 4201 Propulsion, 10
AERO 4250 Aerodynamics 4, 10
AERO 4290 Rotary Wing Aircraft, 10
AERO 4291 Advanced Computational Aerodynamics, 11
AERO 4292 Aeroelasticity, 11
AERO 4300 Aircraft Structures 3, 11
AERO 4301 Applied Numerical Stress Analysis, 11
AERO 4302 Aerospace Structures 3, 11
AERO 4350 Aircraft Structures 4, 12
AERO 4351 Aerospace Structures 4, 12
AERO 4390 Smart Materials and Structures, 12
AERO 4400 Aircraft Design 3, 12
AERO 4490 Advanced Aircraft Design, 12
AERO 4500 Flight Mechanics 2, 12
AERO 4590 Advanced Flight Mechanics, 13
AERO 4600 Practical Experience, 13
AERO 4620 Aeronautical International Exchange Progra, 13
AERO 4700 Space Engineering 3, 13
AERO 4900 Thesis or Design Project, 14

AERO 4920 Seminar, 14
Aerodynamics 1 AERO 3200, 7
Aerodynamics 2 AERO 3250, 8
Aerodynamics 3 AERO 4200, 10
Aerodynamics 4 AERO 4250, 10
Aeroelasticity AERO 4292, 11
Aeronautical Engineering Computing AERO 2800, 7
Aeronautical Engineering Department, 1
Aeronautical International Exchange Program AERO 462, 13
Aerospace Design 1 AERO 3401, 9
Aerospace Structures 1 AERO 3301, 8
Aerospace Structures 2 AERO 3351, 8
Aerospace Structures 3 AERO 4302, 11
Aerospace Structures 4 AERO 4351, 12
Air conditioning and Refrigeration MECH 4250, 54
Aircraft Design 1 AERO 3400, 9
Aircraft Design 2 AERO 3450, 9
Aircraft Design 3 AERO 4400, 12
Aircraft Structures 1 AERO 3300, 8
Aircraft Structures 2 AERO 3350, 8
Aircraft Structures 3 AERO 4300,11
Aircraft Structures 4 AERO 4350,12
Algorithms (Advanced Topic) COMP 4301, 36
Anatomy and Physiology for Engineers MECH 2900,48
appeals, grievances, 133
Applied Numerical Stress Analysis AERO 4301, 11
Artificial Intelligence (Advanced Topic) COMP 4302, 36
Aviation Operation and Management AERO 3601, 9
Aviation Technology AERO 3600, 9

B

Biochemical Engineering CHNG 4501, 23
Biologically Inspired Signal Processing ELEC 5603,45
Biomaterials and Biomechanics MECH 4910, 58
Biomedical Design Project MECH 3920, 52
Biomedical Engineering, 3
Biomedical Engineering Systems ELEC 4801, 43
Biomedical Technology MECH 3910,52
Bioremediation CHNG 4505, 24
Bookshop (Co-op), 133
Bridge Engineering CIVL 4221, 32

C

careers information, 133
Cellular Radio Engineering ELEC 5504, 44
Chemical Engineering 1A CHNG 1101, 14
Chemical Engineering 1B CHNG 1102, 14
Chemical Engineering 2A CHNG 2101, 15
Chemical Engineering 2B CHNG 2102, 15
Chemical Engineering Applications CHNG 1001, 14
Chemical Engineering Computations CHNG 2301, 15
Chemical Engineering Department, 1
Chemical Engineering Design 1 CHNG 4201, 21
Chemical Engineering Design 2 CHNG 4202, 21
Chemical Engineering Laboratory CHNG 3001, 16
Chemical Modelling of Aqueous Systems CHNG 4604, 24
Chemical Process Case Studies CHNG 1201,14
CHNG 1001 Chemical Engineering Applications, 14
CHNG 1101 Chemical Engineering 1A, 14
CHNG 1102 Chemical Engineering 1B, 14
CHNG 1201 Chemical Process Case Studies, 14
CHNG 1301 Computing for Chemical Engineers, 15
CHNG 2101 Chemical Engineering 2A, 15
CHNG 2102 Chemical Engineering 2B, 15
CHNG 2301 Chemical Engineering Computations, 15
CHNG 2302 Process Data Management, 15
CHNG 2501 Sustainable Development, 15
CHNG 2502 Clean Products and Processes, 16
CHNG 2601 Materials and Corrosion, 16
CHNG 2701 Fundamentals of Bioprocess Engineering 1, 16
CHNG 2702 Fundamentals of Bioprocess Engineering 2, 16
CHNG 3001 Chemical Engineering Laboratory, 16
CHNG 3041 Year 3 Exchange Program A, 16
CHNG 3042 Year 3 Exchange Program B, 16
CHNG 3101 Unit Operations (Heat Transfer), 17
CHNG 3102 Unit Operations (Mass Transfer), 17
CHNG 3103 Unit Operations (Particle Mechanics), 17
CHNG 3104 Unit Operations (Fluid Mechanics), 17
CHNG 3105 Thermodynamics 1, 17
CHNG 3106 Thermodynamics 2,18
CHNG 3107 Reaction Engineering 1, 18
CHNG 3301 Process Modelling, 18
CHNG 3302 Process Control 1, 18
CHNG 3303 Flowsheeting and Optimisation, 18

Index

- CHNG 3401 Project Economics, 18
CHNG 3501 Waste Management and Treatment Technologies, 18
CHNG 4001 Practical Experience, 19
CHNG 4002 Thesis, 19
CHNG 4003 Advances in Chemical Engineering A, 19
CHNG 4004 Advances in Chemical Engineering B, 19
CHNG 4005 Laboratory Projects in Unit Operations, 19
CHNG 4006 Professional Option, 19
CHNG 4041 Year 4 Exchange Program A, 20
CHNG 4042 Year 4 Exchange Program B, 20
CHNG 4101 Separation Processes, 20
CHNG 4102 Transport Phenomena, 20
CHNG 4103 Advances in Polymer Engineering, 20
CHNG 4104 Reaction Engineering 2, 21
CHNG 4105 Thermodynamics of Natural Gas Engineering, 21
CHNG 4201 Chemical Engineering Design 1, 21
CHNG 4202 Chemical Engineering Design 2, 21
CHNG 4203 Major Industrial Project, 21
CHNG 4301 Advanced Fluid Dynamics Modelling, 22
CHNG 4302 Reservoir Engineering, 22
CHNG 4303 Optimisation Techniques, 22
CHNG 4304 Process Control 2, 22
CHNG 4305 Process Systems Engineering, 22
CHNG 4401 Project Engineering, 22
CHNG 4402 Process Plant Risk Management, 23
CHNG 4403 Engineering Business Skills, 23
CHNG 4501 Biochemical Engineering, 23
CHNG 4502 Advanced Topics in Environmental Engineering, 23
CHNG 4503 Advanced Topics in Environmental Engineering, 23
CHNG 4504 Environmental Decision Making, 23
CHNG 4505 Bioremediation, 24
CHNG 4601 Advanced Particle Mechanics, 24
CHNG 4602 Mineral Processing (Extractive Metallurgy), 24
CHNG 4603 Mineral Processing (Mineral Dressing), 24
CHNG 4604 Chemical Modelling of Aqueous Systems, 24
Circuit Analysis ELEC 2101, 39
Circuit Theory and Design ELEC 3101, 39
Civil Engineering 1 CIVL 1001, 25
Civil Engineering and Project Engineering and Man, 2
Civil Engineering Design CIVL 4903, 35
CIVL 1001 Civil Engineering 1, 25
CIVL 1004 Computational Engineering, 25
CIVL 1051 Dynamics, 25
CIVL 1052 Statics, 25
CIVL 2004 Engineering Communications 1, 26
CIVL 2101 Properties of Materials, 26
CIVL 2201 Structural Mechanics, 26
CIVL 2203 Structural Design, 26
CIVL 2409 Engineering Geology 2, 27
CIVL 2610 Fluids 1, 27
CIVL 2801 Engineering Construction 1, 27
CIVL 3005 Engineering Communications 2, 27
CIVL 3102 Materials Aspects in Design, 27
CIVL 3204 Structural Analysis, 28
CIVL 3206 Steel Structures 1, 28
CIVL 3207 Risk and Reliability Analysis, 28
CIVL 3223 Concrete Structures - Behaviour, 28
CIVL 3224 Concrete Structures - Design, 28
CIVL 3401 Soil Mechanics A, 29
CIVL 3402 Soil Mechanics B, 29
CIVL 3501 Surveying 1, 29
CIVL 3602 Fluids 2, 29
CIVL 3701 Transportation Engineering and Planning, 29
CIVL 3802 Engineering Construction 2, 30
CIVL 3803 Project Appraisal, 30
CIVL 3804 Contracts Formulation & Management, 30
CIVL 3805 Project Scope, Time & Cost Management, 30
CIVL 4008 Practical Experience, 31
CIVL 4013 Honours Thesis, Design, Project, 31
CIVL 4014 Thesis/Design/Project, 31
CIVL 4015 Thesis/Design/Project - One Semester, 31
CIVL 4016 Professional Practice, 31
CIVL 4105 Advanced Materials, 31
CIVL 4218 Concrete Structures 2, 32
CIVL 4219 Structural Dynamics, 32
CIVL 4220 Steel Structures 2, 32
CIVL 4221 Bridge Engineering, 32
CIVL 4222 Finite Element Methods, 33
CIVL 4406 Environmental Geotechnics, 33
CIVL 4407 Geotechnical Engineering, 33
CIVL 4504 Surveying 2, 33
CIVL 4607 Environmental Fluids 1, 33
CIVL 4608 Environmental Fluids 2, 34
CIVL 4609 Water Resources Engineering, 34
CIVL 4803 Engineering Management, 34
CIVL 4807 Project Formulation, 34
CIVL 4808 Project Management & Information Technology, 34
CIVL 4809 Project Planning & Tendering, 35
CIVL 4810 Project Quality, Risk & Procurement Management, 35
CIVL 4903 Civil Engineering Design, 35
Clean Products and Processes CHNG 2502, 16
Combustion and Fire Safety MECH 4260, 54
Communications Electronics ELEC 3402, 40
COMP 4300 Information Systems (Advanced Topic), 35
COMP 4301 Algorithms (Advanced Topic), 36
COMP 4302 Artificial Intelligence (Advanced Topic), 36
COMP 4304 Graphics (Advanced Topic), 36
COMP 4305 Networked Systems (Advanced Topic), 36
COMP 4306 Database Systems (Advanced Topic), 36
COMP 4307 Distributed Systems (Advanced Topic), 36
COMP 4309 Object-Oriented Systems (Advanced Topic), 36
COMP 4400 Operating Systems (Advanced Topic), 37
COMP 4401 Software engineering (Advanced Topic), 37
COMP 4402 User Interfaces (Advanced Topic), 37
COMP 4403 Computation Theory (Advanced Topic), 37
COMP 4404 Scientific Visualisation (Advanced Topic), 37
COMP 4601 Advances in Computer Science 1, 37
COMP 4602 Advances in Computer Science 2, 37
COMP 4603 Advances in Computer Science 3, 38
COMP 4604 Advances in Computer Science 4, 38
Computation Theory (Advanced Topic) COMP 4403, 37
Computational Engineering 1A MECH 1800, 47
Computational Engineering 1B MECH 1810, 47
Computational Engineering 1C MECH 1801, 47
Computational Engineering 1D AERO 1800, 6
Computational Engineering CIVL 1004, 25
Computational Fluid Dynamics MECH 4210, 53
Computer and Network Security ELEC 5610, 46
Computer Control System Design ELEC 4301, 41
Computer Design ELEC 4601, 42
Computers in Real Time Control and Instrumentation M, 58
Computing for Chemical Engineers CHNG 1301, 15
Concrete Structures - Behaviour CIVL 3223, 28
Concrete Structures - Design CIVL 3224, 28
Concrete Structures 2 CIVL 4218, 32
Contracts Formulation & Management CIVL 3804, 30
Counselling Service, 135
- D**
Data Communication Networks ELEC 4501, 42
Database Systems (Advanced Topic) COMP 4306, 36
Digital Communication Systems ELEC 4502, 42
Digital Signal Processing ELEC 4303, 42
Digital Systems Design ELEC 3601, 41
diplomas and certificates, 126
Disability and Welfare Services, 135
Distributed Systems (Advanced Topic) COMP 4307, 36
Doctor of Philosophy, 125
Dynamics CIVL 1051, 25
- E**
Economic, Social and Ethical Aspects of Engineering, 60
ELEC 1001 Introductory Electrical Engineering, 38
ELEC 1101 Foundations of Computer Systems, 38
ELEC 1102 Foundations of Electronic Circuits, 38
ELEC 2001 Electrical and Electronic Engineering, 38
ELEC 2003 Electrical and Electronic Engineering A, 39
ELEC 2101 Circuit Analysis, 39
ELEC 2301 Signals and Systems, 39
ELEC 2401 Electronic Devices and Circuits, 39
ELEC 2601 Microcomputer Systems, 39
ELEC 3101 Circuit Theory and Design, 39
ELEC 3102 Engineering Electromagnetics, 40
ELEC 3103 Electrical Engineering Design, 40
ELEC 3201 Fundamentals of Electrical Energy Systems, 40
ELEC 3202 Power Electronics and Drives, 40
ELEC 3302 Fundamentals of Feedback Control, 40
ELEC 3401 Electronic Devices and Circuits, 40
ELEC 3402 Communications Electronics, 40
ELEC 3403 Switching Devices and High Speed Electronics, 40
ELEC 3502 Random Signals and Communications, 41
ELEC 3503 Introduction to Digital Communications, 41
ELEC 3601 Digital Systems Design, 41
ELEC 3701 Management for Engineers, 41
ELEC 3801 Fundamentals of Biomedical Engineering, 41
ELEC 4201 Electrical Systems Modelling and Analysis, 41
ELEC 4301 Computer Control System Design, 41
ELEC 4302 Image Processing and Computer Vision, 41

ELEC 4303 Digital Signal Processing, 42
 ELEC 4401 Electronic Design, 42
 ELEC 4402 Integrated Circuit Design, 42
 ELEC 4501 Data Communication Networks, 42
 ELEC 4502 Digital Communication Systems, 42
 ELEC 4503 Error Control Coding, 42
 ELEC 4601 Computer Design, 42
 ELEC 4602 Real Time Computing, 43
 ELEC 4604 Engineering Software Requirements, 43
 ELEC 4701 Project Management, 43
 ELEC 4702 Practical Experience, 43
 ELEC 4703 Thesis, 43
 ELEC 4704 Software Project Management, 43
 ELEC 4801 Biomedical Engineering Systems, 43
 ELEC 5201 Electrical Systems Control, 44
 ELEC 5202 Advanced Power Electronics and Drives, 44
 ELEC 5301 Non-linear and Adaptive Control, 44
 ELEC 5302 Fuzzy Systems, 44
 ELEC 5501 Advanced Communication Networks, 44
 ELEC 5502 Satellite Communication Systems, 44
 ELEC 5503 Optical Communication Systems, 44
 ELEC 5504 Cellular Radio Engineering, 44
 ELEC 5505 Spread Spectrum CDMA for Mobile Communicat, 44
 ELEC 5601 Advanced Real Time Computing, 45
 ELEC 5602 Advanced Computer Architecture, 45
 ELEC 5603 Biologically Inspired Signal Processing, 45
 ELEC 5604 Adaptive Pattern Recognition, 45
 ELEC 5605 Advanced Digital Engineering, 45
 ELEC 5606 Multimedia Systems and Applications, 45
 ELEC 5607 Hardware/Software Co-design, 45
 ELEC 5608 Electronic Commerce, 45
 ELEC 5609 Internet Engineering, 46
 ELEC 5610 Computer and Network Security, 46
 Electrical and Electronic Engineering A ELEC 2003, 39
 Electrical and Electronic Engineering ELEC 2001, 38
 Electrical Engineering Design ELEC 3103, 40
 Electrical Systems Control ELEC 5201, 44
 Electrical Systems Modelling and Analysis ELEC 4201, 41
 Electrical, Telecommunications, Software and Comp, 2
 Electronic Commerce ELEC 5608, 45
 Electronic Design ELEC 4401, 42
 Electronic Devices and Circuits ELEC 2401, 39
 Electronic Devices and Circuits ELEC 3401, 40
 Employment, Casual, 135
 Energy and the Environment MECH 4240, 54
 ENGG 1001 Interdisciplinary Project, 58
 ENGG 2002 Advanced Engineering Project, 59
 ENGG 2003 Introduction to Engineering Management, 59
 ENGG 2004 Introductory Engineering Studies, 59
 ENGG 2005 Introductory Engineering Project, 59
 ENGG 3001 Engineering Technology Education, 59
 ENGG 3002 Industrial and Engineering Management, 59
 ENGG 4001 Innovation and International Competitiveness, 59
 ENGG 4002 New Business Creation, 60
 ENGG 4003 Economic, Social and Ethical Aspects of En, 60
 Engineering Business Skills CHNG 4403, 23
 Engineering Communications 1 CIVL 2004, 26
 Engineering Communications 2 CIVL 3005, 27
 Engineering Construction 1 CIVL 2801, 27
 Engineering Construction 2 CIVL 3802, 30
 Engineering Dynamics 1 MECH 2500, 48
 Engineering Dynamics 2 MECH 3500, 50
 Engineering Electromagnetics ELEC 3102, 40
 Engineering Geology 1 GEOL 1501, 26
 Engineering Geology 2 CIVL 2409, 27
 Engineering Management CIVL 4803, 34
 Engineering Software Requirements ELEC 4604, 43
 Engineering Statics MECH 1501, 46
 Engineering Technology Education ENGG 3001, 59
 Enrolment and pre-enrolment, 133
 Environmental Acoustics and Noise Control MECH 4230, 53
 Environmental Decision Making CHNG 4504, 23
 Environmental Engineering MECH 4220, 53
 Environmental Fluids 1 CIVL 4607, 33
 Environmental Fluids 2 CIVL 4608, 34
 Environmental Geotechnics CIVL 4406, 33
 Error Control Coding ELEC 4503, 42
 Examinations and Exclusions Office, 133
F
 Fees Office, 133
 Financial Assistance, 135
 Finite Element Methods CIVL 4222, 33
 Flight Mechanics 1 AERO 3500, 9
 Flight Mechanics 2 AERO 4500, 12
 Flowsheeting and Optimisation CHNG 3303, 18
 Fluid Mechanics AERO 2201, 6
 Fluid Mechanics MECH 3210, 49
 Fluids 1 CIVL 2610, 27
 Fluids 1 MECH 2202, 47
 Fluids 2 CIVL 3602, 29
 Flying Operations AERO 3501, 9
 Foundations of Computer Systems ELEC 1101, 38
 Foundations of Electronic Circuits ELEC 1102, 38
 Freedom of Information, 134
 Fundamentals of Biomedical Engineering ELEC 3801, 41
 Fundamentals of Bioprocess Engineering 1 CHNG 2701, 16
 Fundamentals of Bioprocess Engineering 2 CHNG 2702, 16
 Fundamentals of Electrical Energy Systems ELEC 3201, 40
 Fundamentals of Feedback Control ELEC 3302, 40
 Further Information, 126
 Fuzzy Systems ELEC 5302, 44
G
 GEOL 1501 Engineering Geology 1, 26
 Geotechnical Engineering CIVL 4407, 33
 Graduations office, 133
 Graphics (Advanced Topic) COMP 4304, 36
H
 Hardware/Software Co-design ELEC 5607, 45
 Health Services, 134
 Heat Transfer MECH 3202, 49
 Honours Thesis, Design, Project CIVL 4013, 31
I
 Image Processing and Computer Vision ELEC 4302, 41
 Industrial and Engineering Management ENGG 3002, 59
 Industrial and Engineering Management MECH 4610, 56
 Industrial Engineering MECH 4605, 55
 Industrial Ergonomics MECH 4620, 56
 Industrial Management MECH 3620, 51
 Information Systems (Advanced Topic) COMP 4300, 35
 Innovation and International Competitiveness ENGG 40, 59
 Integrated Circuit Design ELEC 4402, 42
 Interdisciplinary Project ENGG 1001, 58
 International Office, 134
 International Student Services Unit, 134
 Internet Engineering ELEC 5609, 46
 Introduction to Aircraft Construction and Design AER, 5
 Introduction to Digital Communications ELEC 3503, 41
 Introduction to Engineering Management ENGG 2003, 59
 Introduction to Operations Research MECH 4635, 56
 Introduction to Space Engineering AERO 1700, 6
 Introductory Aeronautics AERO 1900, 6
 Introductory Electrical Engineering ELEC 1001, 38
 Introductory Engineering Project ENGG 2005, 59
 Introductory Engineering Studies ENGG 2004, 59
 Introductory Flight Mechanics and Performance AERO 2, 7
K
 Kinematics and Dynamics MECH 1510, 46
 Koori Centre, 134
L
 Laboratory Projects in Unit Operations CHNG 4005, 19
 Language Centre, 134
 Learning Assistance Centre, 135
 Library (Fisher), 134
M
 Machine Vibration and Monitoring MECH 4510, 55
 Major Industrial Project CHNG 4203, 21
 Management for Engineers ELEC 3701, 41
 Manufacturing Engineering MECH 3600, 51
 Manufacturing Systems MECH 3601, 51
 Manufacturing Technology MECH 1600, 46
 Master of Engineering, 125
 Master of Engineering (Research), 125
 Master of Engineering Studies, 125
 Master of Project Management, 126
 Materials 1 MECH 2300, 47
 Materials 2 MECH 3300, 49
 Materials and Corrosion CHNG 2601, 16
 Materials Aspects in Design CIVL 3102, 27
 Mathematics Learning Centre, 134
 MECH 1500 Mechanical Engineering 1, 46
 MECH 1501 Engineering Statics, 46

Index

- MECH 1510 Kinematics and Dynamics, 46
MECH 1600 Manufacturing Technology, 46
MECH 1800 Computational Engineering 1A, 47
MECH 1801 Computational Engineering 1C, 47
MECH 1810 Computational Engineering 1B, 47
MECH 2201 Thermodynamics 1, 47
MECH 2202 Fluids 1,47
MECH 2300 Materials 1, 47
MECH 2400 Mechanical Design 1, 48
MECH 2500 Engineering Dynamics 1, 48
MECH 2700 Mechatronics 1,48
MECH 2900 Anatomy and Physiology for Engineers, 48
MECH 3200 Thermal Engineering 1, 49
MECH 3201 Thermodynamics 2,49
MECH 3202 Heat Transfer, 49
MECH 3210 Fluid Mechanics, 49
MECH 3300 Materials 2, 49
MECH 3310 Mechanics of Solids 2, 50
MECH 3400 Mechanical Design 2A, 50
MECH 3410 Mechanical Design 2B, 50
MECH 3500 Engineering Dynamics 2, 50
MECH 3600 Manufacturing Engineering, 51
MECH 3601 Manufacturing Systems, 51
MECH 3610 Team Project, 51
MECH 3620 Industrial Management, 51
MECH 3700 Mechatronics 2, 51
MECH 3800 Systems Control, 51
MECH 3910 Biomedical Technology, 52
MECH 3920 Biomedical Design Project, 52
MECH 4101 Thesis A, 52
MECH 4102 Thesis B, 52
MECH 4110 Professional Engineering, 52
MECH 4120 Professional Communication, 53
MECH 4130 Practical Experience, 53
MECH 4210 Computational Fluid Dynamics, 53
MECH 4220 Environmental Engineering, 53
MECH 4230 Environmental Acoustics and Noise Control, 53
MECH 4240 Energy and the Environment, 54
MECH 4250 Air conditioning and Refrigeration, 54
MECH 4260 Combustion and Fire Safety, 54
MECH 4310 Advanced Engineering Materials, 54
MECH 4315 Advanced Aerospace Materials, 54
MECH 4410 Advanced Design and Analysis 1, 55
MECH 4420 Advanced Design and Analysis 2, 55
MECH 4510 Machine Vibration and Monitoring, 55
MECH 4605 Industrial Engineering, 55
MECH 4610 Industrial and Engineering Management, 56
MECH 4620 Industrial Ergonomics, 56
MECH 4635 Introduction to Operations Research, 56
MECH 4640 Product Life Cycle Design, 57
MECH 4650 Workplace industrial Relations, 57
MECH 4700 Robotic Systems, 57
MECH 4710 Microprocessors in Engineered Products, 57
MECH 4720 Sensors and Signals, 57
MECH 4730 Computers in Real Time Control and Instrum, 58
MECH 4900 Orthopaedic Engineering, 58
MECH 4910 Biomaterials and Biomechanics, 58
Mechanical Design 1 MECH 2400, 48
Mechanical Design 2A MECH 3400, 50
Mechanical Design 2B MECH 3410, 50
Mechanical Engineering 1 MECH 1500, 46
Mechanical, Mechatronic and Biomedical Engineering, 3
Mechanics of Solids 1 AERO 2300, 7
Mechanics of Solids 2 MECH 3310, 50
Mechatronic Engineering, 3
Mechatronics 1 MECH 2700, 48
Mechatronics 2 MECH 3700, 51
Microcomputer Systems ELEC 2601, 39
Microprocessors in Engineered Products MECH 4710, 57
Mineral Processing (Extractive Metallurgy) CHNG 4602, 24
Mineral Processing (Mineral Dressing) CHNG 4603, 24
Multimedia Systems and Applications ELEC 5606,45
N
Networked Systems (Advanced Topic) COMP 4305, 36
New Business Creation ENGG 4002, 60
Non-linear and Adaptive Control ELEC 5301,44
O
Object-Oriented Systems (Advanced Topic) COMP 4309, 36
Operating Systems (Advanced Topic) COMP 4400, 37
Optical Communication Systems ELEC 5503, 44
Optimisation Techniques CHNG 4303, 22
Orthopaedic Engineering MECH 4900, 58
- P
Power Electronics and Drives ELEC 3202, 40
Practical Experience AERO 4600, 13
Practical Experience CHNG 4001, 19
Practical Experience CIVL 4008, 31
Practical Experience ELEC 4702,43
Practical Experience MECH 4130, 53
Privacy and Freedom of Information, 134
Process Control 1 CHNG 3302, 18
Process Control 2 CHNG 4304, 22
Process Data Management CHNG 2302, 15
Process Modelling CHNG 3301, 18
Process Plant Risk Management CHNG 4402, 23
Process Systems Engineering CHNG 4305, 22
Product Life Cycle Design MECH 4640, 57
Professional Communication MECH 4120, 53
Professional Engineering MECH 4110, 52
Professional Option CHNG 4006, 19
Professional Practice CIVL 4016, 31
Project Appraisal CIVL 3803, 30
Project Economics CHNG 3401, 18
Project Engineering, 2
Project Engineering CHNG 4401, 22
Project Formulation CIVL 4807, 34
Project Management & Information Technology CIVL 480, 34
Project Management ELEC 4701, 43
Project Planning & Tendering CIVL 4809, 35
Project Quality, Risk & Procurement Management CIVL, 35
Project Scope, Time & Cost Management CIVL 3805, 30
Properties of Materials CIVL 2101, 26
Propulsion AERO 4201, 10
R
Random Signals and Communications ELEC 3502,41
Reaction Engineering 1 CHNG 3107, 18
Reaction Engineering 2 CHNG 4104, 21
Real Time Computing ELEC 4602, 43
Research and Scholarships Office, 135
Reservoir Engineering CHNG 4302, 22
Risk and Reliability Analysis CIVL 3207, 28
Robotic Systems MECH 4700, 57
Rotary Wing Aircraft AERO 4290, 10
S
Satellite Communication Systems ELEC 5502, 44
Scholarships Office, 135
Scientific Visualisation (Advanced Topic) COMP 4404, 37
Seminar AERO 4920, 14
Sensors and Signals MECH 4720, 57
Separation Processes CHNG 4101, 20
Services, Student, 135
Signals and Systems ELEC 2301, 39
Smart Materials and Structures AERO 4390,12
Software Engineering, 2
Software engineering (Advanced Topic) COMP 4401, 37
Software Project Management ELEC 4704, 43
Soil Mechanics A CIVL 3401, 29
Soil Mechanics B CIVL 3402, 29
Space Engineering 1 AERO 2700, 7
Space Engineering 2 AERO 3700, 10
Space Engineering 3 AERO 4700, 13
Sports Union, 135
Sports, Women's Association, 135
Spread Spectrum CDMA for Mobile Communications ELEC, 44
Statics CIVL 1052, 25
Steel Structures 1 CIVL 3206, 28
Steel Structures 2 CIVL 4220, 32
Structural Analysis CIVL 3204, 28
Structural Design CIVL 2203, 26
Structural Dynamics CIVL 4219, 32
Structural Mechanics CIVL 2201, 26
Student Centre, 135
student identification cards, 135
Students' Representative Council, 135
Surveying 1 CIVL 3501, 29
Surveying 2 CIVL 4504, 33
Sustainable Development CHNG 2501, 15
Switching Devices and High Speed Electronics ELEC 34,40
Systems Control MECH 3800, 51
T
Team Project MECH 3610, 51
Telecommunications, 2
Thermal Engineering 1 MECH 3200, 49

Thermodynamics 1 CHNG 3105, 17
Thermodynamics 1 MECH 2201, 47
Thermodynamics 2 CHNG 3106, 18
Thermodynamics 2 MECH 3201, 49
Thermodynamics of Natural Gas Engineering CHNG 4105, 21
Thesis A MECH 4101, 52
Thesis B MECH 4102, 52
Thesis CHNG 4002, 19
Thesis ELEC 4703, 43
Thesis or Design Project AERO 4900, 14
Thesis/Design/Project - One Semester CIVL 4015, 31
Thesis/Design/Project CIVL 4014, 31
Transport Phenomena CHNG 4102, 20
Transportation Engineering and Planning CIVL 3701, 29

U

Union, University of Sydney, 135
Unit Operations (Fluid Mechanics) CHNG 3104, 17
Unit Operations (Heat Transfer) CHNG 3101, 17
Unit Operations (Mass Transfer) CHNG 3102, 17
Unit Operations (Particle Mechanics) CHNG 3103, 17
University of Sydney Union, 135
User Interfaces (Advanced Topic) COMP 4402, 37

W

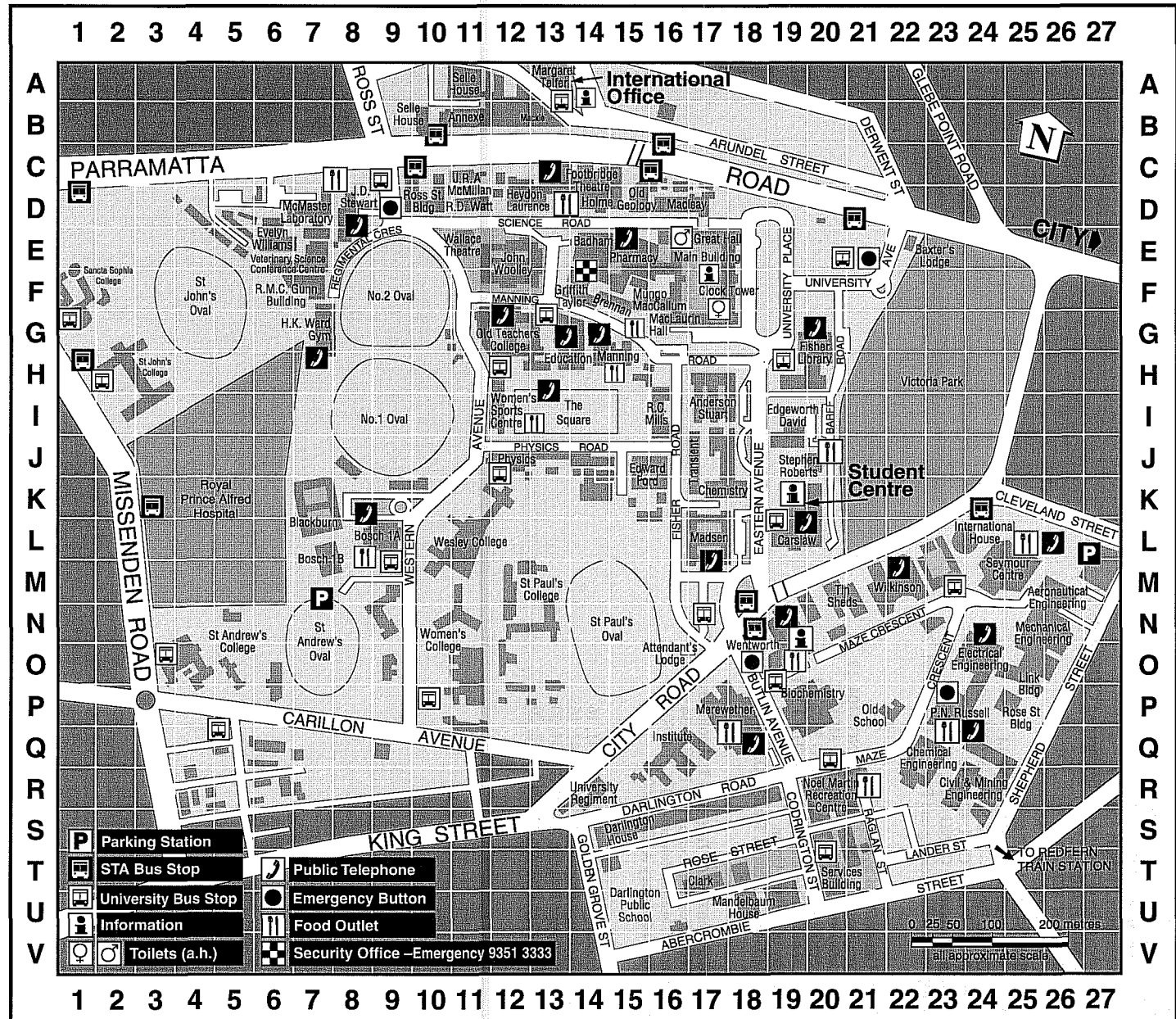
Waste Management and Treatment Technologies CHNG 350, 18
Water Resources Engineering CIVL 4609, 34
Workplace Industrial Relations MECH 4650, 57
Workshop Technology AERO 1600, 5

Y

Year 3 Exchange Program A CHNG 3041, 16
Year 3 Exchange Program B CHNG 3042, 16
Year 4 Exchange Program A CHNG 4041, 20
Year 4 Exchange Program B CHNG 4042, 20

University of Sydney Directory

- Academic & Executive Services **16E**
- Accounting **17P**
- Accommodation Service **13G**
- Administrative Policy & Strategic Planning Div'n **16E**
- Administrative Support Services Division **16E**
- Aeronautical Engineering **26M**
- Agricultural Chemistry & Soil Science **10D**
- Agricultural Economics **HD**
- Agriculture Faculty Office **11C**
- Australian Graduate School of Management **Burren St**
- Alma Street Glasshouse **23N**
- Alumni Relations **16E**
- Anaesthesia **7K**
- Anderson Stuart Bldg **17I**
- Anatomy & Histology **17I**
- Ancient History & Classics **16F**
- Animal Health **Camden**
- Animal Science **7F**
- Anthropology **16F**
- Archaeology **16F**
- Architectural & Design Science **22M**
- Architecture, Dept & Faculty Office **22M**
- Architecture, Planning & Allied Arts **22M**
- Archives **19H**
- Art History & Theory **15I**
- Art Workshop **20M**
- Arts Faculty Office **16F**
- Asset Management **13A**
- Asian Studies **14F**
- Attendant's Lodge **16O**
- Badham Bldg & Library **14E**
- Banks see Financial institutions
- Baxter's Lodge **22E**
- Behavioural & Social Sciences in Nursing **Mallett St**
- Behavioural Science **Cumberland**
- Behavioural Sciences in Medicine **7K**
- Biochemistry **20P**
- Biological Sciences **15D**
- Biomedical Science **Cumberland**
- Blackburn Bldg **7K**
- Bookshops
 - Medical **7K**
 - SRC Secondhand **19N**
 - University Co-operative **21R**
- Bosch 1A (lecture theatres) **8L**
- Bosch 1B Bldg **7M**
- Brennan, C, Bldg **15F**
- Budget Office **16E**
- Business Liaison Office **12E**
- Business Services **19V**
- Campus Services **20T**
- Careers Centre **13B**
- Carslaw Bldg **19L**
- Cashiers **13A**



Central Services **20T**
 Central Records Office **16E**
 Centre for English Teaching **Mallett St**
 Centre for Teaching & Learning **19L**
 Chancellor's Committee Shop **17F**
 Chaplains' Centre **10G**
 Chemical Engineering **22Q**
 Chemistry **17K**
 Child Care
 Boundary Lane **16U**
 Carillon Avenue **9Q**
 Laurel Tree House (Glebe) **16B**
 Union (Darlington) **21S**
 Civil & Mining Engineering **24R**
 Clark Bldg **17T**
 Clinical Nursing **Mallett St**
 Clinical Ophthalmology & Eye Health **Sydney Eye Hospital**
 Clock Tower **17F**
 Clinical Trials **Mallett St**
 Communication Disorders **Cumberland**
 Community & Mental Health Nursing **Cumberland**
 Community Health **Cumberland**
 Community Medicine **15K**
 Computer Sales
 Computer Sales & Service **23U**
 Computer Shop **21R**
 Computer Science, Basser Dept **17L**
 Continuing Education, Centre for **13B**
 Coppleson Postgraduate Medical Institute **9K**
 Copy Centre **21R**
 Counselling Service **13G**
 Crop Sciences **13F**
 Darlington House **14S**
 Dentistry Faculty Office & Dental Studies **Surry Hills**
 Development Office **16E**
 Disability Services **13G**
 Econometrics **17P**
 Economic History **17P**
 Economics, Dept & Faculty Office **17P**
 Edgeworth David Bldg **19J**
 Education Bldg & Faculty Office **13G**
 Educational Development & Evaluation **15K**
 Educational Psychology, Literacies & Learning **13G**
 Edward Ford Bldg **15K**
 Electrical Engineering **24O**
 Employment Service, Casual **14C**
 Engineering Faculty Office **25O**
 English **12E**
 Equal Employment Opportunity Unit **13A**
 Evelyn Williams Bldg **6E**
 Experimental Medicine **7K**
 External Relations Division **16E**
 Facilities Planning, Office of **20T**
 Family & Community Health in Nursing **Mallett St**
 Financial institutions
 Commonwealth Bank **14D**

Credit Union **14D**
 National Australia Bank **15E, 19N**
 Finance, Dept of **16Q**
 Financial Management & Reporting **13A**
 Financial Services Division **13A**
 Financial Systems Development **13A**
 Fine Arts (Art History & Theory)) **151**
 Fisher Library **19G**
 Footbridge Theatre **14C**
 French Studies **15F**
 Garage, University **21T**
 Gender Studies **16G**
 General Practice **Westmead Hospital**
 Geography **16Q**
 Geology & Geophysics **19J**
 Germanic Studies **15F**
 Government & Public Administration **17P**
 Great Hall **18E**
 Greek, Modern **14F**
 Griffith Taylor Bldg **14F**
 Gunn, R. M. C. Bldg **7F**
 Health Information Management **Cumberland**
 Health Sciences Faculty Office **Cumberland**
 Health Service (Holme, Wentworth Bldg) **14C, 19N**
 History **15G**
 History & Philosophy of Science **19L**
 Holme Bldg **14D**
 Industrial Relations, Dept of **16Q**
 Infectious Diseases **7K**
 Information Technology Services **19U**
 Institute Bldg **16Q**
 International Office, International Student Services **13A**
 International House **23L**
 international Preparation Program **13B**
 Italian **151**
 Jurisprudence **St James**
 Koori Centre **12G**
 Law Dept & Faculty Office **St James**
 Learning Assistance Centre **13G**
 Life Sciences in Nursing **Mallett St**
 Linguistics **16J**
 Link Bldg **25O**
 Lost Property **14F**
 Mackie Bldg **13B**
 MacLaurin Hall **16G**
 Macleay Bldg & Museum **16D**
 Madsen Bldg **17L**
 Mail Room (Internal) **20T**
 Main Bldg **17F**
 Management Studies **Burren St**
 Mandelbaum House **18U**
 Manning House **14H**
 Margaret Telfer Bldg **13A**
 Marketing, Dept of **16Q**
 Marketing & Publications **16E**
 Mathematics & Statistics **19L**
 McMaster Bldg **7D**

McMillan, J. R. A., Bldg **11C**
 Mechanical & Aeronautical Engineering Bldg **25N**
 Mechanical Engineering **25N**
 Media Office **16E**
 Medical Radiation Technology **Cumberland**
 Medicine, Dept of **7K**
 Medicine, Faculty of **15K**
 Merewether Bldg **17P**
 Microbiology **20P**
 Mills, R. C. Bldg **161**
 Mungo MacCallum Bldg **15G**
 Music, Dept of **24M**
 Nicholson Museum **16G**
 Nursing Therapeutics **Cumberland**
 Obstetrics & Gynaecology **9K**
 Occupational Therapy **Cumberland**
 Old Geology Bldg **15D**
 Old School Bldg **21P**
 Old Teachers' College Bldg **12G**
 Operations Accounting **13A**
 Orange Agricultural College **Orange Agricultural College Campus**
 Orthoptics **Cumberland**
 Paediatrics & Child Health **New Children's Hospital**
 Pathology **7K**
 Personnel Services **13A**
 Pharmacology **7L**
 Pharmacy **15E**
 Philosophy **17G**
 Photowise Imaging **20T**
 Physics **13J**
 Physiology **171**
 Physiotherapy **Cumberland**
 Planning Support Office **16E**
 Post Office **15E**
 Printing Services, University **20T**
 Professional Studies **13G**
 Properties & Investments **13A**
 Prospective Students Unit **12B**
 Psychological Medicine **4K**
 Psychology **14F**
 Purchasing **13A**
 Publications Office **16E**
 Public Health & Community Medicine **15K**
 Quadrangle **17F**
 Queen Elizabeth II Research Institute **9K**
 Regiment, University **14R**
 Religion, School of Studies in **12E**
 Research & Scholarships **16E**
 Revenue Services **13A**
 Risk Management **13A**
 Rose Street Bldg **24P**
 Ross Street Bldg **10D**
 Russell, Peter Nicol, Bldg **23P**
 St Andrew's College **50**
 St John's College **3H**
 St Paul's College **12N**

