UTS

Faculty of Engineering Handbook

University of Technology, Sydney

1999

UTS Faculty of Engineering Handbook 1999

The University attempts to ensure that the information contained in this handbook is correct as at 12 August 1998. The University reserves the right to vary any matter described in the handbook at any time without notice.

University of Technology, Sydney

Equal opportunity

It is the policy of the University of Technology, Sydney to provide equal opportunity for all persons regardless of sex, race, marital status, family responsibilities, disability, sexual preference, age, political conviction or religious belief.

Free speech

The University supports the right to freedom of speech and the rights of its members to contribute to the diversity of views presented in our society.

Non-discriminatory language

UTS has adopted the use of non-discriminatory language as a key strategy in providing equal opportunity for all staff and students. Guidelines for the use of non-discriminatory language have been developed and all members of the University community are encouraged to use them.

Access UTS on the Web

http://www.uts.edu.au

Faculty Handbooks
http://www.uts.edu.au/div/publications/index.html

UTS Calendar
http://www.uts.edu.au/div/publications/cal/gencontents.html

UTS Rules and Policies
http://www.uts.edu.au/div/publications/policies/index.html

Editorial and production

Publications Branch,
Secretariat and Corporate Affairs Unit,
Registrar's Division

Cover

Design by
External Relations Unit

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General information

WELCOME

Welcome to the University of Technology, Sydney (UTS), one of the largest universities in New South Wales – a university with an international reputation for quality programs and flexible learning. UTS develops, and regularly revises its programs of study in partnership with industry, government and professional bodies, so that its degrees are based on the latest professional standards and current practices. As a result, UTS produces graduates who are ready for work, and this is demonstrated in the high numbers of its students who enter the workforce within four months of finishing their degree.

UTS offers its 24,000 students a lively, supportive and diverse learning environment across three campuses, and a range of social, cultural and sporting facilities to enrich each student's experience. UTS regards learning as a lifelong experience, and offers a range of programs to cater for the educational needs of people at a variety of stages in their lives, and from diverse backgrounds and cultures. UTS welcomes school leavers and re-enrolling students, those returning to study after a break, those seeking to add to their existing qualifications, and those who wish to change direction or begin a new career.

ABOUT UTS

UTS offers over 100 undergraduate degrees and more than 280 postgraduate degrees, which are developed by the Faculties of Business; Design, Architecture and Building; Education; Engineering; Humanities and Social Sciences; Law; Mathematical and Computing Sciences; Nursing; and Science. Each of these faculties is responsible for a range of programs across a number of key disciplines, and many offer courses in conjunction with one another, or with the Institute for International Studies.

ABOUT THE UTS HANDBOOKS

Every year UTS produces 10 faculty/institute handbooks which provide the latest information on approved courses and subjects to be offered in the following year. These handbooks include comprehensive details about course content and structure, subject and elective choices, attendance patterns, credit point requirements, and important faculty and student information. Many of them also contain faculty policies and guidelines for participation in specific courses. This provides students with the necessary information to meet the requirements of the course, complete a program of study, and receive a degree.

UTS also produces a companion volume to these handbooks every year. The *UTS Calendar* contains the University Act, By-law and Rules, a list of courses offered across the University, and other useful University information. Copies of the faculty/institute handbooks and the *UTS Calendar* are held in the University's libraries and faculty offices and can be purchased at the Co-op Bookshop.

The handbooks and Calendar are also published on the World Wide Web at:

http://www.uts.edu.au/div/publications/

UTS PRIORITIES FOR THE FUTURE

Flexible learning

The University of Technology, Sydney has made it a priority to develop a more flexible and responsive learning environment for its students. One of the ways UTS has achieved this is by restructuring some of its courses, giving students the opportunity to combine core studies with sub-majors or electives from across the University. This means that some students now have a choice of learning pathways (or subject combinations) which lead to a degree.

In an increasing number of UTS courses, some students also have a choice in the method of learning. For example, some subjects offer campus tutorials and lectures, others a mixed mode setting which combines intensive workshops, self-managed learning booklets, an interactive web site and phone links to other students.

UTS has also introduced greater flexibility in the time, rate and location at which students can learn, so that now many courses are offered in summer and winter schools, others allow students to use self-managed learning tools to learn in their own time. The implementation of **work-based learning** means that UTS is developing courses in conjunction with industry and business, so that students can learn at work, and be assessed on participation and proficiency in the work place.

Flexible learning at UTS is also reflected in changes which have been made to assessment, enrolment and fee payments, which are being geared to make the systems more user-friendly. For more information about flexible learning alternatives, contact your Faculty Student Centre.

Internationalisation

At UTS students receive an education of international standing, because the University is committed to providing increased awareness and understanding of international issues for its students and staff. It achieves this by delivering and sharing its educational and research expertise overseas, expanding links with industry and business to include international relationships, and inviting students from overseas to gain a UTS award in Australia.

Some UTS students also have the opportunity to live and study overseas. Through the Institute for International Studies, students can study the language and culture of a non-English-speaking country or region of the world. Undergraduate and postgraduate programs in International Studies can be combined with a range of degrees from faculties across the University. For more information contact the **Institute for International Studies**.

telephone 9514 1574
email iisinfo@uts.edu.au

Alternatively, students can undertake part of a degree overseas through the exchange student program. Contact the Faculty Student Centre or the International Programs Office for more information.

Overseas students who want to study at UTS must meet the normal entry requirements for the course and be proficient in English. For details about courses, fees and application procedures, contact the **International Programs Office**.

telephone 9514 1531
email Intlprograms@uts.edu.au

Research

UTS has developed a lively research culture which encourages interdisciplinary research and contributes to issues of international, national and local significance. UTS offers a choice of over 280 postgraduate courses including PhDs and Professional Doctorates. UTS promotes the formation of strategic partnerships with appropriate external organisations, and this helps students to make important links with the workplace before completing their studies.

Because UTS focuses on the needs of industry, business, the professions, cultural organisations and the community, its postgraduate courses are extremely attractive to employers and students alike. Postgraduate students are encouraged to be innovative and flexible in applying the knowledge gained during studies here, and these attributes make graduates well placed to handle the increasing complexities of globalisation, technological change and the workplace.

HOW TO APPLY TO STUDY AT UTS

Undergraduate applications

The NSW and ACT Universities Admissions Centre (UAC) processes most applications for undergraduate courses which start at the beginning of the year. Students are required to lodge these UAC application forms between August and October. To find out more about these courses and the application procedures, check the *UAC Guide*. Students can also apply for entry to some UTS courses by lodging a UTS application form directly with the University. These are usually courses that are not available to school leavers.

A small number of UTS courses also start in the middle of the year. Applications for these should be made direct to UTS in May. For more information contact the UTS Information Centres at the City campus on 9514 1222 or Kuring-gai campus on 9514 5555.

Postgraduate applications

Applications for postgraduate courses should be made directly to UTS. For courses starting at the beginning of the year, most applications are open from August to October, but some may have earlier closing dates. For courses starting in the middle of the year, applications close in May. For more information contact the UTS Information Centres at the City campus on 9514 1222 or Kuring-gai campus on 9514 5555.

International student applications

International student's applications for both postgraduate and undergraduate courses can be made either directly to the International Programs Office or through one of the University's registered agents. For courses starting at the beginning of the year, applications should be received by 31 December of the previous year. For courses starting in the middle of the year, applications should be received by 31 May of that year. For more information please contact the International Programs Office on 9514 1531.

Applications for non-award and external award study

Students who want to study a single subject at UTS which is not part of a UTS degree or qualification, must apply for non-award or external award study. There are four application periods, and closing dates vary for each semester. Some faculties may have special application procedures which will depend on the subjects chosen. For more information contact the UTS Information Centres or the appropriate faculty office.

STUDENT INQUIRIES

City campus

UTS Information Office
Foyer, Tower Building
1 Broadway

Postal address
PO Box 123
Broadway NSW 2007
Telephone: 9514 1222
Fax: 9514 1200

Email inquiries
Within Australia – *info.office@uts.edu.au*

Kuring-gai campus

Kuring-gai Student Centre
Level 6, Main Building
Eton Road
Lindfield

Postal Address
PO Box 222
Lindfield NSW 2070
Telephone: 9514 5555
Fax: 9514 5032

International Programs

10 Quay Street, Sydney

Postal Address
PO Box 123
Broadway NSW 2007
Telephone: 9514 1531
Fax: 9514 1530

Email inquiries
International – *intlprograms@uts.edu.au*

World wide web address

http://www.uts.edu.au

Transition to university programs

UTS offers a free 'Study Success' program of integrated lectures and activities before semester begins, to help new students manage the transition to university study. Students are informed of academic expectations, the skills needed to be an independent learner, and learning strategies which can help them successfully manage the work load. To help students adjust to university life, they are familiarised with the campus, the services available, the learning assistance programs available and valuable information about how the university and faculties operate.

The program is run by university staff with assistance from current students and recent graduates. For more information contact Student Services Unit.

telephone: 9514 1177 (City)
or 9514 5342 (Kuring-gai)

FINANCIAL HELP

Austudy/Youth Allowance

Students under 25 years old, may be eligible to receive financial assistance in the form of the Youth Allowance, which replaced AUSTUDY for people in this age group from 1998.

Full-time students over 25 years old, may be eligible to receive Austudy which provides financial help to students who meet its income and assets requirements. Application forms and information about eligibility for Austudy are available from Student Services at Kuring-gai or City campuses.

Federal legislation sets strict requirements over which the University has no control. It is important for the students concerned to understand these requirements.

Students who receive Austudy and decide to drop subjects during the semester, need to be aware that to remain eligible for Austudy they must be enrolled in a minimum of 18 credit points, or have a HECS liability for the semester of .375. The only exceptions made are for students with disabilities which interfere with their studies, students who are single supporting parents or those who have been directed by the University to reduce their study load.

For more information, talk to a student welfare officer in the Student Services Unit.

telephone: 9514 1177 (City)
or 9514 5342 (Kuring-gai)

Application forms for both schemes should be lodged as soon as possible with any Centrelink office, or:

Centrelink Student Services
Parker Street, Haymarket
Locked Bag K710
Haymarket NSW 2000

Abstudy

Abstudy assists Aboriginal and Torres Strait Islander tertiary students by providing income support and other assistance. For more information about Abstudy, contact the staff at Jumbunna Centre for Australian Indigenous Studies, Education and Research.

Level 17, Tower Building
telephone 9514 1905.

HECS (Higher Education Contribution Scheme)

HECS is a financial contribution paid to the Commonwealth Government by tertiary students towards the cost of their education. HECS is payable each teaching period as a proportion of the standard annual charges set by the Commonwealth Government, and the amount paid will vary according to the number of credit points undertaken and the method of payment nominated. Many students choose to defer their payment until they have finished their degree and are participating in the work force. However, some pay the amount in full (up front) or pay part of the amount (partial payment). Some tertiary students are not required to pay HECS.

Federal legislation sets strict conditions for HECS over which the University has no control. HECS charges are based on the subjects in which students are enrolled on the HECS Census Date. It is important for students to realise that any reductions in their academic workload after the census date for a particular semester (e.g. by withdrawals or substitution of subjects with a lower credit point value) will not reduce their HECS liability.

For Autumn Semester the HECS Census Date is 31 March, and for Spring Semester the HECS Census Date is 31 August. HECS Census Dates for other teaching periods can be obtained from the UTS Information Centre.

EQUITY AND DIVERSITY

It is the policy of the University of Technology, Sydney to provide equal opportunity for all persons regardless of sex, race, marital status, family responsibilities, disability, sexual preference, age, political conviction or religious belief. UTS has a strong commitment to ensure that the diverse nature of the Australian society is reflected in all aspects of its employment and education.

The Equity and Diversity Unit provides a range of services for students and prospective students. These include community outreach programs to support the participation of disadvantaged students/under-represented groups; coordination of the inpUTS Educational Access Scheme for students who have experienced long-term educational disadvantage; coordination of financial scholarships and awards for commencing low-income students; coordination of the Women's Re-Entry Scholarships for women who have been out of the workplace due to family responsibilities; and the provision of confidential advice and assistance with the resolution of equity-related student grievances, including complaints about racism, sexism, sex-based harassment, homophobia, pregnancy/family responsibilities, or other equity issues. The Unit also undertakes research, conducts training and develops policy and programs relating to equity, diversity and social justice issues.

Equity and Diversity Unit
Level 17, Tower Building
telephone 9514 1084

SUPPORT FOR STUDENT LEARNING

The following services and facilities are available to all UTS students.

UTS Library

The University Library collections are housed in three campus libraries which contain over 600,000 books, journals and audiovisual items as well as a large range of electronic citation and full-text databases. Services for students include assistance in finding information through Inquiry and Research Help Desks and training programs, loans, reservations, reciprocal borrowing and copying. The Library provides as much information as possible electronically so that users can also access it from home. More information about the Library can be found at:

http://www.lib.uts.edu.au

City Campus Library

Corner Quay Street and Ultimo Road,
Haymarket
telephone 9514 3388

Kuring-gai Campus Library

Eton Road, Lindfield
telephone 9514 5234

Gore Hill Library

Corner Pacific Highway and Westbourne Street, Gore Hill
telephone 9514 4088

Student Services

The Health, Counselling, Special Needs and Welfare Services are located on Level 3A Tower Building and Level 5, Kuring-gai campus. The Careers Service is located on Level 5 Tower Building and the Housing Service on Level 6 Tower Building. Careers and Housing information is also available from the Student Services Unit office on Level 5 and from the noticeboards on Level 4, Kuring-gai campus.

Careers Service

The Careers Service offers career guidance, and assists with job placement for students seeking permanent or casual employment.

telephone 9514 1471 (City campus)

Counselling

Counsellors are available at the City and Kuring-gai campuses for individual consultation, and group programs are also held throughout the year.

telephone 9514 1471 (City campus)
or 9514 5342 (Kuring-gai campus)

Health

The Health Service offers a bulk billing practice to students at two locations:

telephone 9514 1166 (City campus)
or 9514 5342 (Kuring-gai campus)

Housing

University Housing provides assistance to students in locating private accommodation. Limited UTS-owned housing is also available.

telephone 9514 1509 (listings)
or 9514 1199 (UTS accommodation)

Special Needs Coordinator

Support is also available for students with special needs. Students with a physical, sensory or learning disability can contact the Special Needs Coordinator for information and advice.

telephone 9514 1177

Welfare

Welfare officers assist students with personal financial matters, including loan and financial counselling, Youth Allowance, Austudy and other Social Security claims and appeals advice.

telephone 9514 1177

Chemistry Learning Resources Centre

Room 211, Building 4, City campus.

Dr Ray Sleet
telephone 9514 1739
email r.sleet@uts.edu.au

or

Rosemary Ward
telephone 9514 1729
email rosemary.ward@uts.edu.au

WWW address
http://www.science.uts.edu.au/depts/chem/clrc/index.html

English Language Study Skills Assistance (ELSSA) Centre

ELSSA Centre provides free English language and study skills courses for all UTS students.

ELSSA Centre
Alex Barthel (Director)
Level 19, Tower Building
telephone 9514 2325
email alex.barthel@uts.edu.au
or
Room 2-522
Kuring-gai campus
telephone 9514 5160

WWW address
http://www.uts.edu.au/div/elssa/

Physics Learning Centre

Level 11, Tower Building (with an adjoining computer laboratory).

Peter Logan
telephone 9514 2194
email peter@phys.uts.edu.au

Mathematics Study Centre

Level 16, Tower Building; and at Kuring-gai campus, Room 2-522.

City campus
Leigh Wood (Director)
telephone 9514 2268
email leigh@maths.uts.edu.au

Kuring-gai campus
Dr Jules Harnett
telephone 9514 5186
email jules@maths.uts.edu.au

Computer laboratories

There are 22 computer laboratories throughout the University which are available for all students and staff to use. Details of locations and availability of the computer laboratories may be obtained from the Information Technology Division Resource Centre, telephone 9514 2118.

Jumbunna Centre for Australian Indigenous Studies, Education and Research (CAISER)

Jumbunna CAISER is run by a predominantly Australian indigenous staff who provide specialist advice and a broad range of services to assist Aboriginal and Torres Strait Islander students.

Jumbunna CAISER
Level 17, Tower Building
telephone 9514 1902

OTHER UNIVERSITY SERVICES

Child care

UTS Child Care Inc. (UTSCC) coordinates all child care services at UTS. Child care is available from 8.00 a.m. to 10.00 a.m. at both City and Kuring-gai campuses.

Students and staff of UTS receive priority access and a small rebate on fees. Normal Government assistance is available to low and middle income families.

telephone 9514 1456 (City)
or 9514 2960 (Blackfriars)
or 9514 5105 (Kuring-gai)

The Co-op Bookshop

The Co-op Bookshop stocks the books on student's reading lists, and a variety of general titles and computer software. It has branches at the City and Kuring-gai campuses (Room 2.401), and, at the start of semester, at Haymarket and Gore Hill.

City campus
telephone 9212 3078
email uts@mail.coop-bookshop.com.au

Kuring-gai campus
telephone 9514 5318
email kuringai@mail.coop-bookshop.com.au

WWW address
http://www.coop-bookshop.com.au

Freedom of Information

Under the *Freedom of Information Act 1989* (NSW), students have the right to apply for access to information held by the University.

George Bibicos
FOI Coordinator
Level 4A, Tower Building
telephone 9514 1280
email George.Bibicos@uts.edu.au

Student Ombudsman

Enrolled or registered students with a complaint against decisions of University staff may seek assistance from the Student Ombudsman.

All matters are treated in the strictest confidence and in accord with proper processes.

Room 402, Building 2
City campus, Broadway
telephone 9514 2575
email ombuds@uts.edu.au

Students' Association

The Students' Association (SA) is the elected representative body of students at UTS: it is an organisation run by students for students. UTS students have the right to stand for election of the SA and to vote in the annual elections.

The main office of the Students' Association is located on Level 3 of the Tower Building, City campus, Broadway.

City campus office:
telephone 9514 1155

Kuring-gai campus office:
(next to the cashier service)
telephone 9514 5237

UTS Union

The UTS Union is the community centre for the University. It provides food and drink services, lounges and recreational areas, comprehensive social and cultural programs, sports facilities and programs, stationery shops, a newsagency, ski lodge and resource centres.

Union Office 9514 1444
Haymarket 9514 3369
Kuring-gai 9514 5011

Union Sports Centre

The centre contains a gymnasium, squash courts, weights rooms, climbing wall, and saunas.

Lower ground floor, Building 4
telephone 9514 2444

UTS Rowing Club

Dobroyd Parade, Haberfield
telephone 9797 9523

Radio Station 2SER-FM

2SER-FM is a community radio station run by hundreds of volunteers who are involved in producing and presenting a smorgasbord of programs focusing on education, information, public affairs and specialist music. Students interested in community media, are welcome to visit the 2SER studios or to attend a volunteer recruitment meeting. Contact the station for more details.

Level 26, Tower Building
telephone 9514 9514

UTS Gallery and Art Collection

The UTS Gallery is a dedicated public gallery located on Level 4, Building 6, City campus, 702 Harris Street, Ultimo. The UTS Gallery presents regularly changing exhibitions of art and design from local, interstate and international sources.

The UTS Art Collection comprises a diverse range of paintings, prints, photographs and sculptures which are displayed throughout the University and, at times, in the UTS Gallery.

Tony Geddes, Curator
telephone 9514 1284
fax 9514 1228
email tony.geddes@uts.edu.au

PRINCIPAL DATES FOR 1999

January

2 Release of HSC results

8 Formal supplementary examinations for 1998 Spring semester students

8 Closing date for changes of preference to the Universities Admissions Centre (UAC)

15 Final examination timetable for Summer session

15 Last day to submit appeal against exclusion from Spring 1998

22 Main Round of offers to UAC applicants

22 Last day to submit 'Show Cause' appeal for Spring 1998

26 Australia Day – public holiday

26 Public school holidays end

27 Closing date for changes of preference to Universities Admissions Centre (UAC) for final round offers

29 Last day to submit application for Postgraduate Equity Scholarships for Autumn Semester 1999

29-30 Enrolment of new undergraduate students at City campus (and 1-4 February)

30 Summer session ends for subjects with formal exams

February

1 Last day for continuing students to pay their 1999 Service Fees

1-4 Enrolment of new Undergraduate students at City campus (and 28-30 January)

1-12 Formal examinations for Summer session

1-12 Intensive Academic English course (ELSSA Centre)

5 Final round of offers (UAC)

6 Last day to lodge a Stage 2 appeal against assessment for Spring semester 1998

22 Release of results for Summer session

5-26 Enrolment of students at City campus

March

1 Classes begin

4-5 Enrolment (external award, non-award and exchange students)

12 Last day to enrol in a course or add subjects

19 Last day to pay HECS or postgraduate course fees for Autumn semester 1999

30 Last day to apply to graduate in Spring semester 1999

31 Last day to apply for leave of absence without incurring student fees/charges[1]

31 Last day to withdraw from a subject without financial penalty[1]

31 HECS Census Date

April

2 Good Friday – public holiday

2 Public school holidays commence

5 Easter Monday – public holiday

5-9 Vice-Chancellors' Week (non-teaching)

9 Last day to withdraw from a course or subject without academic penalty[1]

13-16 Graduation (Kuring-gai)

16 Public school holidays end

16 Last day for changes involving subsitution of one subject for another, with the same credit point value, to be processed without charge to the student

16 Last day for changes involving deletion of one or more subjects

16 Last day for changes involving the addition of a subject to be processed –the student will be required to enrol in and incur HECS liability for the subject in Summer session

23 Provisional examination timetable available

23 Public school holidays end

25 Anzac Day – public holiday

May

3 Applications available for undergraduate courses where applicable

3 Applications open for available postgraduate courses for Spring semester 1999

3-14 Graduation (City)

14 Examination masters due

28 Closing date for undergraduate and postgraduate applications for Spring semester

28 Final examination timetable

June

7 Queen's Birthday – public holiday

11 Last teaching day of Autumn semester

12-30 Formal examination period (and 1-2 July)

30 Last day to submit application for Postgraduate Equity Scholarships for Spring semester 1999

July

1-2 Formal examination period (and 12-30 June)

2 Autumn semester ends

5 Public school holidays commence

5-9 Vice-Chancellors' Week (non-teaching)

12-16 Formal alternative examination period for Autumn semester students

16 Public school holidays end

19-30 Intensive Academic English course (ELSSA Centre)

23 Release of Autumn semester examination results; two days earlier via UniPhone™

26 Formal supplementary examinations for Autumn semester students

August

2 Applications available for undergraduate and postgraduate courses for Autumn semester 2000

2 Classes begin

6 Last day to withdraw from full year subjects without academic penalty[1]

13 Last day to enrol in a course or add subjects

13 Last day to submit 'Show Cause' appeal for Autumn semester 1999

20 Last day to pay HECS or postgraduate course fees for Spring semester 1999

31 Last day to apply for leave of absence without incurring student fees/charges (Spring enrolments only)[1]

31 Last day to withdraw from a subject without financial penalty[1]

31 Last day to apply to graduate in Autumn semester 2000

31 HECS census date

September

1 Applications for Postgraduate Scholarships available

10 Last day to withdraw from a course or subject without academic penalty[1]

13 Last day for changes involving subsitution of one subject for another, with the same credit point value, to be processed without charge to the student

13 Last day for changes involving deletion of one or more subjects to be processed as'late withdrawal without academic penalty', however, the student's liability for HECS or course fees liability for HECS or course fees will be unchanged

13 Last day for changes involving the addition of a subject to be processed – the student will be required to enrol in and incur HECS liability for the subject in Summer session

24 Provisional examination timetable available

27 Vice-Chancellors' Week (non-teaching) begins

27 Public school holidays commence

27-29 Graduation (City)

30 Closing date for undergraduate applications via UAC (without late fee)

30 Closing date for inpUTS Equity Access Scheme via UAC

October

1 Graduation (City)

1 Vice-Chancellors' Week (non-teaching) ends

4 Labour Day – public holiday

8 Public school holidays end

15 Examination masters due

29 Final examination timetable available

29 Closing date for undergraduate applications via UAC (with late fee)

29 Closing date for undergraduate applications direct to UTS (without late fee)

29 Closing date for most postgraduate courses for Autumn 2000 (some courses may have earlier closing dates in September)

29 Closing date for Australian Postgraduate Awards , the R L Werner and University Doctoral scholarships

29 Last day to submit application for Postgraduate Equity Scholarships for Summer session 2000

November

12 Last teaching day of Spring semester

13-30 Formal examination period (and 1-3 December)

30 Closing date for undergraduate applications via UAC (with late fee)

December

1-3 Formal examination period (and 13-30 November)

3 Spring semester ends

13-17 Formal alternative examination period for Spring semester students

20 Release of Spring semester examination results; two days earlier via UniPhone™

20 Public school holidays commence

25 Christmas Day – public holiday

26 Boxing Day – public holiday

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[1] HECS/Postgraduate course fees will apply after the HECS census date (31 March and August or last working day before).

Note: Information is correct as at 29 June 1998. The University reserves the right to vary any information described in Principal Dates for 1999 without notice.

Faculty information

This handbook is the formal statement of awards, courses and programs of study offered through the Faculty of Engineering at UTS. It is designed primarily to provide information for students, prospective students and those interested in the Faculty's educational policies and programs. It contains a brief outline of the Faculty's research programs and professional activities, but is not meant to describe these in any comprehensive way.

Other publications are available concerning these matters, together with less formal publications about particular courses and activities and about what the Faculty can offer to particular clients or partners. Inquiries may be directed to any of the principal contacts listed in this handbook.

HISTORY

The Faculty began teaching in 1965 as part of a new institute, soon to become the New South Wales Institute of Technology (NSWIT). In 1987, by Act of the Parliament of New South Wales, NSWIT was reconstituted as the University of Technology, Sydney, and commenced operation as UTS in January 1988. During 1988 and 1989, UTS amalgamated with several other institutions and parts of institutions, and the 'new UTS' came into being in its present form in 1990. None of the University's new partners had engineering schools, and so the Faculty of Engineering has continued in essentially the same form since its inception.

The first courses offered led to the award of Diploma in Technology. These were extended to Bachelor of Engineering level in 1971, and the Diploma courses gradually phased out. The first BE degrees were awarded in 1972. Programs leading to Master of Engineering by coursework and by research were offered in 1975. The degree of Doctor of Philosophy by research was made available in 1986, initially by arrangement with another university and, from 1988, by UTS in its own right.

In 1998, the Faculty has some 2,679 undergraduate students and 478 postgraduate students. Of the latter, some 66 are candidates for higher degrees by research, and 412 are enrolled for postgraduate awards by coursework.

MISSION

The mission of the Faculty of Engineering is to be the Australian leader, and among the world leaders, in practice-based engineering education and research.

PRACTICE-BASED ENGINEERING EDUCATION

What does it mean?

Engineering is about devising ways in which technology can contribute to human ends, and about developing, delivering and maintaining technical systems that do so. The practice of engineering is about doing this reliably and cost-effectively, in the context of real social and economic objectives and pressures, and in a variety of business and community settings. It embraces many technical and non-technical factors that cannot be replicated in the classroom, including the need to understand and interact with a wide range of people and perspectives as well as to deal with new or unexpected technical issues and with uncertainty and risk. It should recognise the fundamental need to ensure a sustainable future.

Education for professional engineering must include a strong intellectual training, and a strong grounding in engineering science. But over-concentration on engineering science can impart a narrow technical mindset; and an education that is exclusively academic can be remote from reality. Either of these can cause graduates serious difficulty in later coming to grips with the human aspects of engineering and with the demands of practice.

Practice-based engineering education requires that students experience the reality of engineering practice from an early stage in their professional formation. It actively relates this experience to their developing understanding of engineering theory, analysis and laboratory work, and to studies in other disciplines, and promotes critical and creative thinking based on knowledge gained outside as well as within the university. This interaction requires that most academic staff

themselves have significant experience of engineering practice, and keep it constantly refreshed. Educational programs in which either students or a majority of staff do not have current experience of practice cannot validly be called practice-based.

Practice-based education is more than practice, and more than education. A university education should impart a thorough grasp of fundamental principles, a respect for knowledge, a capacity for critical inquiry and lateral thinking, a fluency in communication, a pride in excellence, and an eagerness to contribute to shaping the future. Practice-based engineering education claims that these attributes can be more effective when they have been developed in contact with the human and technical challenge of real engineering situations.

Engineering education at UTS

In Australia, the basic qualification for professional engineering practice is the Bachelor of Engineering degree (BE). At most universities the BE occupies four years of full-time academic study. At UTS, as well as completing the academic program, all undergraduate engineering students must gain substantial, approved experience in industry, or in other authentic professional settings. This experience must be distributed over the period of the course and must meet standards of level, quality, and relevance. Traditionally, it has taken six years to complete a UTS Engineering degree. From 1998, it will take five years.

Graduates of most university engineering courses need up to two years' experience in industry, after graduation, before they are able to assume real responsibility. UTS Engineering graduates have already gained much of this experience, together with a real understanding of the inter-relations between theory and practice, technology and human factors. They are equipped to undertake professional responsibility much sooner than after courses at other universities – often, immediately upon graduating.

The combination of formal academic learning in the University, and experiential learning in the workplace, is called Cooperative Education (or Co-op). UTS Engineering courses have embodied this principle for over thirty years. The courses have been highly regarded in industry and according to many reports and surveys, the graduates enjoy the highest employment rate of any engineering degree courses in Australia. UTS Engineering is by far the largest Co-op faculty in Australia, in any discipline, and it is now the only Australian faculty of engineering in which all BE students take the Co-op program. Co-op is well-known and highly regarded in other countries also, particularly in North America. UTS is a member of the World Council for Cooperative Education.

The BE program has been completely re-designed. It retains the Co-op requirement for substantial work experience, but now goes much further. It extends the concept of practice-based engineering education into one of total professional formation, and leads to the combined award of Bachelor of Engineering, Diploma in Engineering Practice. Details appear in the relevant section of this handbook.

Other UTS Engineering courses, undergraduate and postgraduate, are also designed to interact strongly with industry, though the work-experience requirements are mostly less structured than those of the BE DipEngPrac. In all programs, the majority of students already have significant industrial experience, or are gaining it concurrently. The Faculty has policies for maximising opportunity for its academic staff to maintain first-hand experience in industry, and engages many practising engineers as adjunct teaching staff. It also strongly encourages collaborative research and consultancy with industry, and many of its research students are industry-based. The predominant culture, therefore, is strongly practice-oriented, and this also benefits the relatively small number of students who do not yet have engineering work experience.

The Faculty is actively exploring the new paradigms of work-based learning now developing in several countries, and has recently introduced a work-based learning program.

In all of its activities the Faculty seeks to promote better understanding of the role of engineering in society, and to promote and support service to the community through other channels as well as industry.

WOMEN IN ENGINEERING

The engineering profession in Australia has traditionally attracted few women. Currently women represent around 5 percent of practising professional engineers and 14 percent of enrolments in engineering degree courses nationally.

The Women in Engineering Program was first established at UTS to improve this rate of participation by communicating a broadened concept of engineering to secondary students. This experience led to the development of curriculum resources on teaching technology for girls. The Program now communicates with secondary schools in ways that are inclusive of the interests and capabilities of a diverse range of students, especially women, and also works to address educational, cultural and professional barriers that may still inhibit the contribution of women to the engineering profession. Its most recent publication on this front is *Finding the challenge in change: choices for women in engineering.*

The Program is recognised in engineering education and professional spheres by its inauguration of the Annual Australasian Women in Engineering Forum, which UTS hosted for the second time at UTS in 1996, for its initiatives in curriculum development; and its contributions to the groundbreaking national Review of Engineering Education. It has strongly influenced the philosophy of engineering at UTS, and has been a catalyst for many innovations in the BE DipEngPrac curriculum. The Program is currently consolidating its experience in communicating with schools about engineering into curriculum innovation in the BE at UTS.

The Faculty has the highest proportion of women academic staff of any Australian engineering faculty. Several are past co-ordinators of the Program.

The Faculty strongly welcomes women students and looks forward to the time when women constitute a substantial proportion of its students and staff and of the profession generally.

INTERNATIONAL ENGINEERING PROGRAMS

Engineering is an international profession, and international interactions are essential to the development and professional currency of any engineering school. UTS Engineering has vigorous international partnerships in all its areas of activity, and works to build relationships with international as well as Australian leaders in engineering practice and practice-based education and research.

In its educational programs, the Faculty seeks to emphasise the international dimension of engineering and of professional development and practice. All students, undergraduate and postgraduate, are strongly encouraged to undertake international placements as part of their academic program, for full credit. Research students and Faculty staff are similarly encouraged to develop international partnerships and to gain international experience in the course of research projects or development leave. The Faculty has many staff with strong international backgrounds, and has many international visitors from overseas universities and engineering organisations.

The Faculty welcomes international students, both through exchange programs and as candidates for UTS degrees, and expects to recruit increasing numbers of international students to its undergraduate and graduate programs. These students provide an essential and welcome internationalising influence, and help Australian students and staff to become more fluent in their international interactions. It is the Faculty's business to offer a satisfying and rewarding experience to all its students, and in relation to its international students, this should contribute to the strengthening of personal, professional and economic links between Australia and other countries.

International exchange programs relating to the undergraduate degrees are outlined in the Undergraduate courses section of this handbook. Similar opportunities are available to students in graduate programs. All inquiries should be directed to the Undergraduate Programs Office or to the Director, International Engineering Program. International research partnerships are too numerous to list in this handbook, and are constantly evolving. Details appear in descriptions of particular research programs, or are available from their directors.

STRUCTURE OF THE FACULTY

The Faculty is not sub-divided into departments or other entities, but functions on an integrated basis. Its operating structure is essentially a matrix.

All operations are conducted through Programs, each with a designated Director who is responsible for leading and managing the Program. Programs are grouped into five areas:

Undergraduate Programs
Graduate Coursework Programs
Research
Development
Administration.

Each of the first four is headed by an Associate Dean, and the fifth by the Faculty Administrator. The Dean has overall responsibility for the Faculty as a whole.

The Graduate School of Engineering (GSE) is responsible for conducting all graduate programs. The Associate Dean Graduate Coursework Programs is Head of the GSE.

Each member of academic and general staff belongs to a staff Group, reflecting their professional interests and expertise. The Group titles are:

Civil Engineering
Computer Systems Engineering
Electrical Engineering
Engineering Management and Practice
Environmental Engineering
Mechanical Engineering and Manufacturing
Telecommunications Engineering
Civil and Mechanical Engineering Laboratories
Administration and Information.

The Groups are expected to re-form and evolve with time.

Any Program can draw on the resources of any Group. All Groups and Programs contribute to future planning, for which the Faculty Executive (Dean, Associate Deans and Faculty Administrator) has overall responsibility.

The Faculty's governing body is the Faculty Board in Engineering, of which details are given later. There is a Dean's Advisory Committee, a Faculty Budget Committee, a Committee on Curriculum, Learning and Teaching, a Graduate Courses Committee, a Research Degrees Committee, and a Research Management Committee. There is a network of advisory committees with membership drawn from industry, the profession and the community, of which details are also given later.

The Faculty is represented on most of the University's boards and committees.

LOCATION

The Faculty of Engineering is located at the City campus, Broadway, in Buildings 1 and 2. Main locations (mid-1998) are:

- Dean, Faculty Administrator, Undergraduate Programs Office, Industrial Liaison, Graduate School of Engineering, and Women in Engineering Program:
  Level 7, Building 2.
- Associate Dean Undergraduate Programs:
  Level 24, Building 1.
- Associate Dean Graduate Coursework Programs:
  Level 7, Building 2.
- Associate Dean Research:
  Level 5, Building 2.
- Associate Dean Development:
  Level 5, Building 2.

General guide to locations of staff and facilities:

- Civil, Structural, and Environmental Engineering: academic staff on Level 5, Building 2; laboratories mainly on Levels 1 and 2, Building 2, and some on Level 5.
- Electrical, Computer Systems, and Telecommunications Engineering: academic staff and laboratories on Levels 18–25, Building 1.
- Mechanical Engineering and Manufacturing: academic staff on Level 6, Building 2; laboratories mainly on Levels 2 and 3, Building 2.
- Learning and Design Centres: Level 23, Building 1 and Level 6, Building 2.
- Centre for Local Government Education and Research: Level 17, Building 1.
- National Centre for Groundwater Management: Level 17, Building 1.
- APACE (Appropriate Technology for Community and Environment, Inc.): Level 4, Building 2.

PRINCIPAL CONTACTS

	Building/Room	Telephone Ext
Dean of Engineering		
Professor Peter Parr	2/7092	2599
Faculty Administrator		
Ms Deborah Carraro	2/7093	2594
Associate Dean, Undergraduate Programs		
Professor Warren Yates	1/2427	2436
Manager, Undergraduate Programs Office		
Ms Susana Tanuwijaya	2/7100	2671
Sub-Dean		
Dr John Nicol	1/2428	2438
Associate Dean Graduate Coursework Programs		
Head, Graduate School of Engineering		
Associate Professor Jim Parkin	2/7078	2638
Graduate Studies Officer		
Ms Beate Buckenmaier	2/7080	2590
Associate Dean Research		
Professor John Reizes	2/511C	2742
Directors, Research Concentrations		
Biomedical Technology		
Associate Professor Hung Nguyen	1/2517	2451
Energy Technology		
Professor Vic Ramsden	1/2417C	2420
Intelligent Transport Systems		
Professor Chris Drane	1/2221B	2390
Nomadic Multimedia Data Systems		
Associate Professor Aruna Seneviratne	1/2429	2441
Satellite Systems		
Associate Professor Sam Reisenfeld	1/2512B	2448
Technologies for the Built Infrastructure		
Professor Steve Bakoss	2/528	2629
Wastewater and Waste Management		
Professor S Vigneswaran	2/523	2641
Associate Dean Development		
Professor Rod Belcher	2/511C	2423
Directors, Community Service Program		
Associate Professor Paul Bryce	1/2420A	2425
Associate Professor Helen McGregor	2/620	2678
Manager, Marketing Projects		
(to be advised)		
Director, Industrial Liaison		
Mr Paul Stapleton	2/7097	2592
Director, International Engineering Program		
Mr Paul Maloney	2/7087	2591
Director, Women in Engineering Program		
Ms Bronwyn Holland	2/7071	2601

Note: Names of Program Directors for undergraduate and postgraduate programs are published separately, and are available from the offices of the respective Associate Deans, the Undergraduate Programs Office or the Graduate School of Engineering.

A list of academic staff by Groups, showing their professional interests, is given at the end of this section. The University's formal listing of Faculty of Engineering staff, with qualifications, appears at the end of this handbook and in the *UTS Calendar*.

Please note that some locations are provisional and may change.

RESEARCH PROGRAMS

An outline of the Faculty's research interests and strengths appears in the Postgraduate section of this handbook under the heading Research Areas and Associated Centres. Details of research programs are published separately.

ASSOCIATED CENTRES

The Faculty participates in the work of the following centres and organisations:

APACE

APACE (Appropriate Technology for Community and Environment, Inc.) is an independent, community-based organisation to develop ecologically-sustainable technologies for developing countries, particularly in the Asia–Pacific region, and to interact closely with the local communities in devising and operating appropriate energy-supply systems and other forms of infrastructure support. Housed at UTS, it is a recognised non-government organisation under national and international aid programs. Principal contact: Associate Professor Paul Bryce (Chair of Directors).

Australian Graduate School of Engineering Innovation Ltd

The Australian Graduate School of Engineering Innovation Ltd (AGSEI) was formed by UTS, the University of Sydney and a number of industry partners, and is funded as a Commonwealth Government Advanced Engineering Centre. The School's purpose is to help Australian enterprises combine the best of engineering and management into an effective culture of innovation. It builds specifically on the capability of engineers, and focuses on the contribution of engineering to business performance. It is located at the Australian Technology Park, at Eveleigh, close to UTS. Principal contact: Professor Peter Parr.

Australian Technology Park, Sydney Limited

The Australian Technology Park, Sydney Limited is designed to become South-East Asia's premier technology centre. It is situated at the centre of a triangle formed by the three participating universities – the Universities of Sydney and New South Wales, and UTS. It will concentrate on ten generic areas of strength: information technology, telecommunications, biomedical technology, biotechnology, agriculture and food processing, environmental technology and management, transport systems, instrumentation, materials, and power and energy. It is designed to support and incubate new technology intensive businesses as well as research and development by established enterprises. It is located at Eveleigh, near Redfern, close to UTS. Principal contact: Professor Rod Belcher.

Centre for Biomedical Technology

The Centre for Biomedical Technology is a multi-faculty and interdisciplinary research centre of UTS, with a network of research and education teams from the Faculties of Engineering, Science, Mathematical and Computing Sciences, Nursing and Business. It aims to enhance the scientific and technological base for the biomedical technology industry, government, and health care providers, through research, development, consultancy and continuing education programs. Principal contact: Associate Professor Hung Nguyen (Director).

Centre for Local Government Education and Research

The Centre for Local Government Education and Research at UTS provides education, training, research facilities and support in the development of ideas for the growth and future direction of local government. It is a major provider of continuing education, has been commissioned by the Commonwealth, State and local governments to provide training programs for major reforms, and has made international contributions to local government development in collaboration with several countries. Principal contact: Mr Graham Sansom (Director).

Cooperative Research Centre for Cardiac Technology

The CRC for Cardiac Technology includes UTS and three other university participants, CSIRO, three companies, and three hospitals. It has links with leading international cardiac research groups in the USA, the UK, and Japan. The Faculty is involved in a number of programs through the Centre for Biomedical Technology. Principal contact: Associate Professor Hung Nguyen.

Cooperative Research Centre for Distributed Systems Technology

The CRC for Distributed Systems Technology has five university and eight industry participants. Its focus is on the production of demonstrable prototype technology encompassing distributed systems architectures, databases, tools and management. UTS's contribution is primarily on the management and performance of systems supporting the exchange of large amounts of information between dispersed users, including person-to-person communication. Principal contact: Associate Professor Aruna Seneviratne.

Cooperative Research Centre for Renewable Energy

The CRC for Renewable Energy has seven university and 13 other participants. It undertakes strategic research in energy generation and storage, power conditioning, energy efficiency, and systems integration, aimed at fossil fuel replacement and greenhouse gas abatement. UTS Engineering is primarily involved in the energy efficiency program. Principal contact: Professor Vic Ramsden.

Cooperative Research Centre for Satellite Systems

The CRC for Satellite Systems will be based on a microsatellite that will be used to conduct communication, space physics, remote sensing and engineering experiments. It will give Australian scientists and engineers valuable data about the space environment, as well as experience in space engineering and practical application of space technology. UTS Engineering is involved together with CSIRO, the University of South Australia, Queensland University of Technology, University of Newcastle, Auspace Limited, VIPAC Scientists and Engineers Pty Ltd, La Trobe University, Curtin University of Technology, the Defence Science and Technology Organisation, the ARIES Consortium, MITEC Pty Ltd, D-Space Ltd and Optus. Principal contact: Associate Professor Sam Reisenfeld.

Institute for Coastal Resource Management

The Institute for Coastal Resource Management is an inter-faculty network within UTS, integrating expertise and resources in environmental sciences, engineering, law, and business, for sustainable development, planning and natural resource management in the coastal zone. It conducts research, consultancy and interdisciplinary professional courses, and has international links in the Pacific region and in North America and Europe. Principal contact: Professor Vigi Vigneswaran.

National Centre for Groundwater Management

The National Centre for Groundwater Management at UTS conducts research and consultancy in groundwater and environmental problems of strategic national importance, and postgraduate and continuing education programs. It is recognised by the Commonwealth as a national centre, liaises extensively with industry, and participates in international research and development programs. Its Director is currently President of the International Association of Hydrogeologists. Principal contact: Professor Michael Knight (Director).

Sydney Microwave Design and Resource Centre

The Sydney Microwave Design and Resource Centre is a joint initiative of UTS, the University of Sydney, and Hewlett Packard Australia. It assists researchers and Australian companies to develop or extend advanced microwave capabilities through access to modelling, design and measurement facilities, and undertakes research in areas such as microwave communications, electromagnetic interference, antennas, microwave processing and materials characterisation. Principal contact: Dr Ananda Mohan Sanagavarapu.

Institutes of UTS

The Faculty also interacts closely with the following institutes at UTS:

- Institute for Interactive Multimedia
- Institute for International Studies
- Institute for Sustainable Futures.

Further details of all these centres, institutes and other organisations are published in the *UTS Calendar*.

PROFESSIONAL BODIES IN ENGINEERING

The Institution of Engineers, Australia

The Institution of Engineers, Australia (IEAust) is the principal professional engineering body and learned society in Australia. Its membership covers all branches of engineering, with specialist Colleges catering for the main fields of practice. Its headquarters are located in Canberra, with operating divisions in capital cities and regional centres. The local division for UTS is Sydney Division, which runs an annual program of lectures, seminars and professional activities, with particular events for Young Engineers. Its offices are located in North Sydney, and the telephone number is (02) 9929 8544.

Corporate membership of IEAust (in the grades of Member or Fellow) confers the status of Chartered Engineer and listing in the National Professional Engineers Register. Students enrolled in courses leading to the Bachelor of Engineering degree may join IEAust as Student members, and upon graduation become eligible for Graduate membership. To attain the corporate grade of Member, certain professional competencies must be gained and demonstrated, normally in employment after graduation. UTS graduates may expect to receive credit towards this requirement for the industrial experience gained during their degree, although some further experience is normally needed (refer also to Professional Recognition under Bachelor of Engineering, Diploma in Engineering Practice).

IEAust membership is also available in the categories of Engineering Associate (normally holding a TAFE Associate Diploma or equivalent) and Engineering Technologist (normally holding a Bachelor of Technology degree or an Advanced Diploma).

IEAust assesses degree courses conducted by Australian universities, and may recognise them as meeting its educational requirements for membership. All UTS Bachelor of Engineering degrees are so recognised.

The Association of Professional Engineers, Scientists and Managers, Australia

The Association of Professional Engineers, Scientists and Managers, Australia (APESMA) provides advice and assistance on employment-related matters for professional engineers, scientists and managers. Student members receive a publication *The Student Update* three times a year, which gives practical insight into the workplace and employment issues that affect them as professional engineers. For information and student membership application forms call APESMA on (02) 9264 9500.

Other Bodies

There are a number of other national and regional associations representing particular branches of engineering. Faculty staff with interests in the field concerned are often active in these bodies, and glad to provide information.

ENGINEERING LEARNING AND DESIGN CENTRES

The Faculty has a strong commitment to providing an effective and supportive learning environment for engineering students. The Learning and Design Centres are located in Building 1, Room 2315 (Level 23) and Building 2, Room 639 (Level 6). They serve students by providing access to tutors for individual and small group support, reference material, and software and hardware resources, on a drop-in basis, and are open for extended hours.

OTHER SUPPORT CENTRES

The English Language and Study Skills Assistance (ELSSA) Centre provides free English language and study skills courses for UTS students and staff. These include intensive vacation courses, weekly workshops, day and evening courses on essay and report writing, advanced grammar, critical thinking, discussion skills, seminar presentation, effective reading, pronunciation, and writing at postgraduate level. Individual consultations and self-study facilities are available.

The Mathematics Study Centre coordinates mathematics study assistance across the University. It offers many services to students from all faculties, including assistance with common computing packages.

The Physics Learning Centre operates on a drop-in basis and provides assistance to students from all faculties in relation to first-year Physics studies.

ENGINEERING CLUBS AND SOCIETIES

Engineering clubs and societies at UTS include:

- The Faculty of Engineering Speakers Club
- Civil and Structural Engineering Society (CASES)
- Society for Electrical, Computer Systems and Mechanical Engineers (SECSME).

ENDOWMENTS, PRIZES AND SCHOLARSHIPS

A number of prizes and scholarships for academic excellence are awarded to students enrolled in the Faculty of Engineering. Prizes are awarded in respect of each academic year and are presented annually at a Faculty ceremony. These prizes are made available through the generosity of private individuals, and organisations in the public and private sector.

Scholarships for commencing students are also available. Undergraduate scholarships are described below. Inquiries about postgraduate scholarships should be made with the University Graduate School on 9514 1521.

Prizes which are available to students in all faculties of the University are described in the *UTS Calendar*.

Endowments

James N Kirby Chair of Manufacturing Engineering

In 1983, the James N Kirby Foundation commenced a series of donations to the Faculty of Engineering Development Fund, towards the establishment of a Chair in an area relating to manufacturing industry. The capital fund to support the Chair was built up over some twelve years, and is now expected to be capable of providing a substantial annual contribution in perpetuity.

Through the Foundation's generosity, the Council of UTS was able to establish the James N Kirby Chair of Manufacturing Engineering in 1988. The inaugural professor, Dr Frank Swinkels, was appointed in 1989 and took up duty in 1990. Dr Swinkels had previously been Director of the University's Centre for Industrial Technology.

Prizes

Association of Consulting Structural Engineers Prizes

Two prizes from the Association of Consulting Structural Engineers were established in 1986, and are awarded annually to students enrolled in either the Civil or Structural Engineering degree course. The Stage 4 prize is awarded to the student who achieves, at the first attempt, the highest aggregate in the subjects Concrete Design 1, Structural Analysis 1 and Timber Design. The cash value of the prize is $200. The Stage 6 prize is awarded to the student who

achieves, at the first attempt, the highest aggregate in the subjects Concrete Design 3 and Steel Structures and Concept Design 1. The cash value of the prize is $250.

Australian Industry Group John Heine Memorial Prizes

These prizes were formely known as the MTIA John Heine Memorial Prizes and have been renamed because the Metal Trades Industry Association of Australia merged with the Australian Chamber of Manufacturers in 1998 to form the Australian Industry Group.

The MTIA established the John Heine Memorial Foundation in 1950 in memory of John Heine who did much to advance the cause of the metal trades industry. In 1971, the Foundation decided to give support and encouragement to students by the annual award of prizes to outstanding students in undergraduate Mechanical and Manufacturing Engineering degree courses. The Foundation continues to offer these prizes thourhg the Australian Industry Group. The prizes are in the form of cash awards to help students cover costs for books and equipment for use in connection with their early years of study at UTS. Currently, prizes are awarded to students in Stages 1, 2, 3 and 4. Each is a cash award of $400.

L H Baker Medal

The medal was established in 1977 to perpetuate the memory of the late L H Baker, former Head of the School of Mechanical Engineering, who died in 1976. The prize consists of a medal and may be awarded annually to a part-time student who obtains the highest aggregate in Stage 8 of the Mechanical Engineering or Manufacturing Engineering degree course.

Eldred G Bishop Prize

The prize was established in 1974 to commemorate the leadership of Mr Eldred George Bishop in improving the standard and quality of manufacturing engineering in Sydney. The prize is awarded to a student who is an Australian citizen, generally entering his or her final year of studies towards the Bachelor of Engineering degree with a major project in manufacturing systems engineering or a closely-related area. Selection is based on a written application and an interview. No candidate may be considered for the prize more than once. The prize consists of a commemorative trophy and a cash award of $1,350.

Trevor Buchner Design Prize

This prize was established in 1988 from a Trust Fund set up in recognition of the contribution and distinguished service of Trevor Buchner, the first academic member of staff of the School of Civil Engineering. This prize is awarded annually to the student enrolled in the Bachelor's degree course in either Civil or Structural Engineering, who achieves the highest aggregate, at the first attempt, in the subjects Steel Design 1, and Steel Structures and Concept Design 1. The prize has a cash value of $200.

Compumod Prize in Solid Mechanics

This prize is awarded annually to the student, enrolled in either of the Bachelor's degree courses in Mechanical Engineering or Manufacturing Engineering, who obtains the highest aggregate mark in the four subjects, Solid Mechanics 1, Solid Mechanics 2, Solid Mechanics 3, and Finite Element Stress Analysis. The prize consists of a commemorative certificate and a cash award of $200.

Electricity Supply Engineers' Association Inc. Prize

Since 1976 the Electricity Supply Engineers' Association Inc. of New South Wales has offered encouragement, by way of an annual cash award of $200, to Electrical Engineering students. The purpose of the prize is to attract the interest of students in pursuing a course which will enable them to become engineers in the electric power distribution industry. The prize is awarded to a sandwich pattern- or part-time student who excels in the subjects Power Apparatus and Systems, and Power Circuit Theory.

Energy Australia Prize in Power Engineering

This prize was established in 1986 and is awarded annually to the student who completes the requirements of the Electrical Engineering degree course and who obtains the highest aggregate in any three of the power engineering professional elective subjects. The cash value of the prize is $250 and is subject to periodic review for the purpose of maintaining its real value.

Francis E Feledy Memorial Prize

This award was established by the staff of the British Motor Corporation as a memorial to the late Francis E Feledy for his work as an architect and engineer with that company. The award was first made available in 1966 through the then Department of Technical Education. In 1974, the then Institute became the Trustee of the fund. At the discretion of the Trustee, the prize is awarded annually to an outstanding part-time student entering his or her final year in each of the Faculties of Engineering; Science; and Design, Architecture and Building. Each prize is valued at $600.

The George J Haggarty Civil Engineering Prize

In 1981, the George J Haggarty Student Endowment Fund was established to commemorate the significant contribution made by the Foundation Head, School of Civil Engineering, to engineering education. From the Fund, a prize, known as the George J Haggarty Civil Engineering Prize is awarded annually to a Civil Engineering student who, at his or her first attempt, achieves the highest aggregate in the subjects Statics, Mechanics of Solids 1, Mechanics of Solids 2, and Fluid Mechanics. The award is a cash prize of $200.

The IEAust MEM Prize

This prize was established in 1992 by the Institution of Engineers, Australia. The prize may be awarded in respect of each academic year but will not be awarded if no candidate reaches a level acceptable to the Faculty Board in Engineering. The recipient of the prize shall satisfy the following conditions: (i) he or she must have been a registered student in the Master of Engineering Management degree; (ii) he or she must have achieved the highest aggregate marks of students fulfilling the requirements to graduate. The prize is a cash award of $250.

The Institute of Municipal Engineering Australia (IMEA) — NSW Division Medal

This prize was established in 1975. It is awarded annually to the student, in either part-time study or 'sandwich' mode, with the best overall academic performance in the Civil Engineering Bachelor's degree course and who is employed by a Local Government Authority at the time of completing the course. The recipient must have been employed by a Local Government Authority for at least three semesters during the period of his or her course. The award comprises $500 cash and a medal.

The Institute of Instrumentation and Control, Australia Prize

This prize was established in 1992 by the Institute of Instrumentation and Control, Australia. The prize may be awarded each academic year but will not be awarded if no candidate reaches a level acceptable to the Faculty Board in Engineering. The prize is awarded to Mechanical Engineering and Electrical Engineering students.

The recipient of the prize in Mechanical Engineering shall satisfy the following conditions: (i) have been a registered student in the Mechanical Engineering or Manufacturing Engineering degree courses during the year for which the award is made; and (ii) have achieved the best performance in the subjects 46530 Measurement and Instrumentation and 46531 Control Engineering 1.

The recipient of the prize in Electrical Engineering shall satisfy the following conditions: (i) have been a registered student in the Electrical Engineering or Computer Systems Engineering degree courses during the year for which the award is made; and (ii) have achieved the best performance in the subject 45581 Analogue and Digital Control.

Each prize is a cash award of $250.

The Institution of Electrical Engineers Prize

This prize is offered by the Institution of Electrical Engineers in the United Kingdom to institutions in which the degree programs have been mutually accredited by the IEAust and the IEE. It was established at UTS in 1991. The prize may be awarded in respect of each academic year but will not be awarded if no candidate reaches a level acceptable to the Faculty Board in Engineering. The prize is awarded to a graduating Electrical Engineering student on the basis of outstanding performance in the final-year project. The prize consists of a certificate, a cash prize of $250 and two years' free membership of the Institution of Electrical Engineers.

Institution of Electrical Engineers E C Parkinson Prize

The Sydney Section of the Institution of Manufacturing Engineers donated a sum of money in 1964 to be used to establish a prize

for the purpose of perpetuating the memory of the late E C Parkinson, a distinguished production engineer and, for many years, a senior executive of the AWA Company. Since 1970 the prize has been awarded to a student of the University. The prize is awarded annually, subject to a suitable recipient being nominated by the Head of the Mechanical Engineering Group, for distinguished performance in the final Stage of the Manufacturing Engineering degree course. The prize comprises a certificate and a book allowance of $150.

Iplex Pipelines Award

This award was established in 1983 as the Hardie's 'Pipeline Systems' Award. In 1998, it was re-named the Iplex Pipelines Award. The prize is awarded annually to the student in the Bachelor of Engineering degree course who obtains the highest aggregate in the subjects Public Health Engineering, Hydrology and Project Planning. The prize consists of a cash award of $250 and a prestigious trophy.

Jack Kaganer Prize

This prize was established in 1991 by donations from the family and friends of the late Jack Kaganar to commemorate his long and distinguished service to what was then the School of Civil Engineering of NSWIT. Jack Kaganar was the second member of staff to join the School of Civil Engineering and played an important role in its development until his retirement at the end of 1984. The prize is awarded annually to a student registered in either Civil or Structural Engineering during the year in which the award is made, and who achieves, at the first attempt, the highest aggregate in the subjects Structural Analysis 1 and Structural Analysis 2. The award is a cash prize of $250.

Leica Geosystems Pty Ltd Prize

This prize was established in 1986 as the Leica Instruments Prize. In 1998 it was re-named the Leica Geosystems Pty Ltd Prize. The prize is awarded to the Civil Engineering student who obtains the highest mark in the Surveying 1B Practical Test, or, if the Practical Test is not conducted in either semester of the year for which the award is made, the prize will be awarded to the student who has obtained the highest aggregate mark in Surveying. The prize is an instrument chosen by the company.

Ove Arup Bursary

The Ove Arup Bursary was established in 1994. It provides financial support of up to $2,000 per annum to a student of Aboriginal or Torres Strait Islander descent who is enrolled in one of the Civil Engineering programs offered by the Faculty of Engineering. The aim of the bursary is to provide financial support to students who would otherwise be constrained by inadequate financial resources, to assist them to begin or to continue their studies.

Applications for the bursary will be invited from eligible candidates by the relevant Program Director. The successful applicant will be selected by a committee comprising a nominee from Ove Arup and Partners, the relevant Program Director or his/her nominee and the Faculty Administrator, Engineering, who shall act as convener of the committee.

The financial support from the bursary is provided to the student while he or she undertakes full-time study. The benefits of the bursary continue to be provided to the student during academic semesters until completion of the course or withdrawal from it, subject to satisfactory academic progression being maintained.

Only one bursary will be current at any one time.

Optus Medal

The Optus Medal was established in 1994 and is awarded annually to a student who has been registered in either the Bachelor of Engineering in Telecommunications degree, or in the Telecommunications Strand of the Bachelor of Engineering in Electrical Engineering degree and who achieves the highest graduation weighted average mark (WAM) of students fulfilling the requirements to graduate in either of these two degrees. The prize will not be awarded if no candidate reaches a level acceptable to the Faculty Board in Engineering. The prize is an inscribed medal and a cash award of $500.

Pioneer Concrete (Stage 5) Prize

This prize was established in 1987 by Pioneer Concrete (NSW) Pty Ltd. The prize is awarded annually to the student enrolled in the Civil or Structural Engineering degree course who achieves, at the first attempt, the highest scaled aggregate in the subjects Computations 4, Construction Contracts, and Steel Structures and Concept Design 1. The prize has a cash value of $500.

RS Components Pty Ltd Prize

This prize was established in 1996 by RS Components Pty Ltd, an organisation located in Perth, Western Australia, which firmly believes in the principles of a strong technical education. The prize is awarded to a final year student in Electrical Engineering who has achieved the highest level of academic excellence or who has conducted the best final year project. The prize consists of an instrument or a combination of instruments to the value of $500, and a commemorative certificate from the company.

Society of Manufacturing Engineers Prizes

The Society of Manufacturing Engineers has supported two prizes in the Faculty since the early 1970s. Over time prize names have changed to reflect course developments. The current prizes are available in the Bachelor of Technology in Manufacturing Engineering, and in the Bachelor of Engineering courses in either Mechanical or Manufacturing Engineering.

Society of Manufacturing Engineers (Bachelor of Technology) Prize

This prize is awarded annually to the student who achieves the highest graduating WAM in the Bachelor of Technology in Manufacturing Engineering degree course. The prize is a cash award of $200 together with copies of the publication *Manufacturing Engineering* and one year's free membership of the Society.

Society of Manufacturing Engineers (Stage 8) Prize

This prize is awarded to the student enrolled in the Mechanical Engineering or Manufacturing Engineering degree course who obtains the highest mark in the subject Project for a thesis on a manufacturing engineering topic. The prize is a cash award of $250 together with one year's free membership of the Society and a framed certificate.

United Associations of Women Prize

This prize was established in 1982 by the United Associations of Women to commemorate its work. It is offered annually to students in Bachelor's degree courses within the Faculty of Engineering and will be awarded to the student who achieves the highest WAM over all subjects studied in the year for which the prize is awarded. Students eligible for this prize shall be all women students enrolled in subjects in Stages 5, 6, 7, or 8 of a course, and who should have completed at least 18 credit points in the year. A student is not eligible to receive the prize a second time. The prize consists of a cash award of $550.

Richard Whitfeld Prize for Industrial Experience

This prize was established in 1992 by the Computer Systems Engineering Forum. In 1997 it was re-named in honour of the late Richard Whitfeld, an eminent figure in the computer industry, and an active contributor to the work of the Faculty.

The prize may be awarded each academic year but will not be awarded if no candidate reaches a level acceptable to the Faculty Board in Engineering. The recipient shall satisfy the following conditions: (i) have been an enrolled student in the Computer Systems Engineering degree course during the entire calendar year for which the award is made; (ii) have achieved the most outstanding performance in the third block of Industrial Experience.

In selecting the prize winner, account is taken of industrial experience log books, reports, submissions from employers, and any other relevant material, and the criteria include appropriateness of experience, engineering excellence, technical ability, communication skills, quality of report and degree of innovation shown during the work experience. The prize is in the form of a certificate and a cash award of $500.

Scholarships

Engineering Co-op scholarships

Availability

Engineering Co-operative Scholarships will be awarded in 1999 to students who are successful candidates at the 1998 NSW Higher School Certificate examinations (or equivalent) and who are either Australian citizens or Permanent Australian Residents. Awards will be made only to young men and women who satisfy the requirements for admission to the Bachelor of Engineering, Diploma in Engineering Practice.

Scholarships are not normally available for the Bachelor of Engineering, Bachelor of Arts in International Studies, Diploma in Engineering Practice. Because of its special nature, this course has different employment and support arrangements in place, including scholarship support for study and work overseas.

Sponsors

The scholarships are derived from gifts made to the University by industry sponsors who are engaged in a variety of engineering endeavours. The value of each scholarship depends on the level and period of sponsorship but is between $5,000 and $10,000 per annum. The stipend to students is tax free.

The Faculty acknowledges the commitment and generous sponsorship of the Engineering Co-op Scholarship Program by the following organisations:

BP Australia; Cannon Australia; Ci Technologies Pty Ltd; CMPS&F; Commonwealth Bank; Comalco; Delta Electricity; Energy Australia; GHD; IBM Australia; Insearch Institute of Commerce; Institute of Municipal Engineering Australia; Keycorp Limited; Kinhill Engineers; Leighton Contractors; McMillan, Britton & Kell; National Facility for Dynamic Testing; Pacific Power; Optus; Ove Arup & Partners; Rose Consulting; Vodafone; Warman International. Sponsors of 1999 scholarships are not yet finalised.

Duration and payments

The scholarships are designed to provide students with financial support at the start of their course. Most scholarships operate only during the first academic year of each scholar's course; some commencing in 1999 may be available for longer periods.

An initial payment of ten per cent of the total annual stipend will be made at the time of enrolment. This will be followed by fortnightly payments commencing during the second week of the Autumn semester 1999 and concluding at the end of the Spring semester 1999 examination period.

Engineering practice opportunities

During their second academic year, scholars may be given the opportunity to undertake one period of work experience with the sponsor of their scholarship.

Personal requirements

Scholars will be selected jointly by the University and Scholarship sponsors on the basis of a combination of academic achievements, personal attributes relevant to a career in professional engineering such as an interest in engineering, communications skills, leadership and creativity.

Academic requirements

Competition for Scholarships will be strong and a UAI of approximately 97 will be required for success. It will also be a requirement that the professional engineering interests of each Scholar be in the field of activity of the sponsor of the Scholarship.

Applications and interviews

Applications forms are available from high school careers advisers in August each year. The closing date is 30 September. Applicants who are short-listed will be required to attend an interview on Monday 30 November 1998. Other than in exceptional circumstances, Scholarships will be awarded only to applicants able to personally attend the interview.

Conditions of award

Conditions of award applying to individual scholarships will be consistent with this information, and advised when the offer is made.

The George J Haggarty Civil Engineering Scholarship

This scholarship was established in 1981 from funds made available from the George J Haggarty Student Endowment Fund. The scholarship, to be known as the George J Haggarty Civil Engineering Scholarship, is aimed primarily at country-based students who are about to start a sandwich course. Preference will be given to country students wishing to enter the area of Local Government engineering who have little other opportunity of alternative study programs or venues. The scholarship will be offered occasionally as funds permit, the amount to be determined from time to time. The grant will be between $1,000 and $1,200.

ACADEMIC STAFF GROUPS – AREAS OF PROFESSIONAL INTEREST

(The staff list at the end of the handbook includes academic and general staff)

Civil Engineering

	Building/Room	Telephone Ext
Professor Steve Bakoss Structural Mechanics	2/528	2629
Associate Professor Tom Anderson Construction and Management	2/527	2639
Associate Professor Geoffrey O'Loughlin Water Engineering	2/508	2644
Professor Bijan Samali Structural Dynamics, Structural Mechanics	2/7070	2632
Dr Simon Beecham Water Engineering	2/507	2623
Mr Alan Brady Surveying	2/511B	2627
Dr Hung Chung Construction Materials	2/519	2637
Mr Keith Crews Timber Engineering, Structural Design	2/503	2619
Mr Ken Halstead Local Government Engineering	2/522	2640
Dr Reza-ul Karim Structural Mechanics, Analysis and Design	2/505	2621
Mr Patrick Kenny Roads and Transport	2/502	2618
Dr Kin Leung Lai Structural Mechanics, Design and Construction	2/510	2626
Dr Sia Parsanejad Design of Steel Structures and Structural Analysis	2/504	2620
Dr R. Sri Ravindrarajah Concrete Technology	2/509	2625
Dr Gerald Ring Soil Engineering	2/506	2622
Dr Ali Saleh Structural Mechanics, Finite Element Method Computational Mechanics	2/517	2635
Mr Chris Wilkinson Structural Mechanics, Fabric Structures	2/518	2631
Research Fellow Dr Jianchun Li	2/536	2651

	Building/Room	Telephone Ext
Computer Systems Engineering		
Professor Chris Drane Positioning Systems, Intelligent Transport Systems, Software Engineering	1/2221A	2390
Associate Professor Chris Peterson Research Policy, Computer-integrated, Year 2000 Software Compliance, Software Project Management	1/2220A	2392
Mr Noel Carmody Microcomputer System Design, Operating Systems, Computer Architecture, Digital Control Systems	1/2221B	2391
Dr K K Fung Parallel Processing, Software Engineering, Computer Simulation, Microcomputer Engineering, Digital Systems	1/2225	2394
Mr John Leaney Software/Systems Engineering, Real-time Computing, Intelligent Instrumentation, Robotics	1/2221A	2389
Dr David Lowe Hypermedia Information Modelling, Web and Hypermedia Development Processes, Web Project Scoping	1/2226	2526
Dr Ron Meegoda Multimedia/Hypermedia Systems, Object Oriented Software Engineering, Software Process Assessment	1/2227	2396
Mr Steve Murray Embedded Systems, Real-time Systems, Operating Systems, Computer Systems Engineering	1/2222	1553
Dr Craig Scott Intelligent Transport Systems, Positioning Systems, Motor Vehicle Navigation, Mobile Telecommunications	1/2220C	2397
Dr Keiko Yasukawa Mathematics Education, Nonlinear Systems and Control, Numeracy and Engineering	1/2210C	2437
Electrical Engineering		
Professor Vic Ramsden Electrical Machines, Electrical Variable-Speed Drives, Electromagnetics	1/2417C	2420
Associate Professor Roman Stere Instrumentation and Control, Data Acquisition Systems, Electronic Measurements, Engineering Education	1/2315	2401
Associate Professor Hung Nguyen Biomedical Engineering, Neural Networks and Fuzzy Systems, Power Electronics and Machine Control	1/2515	2451
Ms Vicki McKain Instrumentation and Control, Biomedical Engineering	1/2433	2443

	Building/Room	Telephone Ext
Mr Peter McLean Embedded Systems, Signal Processing Numerical Methods	1/1921	2339
Dr Andrew Mears Biomedical Engineering, Instrumentation and Control, Biosensors, Signal Processing and Identification	1/2432	2427
Dr John Nicol Control Theory, Optimal Control, Multivariable Control	1/2428	2438
Dr Venkat Ramaswamy Power Electronics, Electrical Machines, Variable Speed Drives, Computer Simulation and Modelling	1/2417A	2418
Dr Ben Rodanski Numerical Methods, Computer-aided Design, Device Modelling for CAD, Software Engineering	1/2420B	2426
Dr David Webster Estimation and Detection Theory, Sensors and Transducers, Radar, Sonar	1/2419C	2453
Dr Jianguo Zhu Electromagnetics, Electrical Machines and Drive Systems, Power Electronics	1/1823	2318
Senior Research Fellow		
Dr Peter Watterson Electromagnetics, Engineering Mathematics, Numerical Methods	1/1823	2319
Engineering Management and Practice		
Mr Ravindra Bagia Systems Engineering, Software Engineering, Engineering Management	1/2423	2432
Professor Rod Belcher Antenna and Microwave Systems, Systems Engineering	2/511	2423
Associate Professor Paul Bryce Microhydroelectricity, Appropriate Technology, Fibre Optic Communications, Electromagnetic Theory	1/2420A	2425
Mr Peter Lewis Engineering Education, Engineering Management, Project Management	1/2431	2431
Mr Paul Maloney International Engineering, Philosophy of Science	2/7087	2591
Associate Professor Helen McGregor Human Communication, Engineering and Social Issues, Cooperative Education, Engineering Documentation, Professional Development	2/620	2678
Mr Robert Mellor Local Government Management (Centre for Local Government Education and Research)	1/1714	2595
Professor Peter Parr Engineering Education and Management	2/7092	2599

	Building/Room	Telephone Ext
Dr Deepak Sharma Energy Planning and Policy, Institutional Restructuring and Decision Processes, Project Planning and Performance	2/7088	2422
Mr Paul Stapleton Industrial Liaison	2/7097	2592
Ms Elizabeth Taylor Sociology and Engineering, Engineering Education, Appropriate Engineering and Society, Technology, Law and Society	1/2430	2442
Dr Ron Ward Engineering Management, Technical Communication, Maintenance Hazard and Risk	2/621	2679
Environmental Engineering		
Professor S (Vigi) Vigneswaran Environmental Engineering	2/523	2641
Professor Michael Knight (National Centre for Groundwater Management)	1/1715	2692
Associate Professor Jim Parkin Engineering Management, Environmental Planning, Decision Theory	2/7087	2638
Ms Roslyn Crichton Local Government Management (Centre for Local Government Education and Research)	1/1714	2597
Dr Prasanthi Hagare Water & Wastewater Treatment Plant Design Industrial/Hazardous Waste Management Auditing Landfill Management	2/520	1952
Dr Pamela Hazelton Applied Soil Science, Land Resource Management	2/512	2661
Ms Bronwyn Holland Environmental Engineering Women in Engineering Program	2/7071	2601
Mr James Irish Environmental Risk Assessment, Risk Engineering, Statistical Hydrology	2/501	2617
Dr Robert McLaughlan (National Centre for Groundwater Management)	1/1715	2614
Mr Noel Merrick Groundwater Modelling (National Centre for Groundwater Management)	1/1715	2612
Dr William Milne-Home (National Centre for Groundwater Management)	1/1715	2654
Dr Hao Ngo Advanced Water and Wastewater Treatment Processes, Water Quality Assessment and Monitoring, Argo-industries Waste Management	2/547	2653
Ms Kayleen Walsh Site Rehabilitation (National Centre for Groundwater Management)	1/1715	1984

	Building/Room	Telephone Ext
Mechanical Engineering and Manufacturing		
Professor John Reizes Computational Fluid Dynamics, Thermodynamics, Heat Transfer, Engineering Ethics	2/511C	2742
Professor Frank Swinkels Design for Manufacturing, Materials, Computer-aided Design and Computer-aided Manufacturing	2/416	2588
Associate Professor Stephen Johnston Design and Professional Practice, Social Context and Philosophy of Engineering, Sustainability	2/610	2668
Associate Professor Robert Spencer Production Planning and Control, Product Process Design and Development, Computer-aided Manufacture, Metrology/CMM, Robotics	2/606	2660
Mr Terry Brown Experimental and Computer-aided Stress Analysis and Design, Adhesives	2/604	2658
Mr John Dartnall Mechanical Engineering Design	2/622	2541
Mr David Eager Acoustics, Project Management, Occupational Health and Safety, Building Services Engineering	2/612B	2687
Dr Guang Hong Internal Combustion Engines, Boundary Layer Transition, Thermodynamics, Engineering Statistics	2/619	2677
Dr Phuoc Huynh Computational Mechanics, Fluid Mechanics, Heat Transfer	2/616	2675
Ms Catherine Killen Computer-aided Design, Computer-aided Manufacture	2/624	2697
Dr Austin Mack Aerodynamics, Finite Element Methods, Computational Fluid Dynamics	2/626	2684
Dr Jaffar Madadnia Energy Application Systems, Thermofluids Thermal Design Thermodynamics, Heat Transfer	2/607	2740
Mr Garry Marks Political Economy of Technology, Industry Development Policy, Engineering Education	2/609	2683
Dr Fred Sticher Advanced Kinematics and Dynamics, Instrumentation	2/623	2681
Mr Kel Stillman Control Engineering, Chemical Engineering, Real-time Computing, Simulation, Optimisation	2/612C	2667
Dr Nong Zhang Vibration Analysis, Machine and Rotor Dynamics	2/608	2662

Telecommunications Engineering

	Building/Room	Telephone Ext
Professor Warren Yates Signal Processing, Communication System Theory, Packet Radio and Spread Spectrum Communications, Synchronisation Issues in Communications	1/2427	2436
Associate Professor Sam Reisenfeld Communications Systems, Satellite Communication, Information Theory, Modulation, Channel Coding, Synchronisation, Mobile Communications, Wireless Networks, Neural Networks	1/2512B	2448
Associate Professor ~~Aruna Seneviratne~~ Protocol Design, Software Engineering, Computer Networks, Data Communications, Operating Systems	1/2429	2441
Dr Tim Aubrey Antennas and Propagation, Microwave Engineering	1/2417B	2360
Dr Robin Braun Microwave Engineering, Digital Radio Communications	1/2424	TBA
Dr Michael Eckert Human Visual Perception, Medical Image Processing, Biomedical Signal Processing, Signal Compression	1/2420D	2428
Dr Jules Harnett Engineering Mathematics	1/2419	2413
Mr Anthony Kadi Real-time Signal Processing, Ultrasound Signal Processing, Signal Theory, Hardware Design and Construction	1/2420E	2459
Dr Ananda (Mohan) Sanagavarapu High Frequency Electromagnetics, Wave Propagation, Microwave Engineering, Mobile Communication	1/2512A	2447

LIST OF COURSES

Undergraduate

Bachelor of Engineering, Diploma in Engineering Practice	E001
Bachelor of Engineering, Bachelor of Arts in International Studies, Diploma in Engineering Practice	E002
Bachelor of Engineering, Graduate Certificate in Engineering Practice	E004
Major Codes (for E001, E002, E004)	
Civil Engineering	*01*
Civil and Environmental Engineering	*02*
Computer Systems Engineering	*03*
Electrical Engineering	*04*
Environmental Systems Engineering	*05*
Mechanical Engineering	*06*
Software Engineering	*08*
Telecommunications Engineering	*07*
Bachelor of Engineering, Bachelor of Business	E005
Bachelor of Technology	E012
Major Codes (for E012)	
Aerospace Operations	*03*
Heating, Ventilating, Airconditioning and Refrigeration	*02*
Manufacturing Engineering	*01*
Bachelor of Science in Applied Physics, Bachelor of Engineering, Diploma in Engineering Practice	NP04

Postgraduate

Research awards

Doctor of Philosophy	EP99
Master of Engineering (by Thesis)	EP98

Coursework awards

Master of Engineering (by Coursework)	EP81
Master of Engineering (by Coursework) (Energy Planning and Policy)	EP82
Master of Engineering (by Coursework) (Software Engineering)	EP83
Master of Engineering Management	EP85
Master of Environmental Engineering Management	EP89
Master of Engineering Practice	EP86
Master of Engineering Practice (presented in work-based learning mode)	EP90
Master of Engineering in Groundwater Management	E057
Master of Technology	EP71
Master of Technology (Energy Planning and Policy)	EP72
Master of Technology (Software Engineering)	EP73
Master of Engineering Studies	EP88
Master of Engineering Studies (Honours)	EP91
Graduate Diploma in Engineering	EP61
Graduate Diploma in Engineering (Energy Planning and Policy)	EP62
Graduate Diploma in Engineering (Software Engineering)	EP63
Graduate Diploma in Local Government Engineering	EP64
Graduate Diploma in Engineering in Groundwater Management	E061
Graduate Diploma in Engineering (presented in work-based learning mode)	EP65
Graduate Certificate in Engineering	EP51
Graduate Certificate in Engineering (Energy Planning and Policy)	EP52
Graduate Certificate in Engineering (Software Engineering)	EP53
Graduate Certificate in Engineering Management	EP57
Graduate Certificate in Environmental Engineering and Management	EP54
Graduate Certificate in Engineering (presented in work-based learning mode)	EP58

Note: Continuing postgraduate students who commenced before 1 January 1995 and who are uncertain of their course codes should contact the GSE Graduate Student Adviser.

Undergraduate courses

Bachelor of Engineering, Diploma in Engineering Practice

Course code: E001

Abbreviation: BE DipEngPrac

Introduction

The program leading to the combined award of Bachelor of Engineering and Diploma in Engineering Practice is a comprehensive preparation for careers in the professional practice of engineering. The program comprises eight semesters of full-time study, and at least two 24 week periods of experience gained in the engineering industry, or other authentic workplace settings.

The Bachelor of Engineering, Diploma in Engineering Practice is a combined degree and the awards are not available separately. Both elements of the program are closely interwoven and interdependent, and prepare students for professional engineering practice by linking theory and application. The combined degree Bachelor of Engineering, Bachelor of Business also has a practice focus and a workplace-experience component, and students can choose to complete the Diploma in Engineering Practice by undertaking further work and study.

Students who have more extensive and advanced experience of engineering practice than would normally be attained in two six-month periods may be eligible to transfer to the Graduate Certificate in Engineering Practice, described in a later section.

As noted earlier, the combination of formal academic learning in the University and experiential learning in the workplace is called Cooperative Education. UTS Engineering degree courses have embodied this principle for over thirty years. The courses have been highly regarded in industry, and the graduates have enjoyed correspondingly high employment rates: according to many reports and surveys, the highest of any engineering degree courses in Australia. UTS is now the only faculty of engineering in Australia where all BE students take the Co-op program. Co-op is well-known and highly regarded in other countries also, particularly North America.

Engineering education in many countries is undergoing revolutionary change, and the UTS program is believed to be at the forefront.

A national Review of Engineering Education, commissioned by leading Australian engineering bodies, conducted widespread consultations during 1995 and 1996 in industry and business, in universities, among high-school and university students, and in the community generally. Its report, published in late 1996, expressed great concern at the narrow focus of many engineers and many engineering courses, and urged the engineering profession to develop a more outgoing culture. It highlighted the need expressed by employers for graduates with strongly-developed lateral thinking, innovation, communication, interpersonal and networking skills, able to engage with non-technical professions and with environmental, economic and community issues. It strongly recommended a broader approach to engineering education, with a focus on professionalism and social responsibility as well as technical excellence. The same views have been expressed by the Australian Business/Higher Education Round Table, and by similar bodies and reviews of engineering education in many other countries.

The UTS program is designed to give full expression to these new directions, and to equip graduates with the skills and attributes needed for professional practice and professional leadership in the coming century. The program is designed around the triple themes of academic development, personal development, and professional formation. It provides sound foundations in engineering theory, technical expertise, and knowledge of professional practice, while also developing academic literacy, advocacy skills and social awareness so that graduates are equipped to grow as lifelong learners and to become effective citizens in many different capacities. The concept has been strongly endorsed in wide-ranging industry consultations. Interaction between work experience and academic curriculum has been greatly strengthened, giving the program a depth that no full-time academic course can match.

At present, students can major in the combined award in one of eight areas. These are: Civil Engineering, Civil and Environmental

Engineering, Computer Systems Engineering, Electrical Engineering, Environmental Systems Engineering, Mechanical Engineering, Software Engineering and Telecommunications Engineering. The choice of major can be made at entry, or postponed until the end of the first year without extending completion time. Further majors will be introduced in subsequent years in response to technological developments and employment demand, and provision will be made for to allow students to change from existing majors. It is also possible for students to negotiate a program which focuses on an area outside the designated majors. There is considerable elective scope, which can be used either to extend engineering knowledge or to take a sub-major in a different discipline such as business or social science.

Three associated courses are also available. One combines the BE DipEngPrac with a Bachelor of Arts in International Studies. Another combines it with a Bachelor of Science in Applied Physics and the third combines the BE with a Bachelor of Business. These are described in a later section, together with the Graduate Certificate in Engineering Practice.

The Pre-1998 Course

Students who commenced before 1998 will have completed part of their studies under an earlier version of the course. Full details of this course are in the 1997 Handbook which is available free of charge from the Faculty's Undergraduate Programs Office.

All students who commenced before 1998 will graduate under the new course rules as far as the academic subjects are concerned, and will have the choice of continuing with the old course industrial experience requirement or transferring to the BE DipEngPrac. In Autumn semester 1999 all pre-1998 students will be given a listing of the new course subjects along with the number of credit points of electives that they need to complete for graduation.

Students wishing to transfer to the BE DipEngPrac may be able to get earlier industrial experience credited towards the engineering practice program in the post-1998 degree.

Attendance patterns and course duration

Attendance patterns are based on a semester calendar, with some additional flexibilities (see below). A semester consists of 13 weeks of formal teaching, a one-week tutorial week, a one-week study period prior to exams, and a two-week examination period. The Autumn Semester runs from the beginning of March to early July, and the Spring Semester from the beginning of August to early December. Refer to the Principal dates for 1999 under 'General Information' for exact dates.

Students undertaking full-time academic enrolment will normally complete the program in eight academic semesters, each containing four subjects, plus two periods of engineering experience in the workplace totalling at least 48 weeks. On this basis the program takes five years, or ten semesters, to complete. The two periods of work experience must be interleaved with the academic semesters: work experience would typically be taken in the third or fourth semester and again in the seventh or eighth. This mode of attendance is often known as the sandwich pattern.

Course structures provide flexibility to students in negotiating their academic requirements with their work and other commitments. Each semester, students may enrol in up to four subjects and may combine their academic study with work. The only restriction is that subject prerequisites, and requirements of the Engineering Practice program must be met. However, it should be understood that four subjects represent a heavy commitment for most people. Students who combine this with other substantial commitments run the risk of failure and frustration. Students are encouraged to take responsibility for their own arrangements, but should be guided by Faculty advice and by the experience of others.

The timetable of subject offerings is designed to guarantee a viable attendance pattern for students taking the published full-time pattern of four subjects in a stage, and also for students undertaking a four-subject stage on a part-time basis over a full year, with two subjects in each semester. The latter arrangement would normally require attendance on campus for at least one afternoon each week, and preferably two afternoons, as well as evenings.

It is possible to complete the program entirely on a part-time attendance basis, with continuous concurrent employment, by enrolling in academic subjects at the rate of two subjects per semester (half the full-time rate). This would require eight years overall, and is not recommended. Students wishing to make extensive use of part-time attendance are strongly encouraged to negotiate with their

employers at least two full-time semesters somewhere through the program.

The Faculty is aware that some employers appear to expect students to be able to undertake an entire degree program concurrently with a full-time job, without any allowance for study time. This is simply unrealistic, and is not condoned. The Faculty will be glad to advise students in such a situation.

In future years it is anticipated that some subjects will be available during a Summer session, between December and February. This may enable completion of the course in an accelerated timeframe, and also provide opportunity for students to recover missed subjects or to optimise their study–work arrangements. Also, the Faculty expects over the next few years to make increasing numbers of subjects available in flexible learning modes, including distance, block attendance, and work-based learning. Major projects also may often be conducted in the workplace.

Cooperative education in action

While each student is responsible for finding suitable industrial experience to meet the requirements of the program, the Faculty's Industrial Liaison staff will help with information and advice. It is not necessary for a student to have arranged a job before enrolling in the program.

For students seeking employment in particular semesters (the sandwich pattern), arrangements typically fall into three categories:

Cadetships for student engineers are made available by some employers. Some cadets are selected by employers on the basis of HSC results and are then directed to study engineering at UTS. Others are selected after completing the early stages of their course at UTS. Cadets are usually paid while studying during their academic semesters as well as during periods of work experience. A cadet would work for the same employer during each work experience period. Some cadetships are also available for part-time students.

Sponsorships tend to be less formal understandings between an employer and a student, to the effect that regular employment will be offered in each industrial semester, subject to work availability and satisfactory performance in the job. Salary is usually paid only during the industrial semesters.

Freelance employment means that the student seeks a new position in each successive industrial experience semester, usually with a different employer.

Some students prefer to be continuously employed for the whole duration of the degree program (the part-time pattern). They usually have a job before commencing their studies, although they may change their employment during their progression through the course – often to a more senior position.

The overall requirements of the program are the same for all students, in relation both to the academic curriculum and to the recognition of work experience. Sandwich and part-time attendance are only two examples of the flexibility available, and students may adjust their attendance and progression arrangements to suit employment opportunities and personal circumstances.

Students attending on the sandwich pattern are encouraged to undertake additional work experience, over and above the minimum of 48 weeks, provided it is of good standard and contributes to their professional development.

Industrial Liaison Office

The Industrial Liaison Office assists students in obtaining suitable industry or workplace experience to meet the requirements of the program. Its staff maintain contact with industry, register students' intentions of seeking work experience, advise students on the preparation of résumés and presentation at interview, keep students' résumés on file, and advise on the availability of work opportunities in Australia and overseas. Students seeking work experience should register with the Industrial Liaison Office in the semester preceding their intended period of work.

Professional recognition

All Bachelor of Engineering courses offered by the Faculty have been accorded recognition by the Institution of Engineers, Australia (IEAust).

The Institution manages the National Professional Engineers Register (NPER-3), which is the only Australian register of practising professional engineers with legal recognition. Registration assures the community of the member's professional competence and commitment to ethical practice, may be cited in relation to quality assurance systems, and (particularly in New South Wales) can provide legally-established professional limitation of liability. Professional engineers normally join the register

concurrently with their recognition as a Chartered Member of the Institution (CPEng).

A candidate for NPER-3 registration must have completed an accredited undergraduate engineering course, have practised as an engineer, and be able to demonstrate competency against the Institution's competency standards. These are detailed under eleven headings: ethics and principles; practice skills; planning and design; business and management; communication; research, development and commercialisation; materials or components; education and training; manufacturing and production; project implementation; and asset management.

Graduates of full-time engineering degree courses at other universities, without work experience, will typically require three or more years of work experience after graduation to attain NPER-3. UTS Engineering graduates have always been able to apply to IEAust for recognition of their undergraduate work experience towards professional registration. Until now, this has been assessed on a case-by-case basis.

UTS expects to negotiate formal IEAust recognition of the new BE DipEngPrac in such a way that graduates will receive full credit for their work experience towards NPER-3, without the need for this experience to be re-assessed by the Institution. These negotiations are in train but are not complete at the time of printing. It is hoped that the resulting agreement will be of significant advantage to UTS Engineering graduates. The Graduate Certificate in Engineering Practice, described below, further extends this advantage.

Admission to the program

Full details relating to admission are available from the UTS Information Service at the University's postal address, or by telephone on (+61 2) 9514 1222. The following brief comments are offered as a general guide.

The main intake of students commences the program in March each year. Australian residents apply for admission through the New South Wales Universities Admissions Centre (UAC). Mid-year entry may be available, and inquiries for admission mid-year should be directed to the Associate Dean Undergraduate Programs.

International students should apply through the UTS International Programs Office, from which all details of fees, requirements and procedures are available.

A Foundation Studies Program in Mathematics, Science, Computing Science and English is available to international students who do not yet meet the requirements for entry to degree programs. This program is offered through the Insearch Institute of Commerce, affiliated to UTS, and the Institute's and the Faculty's policy is to guarantee an offer to international students who complete the program with a WAM of 60 or better, and to consider but not guarantee applications from students who have satisfactorily completed the program but have achieved a WAM of less than 60.

Entry from NSW Higher School Certificate

Selection is competitive, and is made on the basis of UAI (Universities Admission Index) alone. The minimum UAI for entry varies from year to year and is likely to vary between majors, depending upon the numbers of applications for entry and places available. The *UAC Guide*, published annually, quotes the UAI's applying in the previous year.

Although there are no formal subject prerequisites, the BE DipEngPrac is taught on the assumption that students have competencies equivalent to 2-unit English, 3-unit Mathematics, and 2-unit Physics. Some bridging courses are available and are mentioned below.

For the BE BA DipEngPrac, some background in one of Chinese (Mandarin), French, German, Indonesian, Italian, Japanese, Spanish or Thai is an advantage. Places in this program are very limited and selection is by interview as well as UAI.

Entry from TAFE qualifications or tertiary studies

UTS recognises certain tertiary qualifications for matriculation:

- Completed TAFE Diplomas, Associate Diplomas, Advanced Diplomas, and Tertiary Preparation Certificate (TPC). Partially-completed TAFE courses are not usually acceptable.
- Successful completion of at least one year full-time or two years part-time study in a degree course at an Australian university.
- Awards, or partial completion of degree programs, at recognised overseas universities.

Selection will depend on the level of achievement in the qualification or course concerned, and may involve other factors.

Supplementary and bridging courses, and English proficiency

Entrants who have not studied the equivalent of HSC 3-unit Mathematics, or who do not feel confident with this material, are encouraged to contact the Faculty's Undergraduate Programs Office for advice. Lack of background and/or confidence may create obstacles to successful orientation to the University in the first year of study. There are mathematics bridging courses which may be recommended, as well as an option to take the first mathematics and physics subjects at a slower pace than the standard.

The Mathematics Study Centre, the Physics Learning Centre, the Engineering Learning and Design Centres, and the English Language and Study Skills Assistance Centre are all available to enrolled students.

Admission with advanced standing

Students who have pursued relevant studies at another tertiary institution may be admitted with advanced standing and exempted from certain subjects. Extensive industrial experience gained prior to admission may qualify a student for exemption from part of the engineering practice program requirements. Applicants for advanced standing should read the following sections carefully.

TAFE studies

Students with TAFE Diplomas are entitled to advanced standing in the BE DipEngPrac. The level of advanced standing will depend on the relevance of the TAFE area of study to the proposed major in the BE DipEngPrac. For a TAFE Diploma in the same area, students could expect to get between 24 and 48 credit points (cp) depending on the grades obtained in the TAFE subjects. To qualify for 48cp, all subjects at TAFE would need to be 'A' passes. Once a student has been confirmed as qualifying for a specific credit point value of advanced standing, the individual subject exemptions will be negotiated by the student with an academic adviser, to make up the credit point total. 48 cp corresponds to 25 per cent of the academic content of the course, equivalent to two semesters. Students who have taken specially designed TAFE-university articulation subjects, or who have completed advanced diplomas may gain more than 48 cp.

Completion of particular TAFE qualifications does not guarantee the offer of a place at UTS: selection is competitive.

Partially completed BE studies

Students with partially completed studies in a BE course at another Australian university, accredited by the Institution of Engineers, Australia, who are admitted to a UTS BE course, will be guaranteed full proportional credit for up to 50 per cent of the academic requirements for the degree. This will be on a specified-credit, case-by-case basis. Further credit may be allowed, on a discretionary basis, up to a maximum of 75 per cent of the academic requirements for the degree.

Other studies and RPL

The Faculty will examine applications for advanced standing from entrants in all other circumstances on a case-by-case basis. This may include recognition of prior learning (RPL) for candidates who do not hold formal qualifications but have extensive relevant experience.

Advanced standing in the Engineering Practice Program

Exemption from part of the Engineering Practice Program is granted only on the basis of actual work experience that can be shown to meet the required standards. The maximum exemption would be one work-experience semester, incorporating the subjects 48121, 48110 and 48122.

Candidates for such exemption are advised to consider transfer to the Graduate Certificate in Engineering Practice.

In no circumstances will exemption be granted from the whole of the engineering practice requirement.

Candidates transferring from a full-time degree course at another university are reminded that the academic and work-experience requirements of the UTS program have to be individually satisfied. Advanced standing in the academic program does not confer pro-rata advanced standing in industrial experience. Advanced standing in industrial experience is only granted on the basis of actual experience of the required standard. Candidates transferring from full-time courses elsewhere are welcome, but should seek advice on their attendance pattern and progression plan.

General proviso

The Faculty reserves the right to advise any student who is admitted with advanced standing, and who is not succeeding in the program, to undertake some or all of the subjects from which exemption had been granted.

Engineering Co-op scholarships

Up to 20 UTS Engineering Co-op Scholarships, sponsored by engineering employers, are expected to be awarded in 1999. These will be awarded to students who are successful in the 1998 HSC examinations (or equivalent) and who are entering any of the majors available in the BE DipEngPrac in 1999. Refer to Bequests, Prizes and Scholarships section for details.

Graduation with Honours

The BE DipEngPrac and BE GradCertEngPrac may be awarded with First or Second Class Honours for meritorious performance in the course as a whole.

Additional Publications

The Faculty publishes a 'Student Survival Guide' each January and a 'Sub-major Manual' each September. Both publications are available from the Undergraduate Programs Office, Level 7, Building 2. The Faculty's web site *www.eng.uts.edu.au* gives current information on all aspects of the Faculty's operations.

COURSE DESCRIPTION

Programs lead to the combined award of Bachelor of Engineering and Diploma in Engineering Practice (or Graduate Certificate in Engineering Practice). The Bachelor of Engineering cannot be awarded alone; nor can the Diploma in Engineering Practice.

The award may be taken out with a designated Major. Areas in which majors are currently defined are Civil Engineering, Civil and Environmental Engineering, Computer Systems Engineering, Electrical Engineering, Environmental Systems Engineering, Mechanical Engineering, Software Engineering, and Telecommunications Engineering. Majors in new areas of engineering practice will be introduced as they develop.

Students may select a particular major at entry, or may defer their choice until the end of their first year of study. Such deferment need not normally prolong the period needed to complete the program, nor add to the number of subjects required. Students may choose not to take any major, but to take a general program comprising subjects from different areas of engineering (refer, however, to *General degree without major* in this handbook).

The program overall comprises six principal components: the Core program, the Engineering Practice program, the Fields of Practice subjects, the Electives, the Capstone Project, and the Portfolio. The Core program, the Engineering Practice program, the Capstone Project and the Portfolio are common to all students.

The Engineering Practice program comprises a minimum of two periods of Engineering Experience in the workplace, totalling not less than 48 weeks, plus the associated two Preview and two Review subjects which relate the work experience to the academic program.

The choice of Fields of Practice subjects determines eligibility to graduate with a designated major. Electives may be chosen from a wide range available across and beyond the University, and certain combinations of electives may lead to a sub-major within Engineering or in another discipline. A total of 204 credit points are required for graduation, distributed in the following way:

Core program: 60cp

Engineering Practice program: 12cp, plus 48 weeks of approved work experience

Fields of Practice: 90, 96 or 102cp, depending on Major

Electives: 24 or 30cp, depending on Major

Capstone Project: 6 or 12 credit points, depending on Major.

Students are expected to develop a personal Portfolio over the entire duration of their course, to document, reflect upon, and synthesise their own understanding of engineering practice, drawing from all of their different learning experiences.

All subjects are rated at 6 credit points except for some electives offered by other faculties, and the engineering practice Preview and Review subjects. Face-to-face contact hours vary, depending on the nature of the subject and mode of delivery. Students will need to spend at least nine learning hours, including class contact, for a six credit-point subject. Many students will find they need more time than this, particularly to achieve a high standard of performance. Subject outlines are given later in this handbook.

Core program

This component provides a framework covering knowledge, skills, and attributes that are relevant to all engineers across all fields of practice. It consists of common mathematics and physics subjects, and common engineering subjects which draw on several fields of engineering practice to develop inter-disciplinary knowledge and skills within the larger context of professional practice. It also develops awareness of the values debate in engineering, and promotes commitment to the principles of sustainability.

The core program is not a common first year, but runs throughout the course from admission to graduation. Students take differing combinations of subjects in their first year, and in each successive year, depending on their choice of major.

Subjects in the core have the following titles (not necessarily in chronological order):

Engineering for Sustainability
Mathematical Modelling 1
Physical Modelling
Mathematical Modelling 2
Informatics
Engineering Communication
Uncertainties and Risks in Engineering
Engineering Economics and Finance
Engineering Management
Technology Assessment

Fields of practice and majors

This component relates theoretical and practical learning from core subjects to applications in specific fields of engineering practice. It develops knowledge of engineering science and technologies relevant to particular branches of engineering, and specialist technical expertise. Particular sets of subjects constitute majors in the respective fields of practice, as set out below. A major provides the essential foundations needed for practice in that field, familiarity with current practice, awareness of likely developments, and knowledge of resources available for future self-directed learning.

All majors emphasise and develop the essential engineering skills of observation and experimentation, analysis and synthesis, modelling, systems thinking, conceptual reasoning and judgement, and problem formulation and solving, using as case studies the technologies and contexts relevant to the particular field of practice. Each major involves substantial laboratory content, designed to integrate theoretical and practical understanding. All are designed to link with the core program and with engineering practice.

The totality of all fields of practice subjects across all majors provides the pool from which students wishing to graduate with a general degree may draw (subject to approval) to make up their field of practice component. The field of practice component requires 96 credit points, except in Computer Systems Engineering where it is 90cp, and in Civil Engineering and Civil and Environmental Engineering where it is 102 credit points. Some fields of practice include subjects taught wholly or partly by other faculties.

Electives

In general, students may devote 30 credit points to electives (exceptions below). Electives may be taken from subjects offered by any faculty of the University, or indeed other universities. Students may elect to deepen their knowledge and skills in their own field of practice by taking additional subjects in that field, possibly at graduate level; or to broaden their engineering knowledge by taking field-of-practice subjects associated with another major; or to take subjects from another faculty, including part credit for a second degree. Some students may wish to explore two or more introductory engineering subjects before

making their choice of major, in which case the additional subject/s may be counted (subject to conditions) as part of the elective component. The elective component also provides a mechanism for crediting prior learning and work-based learning.

Students are not permitted to take as an elective, a subject which covers substantially the same material as a required subject or a subject already undertaken.

Some courses and/or majors have an elective component less than 30cp. The Civil Engineering and the Civil and Environmental Engineering Majors have only 24cp of electives. In the case of the Civil and Environmental Engineering Major, because of its dual-disciplinary nature, students are strongly recommended to take as electives, subjects drawn from one of the approved sequences of environmental subjects. In other instances, the elective provision is reduced in order to accommodate a second formal award.

The combined and double degrees have no electives. The BE GradCertEngPrac requires that 12cp of the electives be drawn from a restricted set of graduate engineering subjects.

Sub-majors

The Faculty has defined a large number of sub-majors for students who wish to use their elective components to undertake a coherent program of study in a discipline complementary to their major. Some sub-majors are available to all students, others only to students in specific majors. Each sub-major is defined as a selection of any four subjects drawn from a larger set – typically six to eight. The subjects included in a sub-major set could consist of one or more of the following types: fields-of-practice subjects from another major, graduate engineering subjects, and subjects offered by other Faculties. Students who use graduate engineering subjects to meet their elective requirement can count the credit points towards a Master's degree.

The sub-majors currently available are:

Sub-major	Available to students majoring in:
Biomedical Technology	Computer Systems Engineering, Electrical, Mechanical, Telecom
Business	All
Chemical Technology	Mechanical, Environmental Systems
Civil Engineering	All but Civil, Civil and Environmental
Computer Control and Instrumentation	Electrical
Computer Networking	All
Computing Science	All but Computer Systems Engineering
Construction and Management	Civil, Civil and Environmental
Energy Systems	Electrical, Mechanical
Engineering Management	All
Environmental Engineering	All but Civil and Environmental, and Environmental Systems
Information Systems Engineering	All
Internet Software Development	Computer Systems Engineering, Software Engineering
Land and Water	Civil
Manufacturing Systems	Mechanical, Electrical
Materials	Civil, Civil and Environmental
Mathematics	All
Mechanical Design	Mechanical
Mechanical Engineering	All but Mechanical
Mechatronics	Electrical, Mechanical
Operations Research	All
Software Engineering	All but Software Engineering
Statistics	All
Structures	Civil
Telecommunications Engineering	Electrical, Computer Systems Engineering

Engineering Practice program

The engineering practice program supports and assesses student learning in workplace and community environments. Its objectives are to prepare students for engineering work experience, to support them during that experience, and to assist them in maximising learning. The program also supports the integration of this experiential learning with the theoretical and practical aspects of the academic curriculum.

A fundamental objective is to develop the ability to learn actively in a wide variety of modes and contexts, and to critique and contribute to those learning environments on a lifelong basis.

The program is administered through a series of subjects, offered in flexible mode. Students enrol in the program as a whole and are guided through the respective modules. Students are ultimately responsible for their progression through the program. Academic staff and workplace mentors and supervisors act as facilitators; administrative staff assist in ensuring that students' progress is recorded and validated; and Industrial Liaison staff assist students in securing suitable work placements and in establishing cooperative programs with industry and the community.

The engineering practice program comprises:

48121	Engineering Practice Preview 1	3cp
48110	Engineering Experience 1 (Minimum 22 weeks work experience)	0cp
48122	Engineering Practice Review 1	3cp
48141	Engineering Practice Preview 2	3cp
48130	Engineering Experience 2 (Minimum 22 weeks work experience)	0cp
48142	Engineering Practice Review 2	3cp

Note: Minimum time in the workplace to satisfy each Engineering Experience subject is 22 weeks. In total, however, 48 weeks must be gained to meet course requirements and to be eligible to graduate.

Students are encouraged to undertake additional work experience of good standard.

Capstone project

Each student undertakes a capstone project, supervised by a member of academic staff and designed to consolidate and integrate learning in all aspects of the program. Industry-linked projects, under joint supervision, are strongly encouraged. As a future objective, the Faculty intends to develop the capability to facilitate, supervise and assess team projects, where possible on a multidisciplinary basis involving students from other disciplines as well as Engineering.

The project topic must be approved by the program director of the major (if any) in which the students intends to graduate, and must be relevant to the field of practice concerned. It may be largely technical in emphasis, or may encompass a range of technical and contextual challenges.

The capstone project results in a substantial report, which must be written and produced to professional engineering standards and must demonstrate the student's readiness for professional engineering practice.

Portfolio

An integral requirement of the course is the development of a personal portfolio by each student. The portfolio is used to document academic and workplace experiences, and to provide a personal resource for critical reflection and for educational and professional career planning, as well as personal development. The portfolio development process commences in the first semester of the course and is carried through to graduation, with increasing student autonomy in the content and structure of the documentation.

GENERAL DEGREE, WITHOUT MAJOR

Students may choose not to take any of the specified majors, but instead to make up a personal program drawing on several fields of engineering practice. The program of study would be:

Core program: 60cp

Engineering Practice program: 12cp, plus 48 weeks of approved work experience

Fields of practice: 96cp

Electives: 30cp

Capstone Project: 6cp

Such a personal program must be negotiated with an academic adviser, and approved not later than the commencement of the student's third semester of study. In 1999, all such programs must be approved by the Associate Dean Undergraduate Programs. Any subsequent variations to the program must be approved by the same adviser, or the Associate Dean, who has discretion to approve minor variations to the program above (for example, inclusion in the 96cp fields of practice subjects, of a subject from another faculty or discipline).

The fields of practice subjects must include an appropriate balance of introductory and advanced subjects, which the Associate Dean will determine, and must represent a coherent theme or potential career interest.

Students are cautioned that such a general degree *may* not meet the requirements of the Institution of Engineers, Australia, for NPER-3 registration as a chartered professional engineer. Advice in this regard should be sought, through the Associate Dean, at the time of negotiating the program.

MAJORS

Civil Engineering Major

Major code: 01

Civil engineering covers a broad range of activities and working styles, generally based on a desire to serve society. Civil engineers may work on the design, construction, management or renovation of all types of industrial or commercial buildings or structures. They may be involved with infrastructure developments such as highways, airports or integrated transport systems; water storage, purification and distribution systems to provide safe drinking water and water for irrigation and industrial use; systems for the treatment and disposal of sewage, domestic and industrial waste; and flood mitigation and harbour protection works.

Graduates may be employed with private sector consultants, contracting companies, mining and process industries, commercial business, research organisations or with public sector Federal, State and Local Government and regulatory organisations. Significant employment opportunities exist in Australia, South-East Asia and internationally.

The major is designed to develop technical skills, experience and confidence in engineering analysis, problem identification and problem solving; and to provide a consistent focus that engineering is a mix of technical skill, logical reasoning, common sense, judgement and the management of activities and people. It provides a thorough foundation in applied engineering science and progressively develops basic understanding of the discipline of civil engineering, together with a recognition of the vital links with other professionals and community groups. Emphasis is given to the leadership role that engineers can play, and the need for engineers to be concerned with the social and environmental needs of the community and the impact of their creations on the public.

The program encourages skills in observation, collection and analysis of information, mathematical modelling of processes and behaviour, and thinking particularly in the abstract. It develops ability to communicate ideas, and capacity to listen to and understand the ideas of others. Students are required to take initiatives for their own learning, to develop critical thinking based on technical knowledge and to make rational judgments

regarding the application of theory to practical situations. Reflection on tasks undertaken is strongly encouraged.

As well as submission of formal assignments and reports, students participate in class discussion groups, tutorial sessions, seminar presentations and project work. The approach is structured to develop written, verbal and audio-visual communication skills. Group-based practical exercises, requiring consideration of engineering and non-engineering viewpoints, develop interdisciplinary skills and an ability to cooperate and liaise with colleagues.

Sub-majors See page 44 for a list of available sub-majors.

Civil Engineering major – standard program

Sem 1	Engineering for Sustainability (core)	Mathematical Modelling 1 (core)	Physical Modelling (core)	Introduction to Civil Engineering (fields of practice)	Portfolio
Sem 2	Informatics (core)	Mathematical Modelling 2 (core)	Statics & Introduction to Design Process (fields of practice)	Surveying (fields of practice)	
Sem 3	Engineering Communication (core)	Chemistry & Materials Science (fields of practice)	Mechanics of Solids (fields of practice)	Soil Behaviour (fields of practice)	
Sem 4	Engineering practice subjects (may be taken in semester 3 or 4)				
Sem 5	Uncertainties & Risks in Engineering (core)	Fluid Mechanics (fields of practice)	Structural Mechanics & Component Design (fields of practice)	Construction (fields of practice)	
Sem 6	Engineering Economics & Finance (core)	Construction Materials (fields of practice)	Structural Analysis & Component Design (fields of practice)	Environmental & Sanitation Engineering (fields of practice)	
Sem 7	Engineering Management (core)	Hydraulics & Hydrology (fields of practice)	Behaviour of Structures & Design (fields of practice)	Geotechnical Engineering (fields of practice)	
Sem 8	Engineering practice subjects (may be taken in semester 6 to 9)				
Sem 9	Technology Assessment (core)	Transport in the Environment (fields of practice)	Submajor/electives	Submajor/electives	
Sem 10	Capstone project	Civil & Environmental Design (fields of practice)	Submajor/electives	Submajor/electives	

Engineering practice subjects shown in semesters 4 and 8 for illustration only.

Civil and Environmental Engineering Major

Major code: 02

In addition to the need for all engineers to have an awareness of modern environmental issues (especially the challenges of sustainable development for engineering) and the growing demand for specialist environmental engineers, there is significant demand in Australia for civil engineers with enhanced skills and knowledge in related areas of environmental engineering. Such civil and environmental engineers are sought by the water supply and sanitation industry, in waste management, in transportation, and in the rapidly growing environmental management sector of the economy, including rehabilitation of degraded areas as well as minimising the environmental impact of new activities. Employers include local government, road and other infrastructure agencies, consultants, construction enterprises, and environmental planning and regulatory groups.

This major provides a broad understanding of the art and science of civil engineering, and a wider and more detailed understanding than has been traditional in Australia of those aspects of environmental engineering which are often required in the civil engineering field of practice. This is achieved by substituting four environmental science and engineering subjects for civil engineering field of practice subjects, and utilising a more advanced version of another. While students have a free choice for their four elective subjects, those

undertaking the Civil and Environmental Engineering Major are encouraged to choose from graduate subjects in the area of environmental engineering and management.

Civil engineers practising in areas closely identified with environmental engineering require an understanding of the traditional areas of civil engineering: behaviour of structures, characteristics of the main materials encountered in civil engineering (soil, steel and concrete), hydraulics and hydrology, water supply and sanitation, transportation engineering, management of resources, construction, and design. In addition, they require:

- understanding of biology, ecology and microbiology, and of how such knowledge can be utilised in engineering practice to preserve and enhance environmental values;
- knowledge of the social and political arena in which environmental decisions are made;
- excellent communication skills, so that they may exercise leadership in resolving potential environmental problems and disputes;
- knowledge of the ways in which our laws determine the framework for environmental planning, design, and monitoring;
- more detailed knowledge than most civil engineers of water supply, sanitation, waste management, pollution control, and land and water resources management.

The curriculum aims to develop attributes which will encourage involvement in environmental issues in the community as well as through employment. It highlights the need for engineers to work collaboratively with other professions, with their community, and with environmental interest groups to enhance each others' knowledge of the possibilities for environmental management.

Sub-majors See page 44 for a list of available sub-majors.

Civil and Environmental Engineering major – standard program

Sem 1	Engineering for Sustainability (core)	Chemistry & Materials Science (field of practice)	Biology & Ecology (fields of practice)	Introduction to Civil Engineering (fields of practice)	
Sem 2	Informatics (core)	Mathematical Modelling 1 (core)	Physical Modelling (core)	Introduction to Environmental Engineering (fields of practice)	
Sem 3	Engineering Communication (core)	Mathematical Modelling 2 (core)	Statics & Introduction to Design Process (fields of practice)	Construction (fields of practice)	
Sem 4	Engineering practice subjects (may be taken in semester 3 or 4)				Portfolio
Sem 5	Uncertainties & Risks in Engineering (core)	Fluid Mechanics (fields of practice)	Mechanics of Solids (fields of practice)	Water Supply and Wastewater Engineering (fields of practice)	
Sem 6	Engineering Economics & Finance (core)	Soil Behaviour (fields of practice)	Construction Materials (fields of practice)	Environmental Planning and Law (fields of practice)	
Sem 7	Engineering Management (core)	Hydraulics & Hydrology (fields of practice)	Structural Mechanics & Component Design (fields of practice)	Pollution and Waste Management (field of practice)	
Sem 8	Engineering practice subjects (may be taken in semester 6 to 9)				
Sem 9	Technology Assessment (core)	Structural Analysis & Component Design	Submajor/electives	Submajor/electives	
Sem 10	Capstone project	Transport in the Environment (fields of practice)	Submajor/electives	Submajor/electives	

Engineering practice subjects shown in semesters 4 and 8 for illustration only.

Computer Systems Engineering Major

Major code: 03

The rationale for the CSE major is to develop graduates who are able to specify, design, and implement complex computer-based systems. The increasing complexity and popularity of computer systems creates significant demand for such graduates, evidenced by the employment rate of practically 100 per cent amongst graduates of the old CSE degree.

Many graduates of the major will work in the technical computer industry in such areas as telecommunications, process control, manufacturing, defence, and electronics. Increasingly, graduates will also work in non-engineering industries that have a need for state-of-the-art computer systems, such as finance, retailing, and social services.

Computer systems engineering is a field of challenging intellectual knowledge and experience. Computer systems engineers are highly trained professionals who need to have knowledge not only of software and programming, but also of electronics, mathematics, physics, information theory, and computer hardware. With this breadth of training, they can often work also as software engineers or electronics engineers, or in other areas of information systems and technology.

The major concentrates on professional formation in the area of technical expertise and on providing the necessary technical tools, and incorporates a strong systems engineering approach. It emphasises professional values and an appreciation of the social context within which a computer systems engineer works, and develops information literacy, problem-posing, problem-solving and presentation skills.

A number of subjects are project-based, placing strong emphasis on inter-personal communications skills, team work, and working under simulated stressful conditions, and providing opportunities for development of maturity and the achievement of self-fulfilment within a supportive environment.

Sub-majors See page 44 for a list of available sub-majors.

Computer Systems Engineering major – standard program

Sem 1	Engineering for Sustainability (core)	Mathematical Modelling 1 (core)	Physical Modelling (core)	Introduction to Electrical Engineering (fields of practice)	
Sem 2	Informatics (core)	Mathematical Modelling 2 (core)	Introduction to Mechanical Engineering (fields of practice)	Electronics (fields of practice)	
Sem 3	Engineering Communication (core)	Software Development (fields of practice)	Electromechanical Systems (fields of practice)	Circuit Analysis (fields of practice)	
Sem 4	Engineering practice subjects (may be taken in semester 3 or 4)				Portfolio
Sem 5	Uncertainties & Risks in Engineering (core)	Software Engineering (fields of practice)	Introductory Digital Systems (fields of practice)	Submajor/electives	
Sem 6	Engineering Economics & Finance (core)	Operating Systems (fields of practice)	Advanced Digital Systems (fields of practice)	Submajor/electives	
Sem 7	Engineering Management (core)	Signal & Systems (fields of practice)	Communications Networks (fields of practice)	Submajor/electives	
Sem 8	Engineering practice subjects (may be taken in semester 6 to 9)				
Sem 9	Technology Assessment (core)	Data Acquisition & Distribution (fields of practice)	Computer Systems Analysis (fields of practice)	Submajor/electives	
Sem 10	Capstone project	Capstone Project	Computer Systems Design (fields of practice)	Submajor/electives	

Engineering practice subjects shown in semesters 4 and 8 for illustration only.

Electrical Engineering Major

Major code: 04

There have been few bigger benefits to humankind than the supply of electricity to residential, commercial and industrial sites. Recent advances in electronics and microelectronics have also created a profound impact in homes, industries and hospitals. Automatic control has become an integral part of modern manufacturing and industrial processes, and has been a foundation for many important developments in medicine, economics, sociology and management. All these are part of electrical engineering.

The new generation of electrical engineers will be much more attuned to social and environmental sustainability. They will have the technical expertise in various enabling disciplines, and the interdisciplinary skills, to contribute significantly towards the building of a more harmonious world. The Electrical Engineering Major is concerned with the optimisation of energy systems, alternative energy sources, intelligent electronic systems, real-time computing, industrial networking, automated systems for social benefits, devices for biomedical technology, etc.

Graduates of the major will work in numerous challenging areas: electronic and microelectronic industries, process control, mechatronics and robotics, power generation and distribution, power electronics, building services, manufacturing and transport industries, biomedical industries, mining and agriculture. Increasingly, electrical engineers are also involved in sports medicine, entertainment, environment control studies, and financial engineering.

The major develops technical expertise in electronics and microelectronics, power electronics, energy and power systems, analogue and digital control and automation, data acquisition and distribution, instrumentation and signal processing, artificial intelligence, real-time computing, and industrial networking. It incorporates substantial laboratory work, and most of the advanced subjects have 50 per cent theory and 50 per cent project work. Appropriate theoretical foundations are provided to ensure that designs are based on social responsibility, sustainability, and sound engineering methodologies with guaranteed stability and accuracy. At the same time, strong encouragement is provided to help student projects to production-level completion using appropriate management techniques. Whenever possible, professional hardware systems are produced, and with a high degree of software validation and professional documentation. There is emphasis on development of comprehension, presentation, interpersonal and team skills, and on interdisciplinary interactions.

Students also have the opportunity to develop community involvement through interdisciplinary projects. Examples might include automated systems for disabled people, low-cost efficient hydro-electric systems for villages in third-world countries, or non-invasive blood glucose monitors for patients with diabetes.

Computer control and instrumentation covers areas such as robotics, fuzzy logic, neural networks and software development, relating to practice in fields such as mechatronics, biomedical engineering and financial engineering. Typical thesis topics could be an intelligent robotic system using fuzzy logic, or a voice and handwriting system. Energy technology covers areas such as variable speed drives, energy and environment economics, power system design and power generation. Typical thesis topics could be wind energy, a solar vehicle, or economics of energy distribution. Biomedical technology covers areas such as anatomy and physiology, biomedical instrumentation and medical imaging. Typical thesis topics could be a laser-based spectrometer for measuring muscle energetics, or a blood pressure control system for intensive care.

Sub-majors See page 44 for a list of available sub-majors.

Electrical Engineering major – standard program

Sem 1	Engineering for Sustainability (core)	Mathematical Modelling 1 (core)	Physical Modelling (core)	Introduction to Electrical Engineering (fields of practice)	Portfolio
Sem 2	Informatics (core)	Mathematical Modelling 2 (core)	Introduction to Mechanical Engineering (fields of practice)	Electronics (fields of practice)	
Sem 3	Engineering Communication (core)	Software Development (fields of practice)	Electromechanical Systems (fields of practice)	Circuit Analysis (fields of practice)	
Sem 4	Engineering practice subjects (may be taken in semester 3 or 4)				
Sem 5	Uncertainties & Risks in Engineering (core)	Advanced Mathematics & Physics (fields of practice)	Introductory Digital Systems (fields of practice)	Signal & Systems (fields of practice)	
Sem 6	Engineering Economics & Finance (core)	Power Systems (fields of practice)	Digital Systems (fields of practice)	Advanced Electronics (fields of practice)	
Sem 7	Engineering Management (core)	Analogue & Digital Control (fields of practice)	Power Electronics (fields of practice)	Submajor/electives	
Sem 8	Engineering practice subjects (may be taken in semester 6 to 9)				
Sem 9	Technology Assessment (core)	Data Acquisition & Distribution (fields of practice)	Submajor/electives	Submajor/electives	
Sem 10	Capstone project	Capstone Project	Submajor/electives	Submajor/electives	

Engineering practice subjects shown in semesters 4 and 8 for illustration only.

Environmental Systems Engineering Major

Major code: 05

Community understanding of what constitutes 'wealth' is evolving beyond that measured by consumption-based economic indicators such as gross domestic product. Over the next several decades greater and greater value will be placed on what has been termed 'natural' and 'social' capital. The new imperative is sustainable development. Technology will play a part in bringing about this goal through remediation of compromised sites and the development of technologies that support much greater energy and resource efficiencies in all sectors of the economy. The solutions adopted will involve innovations from many different interest groups in society; compromises will need to be negotiated between interest groups, based on a clear understanding of the technological options and the use of a broadly based systems perspective and the long term analysis of costs and benefits. Engineers will play an important role in this process. They will need to understand the issues, be able to effectively use appropriate analytical tools, be able to participate in interdisciplinary teams generating possible solutions and be able to communicate their findings to a variety of audiences.

The Environmental Systems Engineering major begins by giving students a sound foundation in environmental sciences and the related engineering science areas needed to understand the challenges to the health of water, air and soil systems that are caused by current community practices and industrial processes. Subsequent subjects develop tools for modelling environmental systems in one or more of the three domains and investigate strategies for addressing the problems through techniques such as environmental auditing, waste management, clean manufacturing, life cycle analysis and other methods. The major provides an opportunity for students to focus on one of three sectors of the economy in the last stage of the course: transport, energy or water. The major can be combined with sub-majors in electrical, mechanical, computer systems or telecommunications engineering.

Sub-majors See page 44 for a list of available sub-majors.

Environmental Systems Engineering major – standard program

Sem 1	Engineering for Sustainability (core)	Chemistry and Materials Science (field of practice)	Biology Ecology (field of practice)	Introduction to Environmental Engineering (fields of practice)	
Sem 2	Informatics (core)	Mathematical Modelling 1 (core)	Physical Modelling (core)	Environmental Physical Chemistry (fields of practice)	
Sem 3	Engineering Communications (core)	Mathematical Modelling 2 (core)	Fluid Mechanics (fields of practice)	Environmental Monitoring (fields of practice)	Portfolio
Sem 4	Engineering practice subjects (may be taken in semester 3 or 4)				
Sem 5	Uncertainties & Risks in Engineering (core)	Thermodynamics (fields of practice)	Hydraulics and Hydrology (fields of practice)	Soil and Landscape Systems (fields of practice)	
Sem 6	Engineering Economics & Finance (core)	Air and Noise Pollution (fields of practice)	Environmental Biotechnology and Ecotoxicology (fields of practice)	Environmental Geotechnics (fields of practice)	
Sem 7	Engineering Management (core)	Life Cycle Analysis (fields of practice)	Environmental Systems Modelling (fields of practice)	Elective	
Sem 8	Engineering practice subjects (may be taken in semester 6 to 9)				
Sem 9	Technology Assessment (core)	Environmental Auditing (fields of practice)	Elective	Elective	
Sem 10	Capstone project	Sector Specific Studies in Transport Energy or Water (fields of practice)	Elective	Elective	

Engineering practice subjects shown in semesters 4 and 8 for illustration only.

Mechanical Engineering Major

Major code: 06

Mechanical engineering involves the design, control, management, repair or development of mechanical systems that transform energy and materials into usable forms. It remains one of the defining disciplines of professional engineering activity. The academic knowledge that is fundamental to mechanical engineering is concerned with forces and motion, energy conversion and transmission, and the materials that enable these to occur.

The major provides a strong foundation in dynamics, fluid mechanics, solid mechanics, thermodynamics, materials science, electrical theory and manufacturing technology. The practice of engineering is emphasised through work placements, structured opportunities to reflect on work experience, methods of class presentation and assessment, and the use of design subjects to encourage the development of engineering confidence.

Consideration of values, social contexts and sustainability is seen as part of the learning processes, and is a legitimate concern of all subjects. Management skills are gained through work experience and through management subjects that provide intellectual rigor to what has been learned. Technical expertise is developed through the mechanical engineering field-of-practice subjects, which are structured to emphasise the relationship between engineering science and engineering practice. This is enhanced by the 'design' subjects, which provide a further practical focus on theoretical concepts; and a practice and design component runs through each field of practice subject.

Academic literacy, numeracy and oral comprehension and presentation skills are presented formally in early subjects, and enhanced progressively through the remainder of the program. All subjects will require information retrieval and evaluation skills, also introduced at the outset. Particular emphasis is placed on problem posing and solving, on interaction with the core subjects, and on design.

The major aims to equip students to take control of their own learning, to develop the capacity for community involvement, to think 'big picture', and to act as professionals rather than technicians.

Sub-majors See page 44 for a list of available sub-majors.

Mechanical Engineering major – standard program

Sem 1	Engineering for Sustainability (core)	Mathematical Modelling 1 (core)	Physical Modelling (core)	Introduction to Mechanical Engineering (fields of practice)	
Sem 2	Informatics (core)	Mathematical Modelling 2 (core)	Manufacturing Engineering (fields of practice)	Fundamentals of Mechanical Engineering (fields of practice)	
Sem 3	Engineering Communication (core)	Chemistry & Materials Science (fields of practice)	Mechanics of Solids (fields of practice)	Introduction to Electrical Engineering (fields of practice)	Portfolio
Sem 4	Engineering practice subjects (may be taken in semester 3 or 4)				
Sem 5	Uncertainties & Risks in Engineering (core)	Fluid Mechanics (fields of practice)	Machine Dynamics (fields of practice)	Strengths of Engineering Materials (fields of practice)	
Sem 6	Engineering Economics & Finance (core)	Thermodynamics (fields of practice)	Electromechanical Systems (fields of practice)	Mechanical & Manufacturing Design (fields of practice)	
Sem 7	Engineering Management (core)	Dynamics & Control (fields of practice)	Restricted Choice subject 1[1] (fields of practice)	Restricted Choice subject 2[1] (fields of practice)	
Sem 8	Engineering practice subjects (may be taken in semester 6 to 9)				
Sem 9	Technology Assessment (core)	Submajor/electives	Submajor/electives	Engineering Design (fields of practice)	
Sem 10	Capstone project	Submajor/electives	Submajor/electives	Submajor/electives	

[1] Restricted choice subjects: any two from the following – Energy Applications, Mechanics Applications, Advanced Manufacturing.

Engineering practice subjects shown in semesters 4 and 8 for illustration only.

Software Engineering Major

Major code: 08

Software engineering is growing at a phenomenal rate and is now transforming every aspect of our lifestyle. It underpins modern approaches to medical monitoring, vehicle guidance, industrial processing, robotic operation, telecommunication network management, flight supervision and many other applications.

The Software Engineering major brings together computing and physical sciences, providing the intellectual and practical framework for the conception, design, development, testing and maintenance of useful software-based systems. In addition to being well grounded in the fundamentals of computing science, mathematics, and electrical engineering, graduates will be given the foundations to be able to adapt and learn new discipline areas as they emerge.

Technical skills will be developed in programming, analysis, design, testing, and specification of complex software systems. These will be complemented by academic skills such as problem posing and solving, critical reading, recollection of important facts, research skills, comprehension, written and oral presentation skills, and ability to carry out complex analysis. Through many team-based assignments, students will learn to work together, to develop leadership qualities and to become confident of their professional competencies. Through journal writing and the development of a personal portfolio, students will be able to reflect on both their academic and workplace experiences and to draw on these for their educational and career planning as well as personal development.

Sub-majors See page 44 for a list of available sub-majors.

Software Engineering major – standard program

Sem 1	Informatics (core)	Mathematical Modelling 1 (core)	Physical Modelling (core)	Introduction to Civil Engineering (fields of practice)	P
Sem 2	Engineering for Sustainability (core)	Mathematical Modelling 2 (core)	Principles of Software Development (fields of practice)	Software Development (fields of practice)	o
Sem 3	Engineering Communications (core)	Computer Theory (fields of practice)	Electronics (fields of practice)	Introductory Digital Systems (fields of practice)	r
Sem 4	Engineering practice subjects (may be taken in semester 3 or 4)				t
Sem 5	Uncertainties & Risks in Engineering (core)	Software Engineering (fields of practice)	Operating Systems (fields of practice)	Elective	f
Sem 6	Engineering Economics & Finance (core)	Formal Reasoning in Software Development (fields of practice)	Fundamentals of HC Interaction (fields of practice)	Elective	o
Sem 7	Engineering Management (core)	Specialist Topics in Artificial Intelligence (fields of practice)	Communication Networks (fields of practice)	Elective	l
Sem 8	Engineering practice subjects (may be taken in semester 6 to 9)				i
Sem 9	Technology Assessment (core)	Software Quality Assurance (fields of practice)	Software System Analysis	Elective	o
Sem 10	Capstone project	Capstone project	Software Systems Design (fields of practice)	Elective	

Engineering practice subjects shown in semesters 4 and 8 for illustration only.

Telecommunications Engineering Major

Major code: 07

Telecommunications is a rapidly expanding industry, and Sydney has the status of a global telecommunications hub. Enterprises covering the complete spectrum from large multinational to small home businesses have recognised the critical role that effective use of communications and information technologies will play in maintaining competitiveness.

As in any rapidly-expanding field, there is strong demand in the telecommunications industry for people with entry-level skills. These include familiarity with the products available, and ability to optimise the network interfaces of these equipments at the software and hardware level. Typical tasks are those of local-level system design, system integration and system management, network security management, and restoration of service in the event of a fault. Training courses are offered by public and private providers to produce the skilled personnel needed; and industry, with its understandable focus on addressing immediate skill shortages, offers premium salaries. However, these skills are not the skills of engineers, but of technicians or technologists. Neither the individuals concerned, nor our society, are properly served by relying exclusively on such short-term strategies.

Telecommunications technology has the potential to make a major contribution to the achievement of a more intelligent, socially just and sustainable society. This cannot happen unless the community as a whole is able to effectively influence the manner in which the technology is developed, financed and deployed. This in turn needs broadly educated and socially aware technical experts who can stimulate and engage in community debate and in economic and business planning. The Telecommunications Engineering Major at UTS is designed to develop these characteristics, and to attract able students with broadly-based interests.

The subjects in the major are designed to link with the core and engineering practice programs, and with the portfolio, to contribute progressively to professional formation over the ten semesters of the course. An appreciation of concepts such as sustainability, ethical principles and technology assessment is developed by drawing out common themes

illustrated in multiple case studies over multiple subjects. Competence in modelling, experimental methods, risk analysis, systems thinking, and mathematical analysis is developed alongside the personal effectiveness skills needed for employment. Many subjects engage the perspectives of other disciplines, and both Mobile Communications and the Capstone Project explore the complexity of balancing competing interests and requirements in order to find a design solution. The application of systems engineering methodology as one of the means of dealing with complexity is emphasised.

Information retrieval, writing, speaking, and critical reading skills are valued, and comprehensive feedback and assistance are provided in their development.

The major emphasises the learning potential of failure. Through a guided sequence of design challenges, students are encouraged to value their own intellectual resources and to gain the confidence to tackle complex and ill-defined problems. They are encouraged to become 'reflective practitioners', to critique their own work and the work of others, to take responsibility for their own learning, and to pose and answer their own questions.

Sub-majors See page 44 for a list of available sub-majors.

Telecommunications Engineering major – standard program

Sem 1	Engineering for Sustainability (core)	Mathematical Modelling 1 (core)	Physical Modelling (core)	Introduction to Electrical Engineering (fields of practice)	Portfolio
Sem 2	Informatics (core)	Mathematical Modelling 2 (core)	Introduction to Telecommunications Engineering (fields of practice)	Electronics (fields of practice)	
Sem 3	Engineering Communication (core)	Software Development (fields of practice)	Authentication & System Security(fields of practice)	Circuit Analysis (fields of practice)	
Sem 4	Engineering practice subjects (may be taken in semester 3 or 4)				
Sem 5	Uncertainties & Risks in Engineering (core)	Software Engineering (fields of practice)	Signals & Systems (fields of practice)	Real-time Software & Interfacing (fields of practice)	
Sem 6	Engineering Economics & Finance (core)	Communications Theory (fields of practice)	Signal Procesing (fields of practice)	Submajor/electives	
Sem 7	Engineering Management (core)	Communication Networks (fields of practice)	Mobile Communications (fields of practice)	Submajor/electives	
Sem 8	Engineering practice subjects (may be taken in semester 6 to 9)				
Sem 9	Technology Assessment (core)	Operating Systems (fields of practice)	Network Planning & Management (field of practice)	Submajor/electives	
Sem 10	Capstone project subject	Legal Issues in Telecommunications (fields of practice)	Submajor/electives	Submajor/electives	

Engineering practice subjects shown in semesters 4 and 8 for illustration only.

Bachelor of Technology

Course code: E012

Abbreviation: BTech

Course arrangements are under review and those described below came into operation in 1997. Students admitted in 1996 or earlier will complete their course under the arrangements existing at that time.

Description

The Bachelor of Technology degree is designed to provide the skills development needed by engineering technologists. It builds on work already completed in selected NSW TAFE Associate Diploma courses.

A Bachelor of Technology degree is recognised as a three-year full-time qualification, post-HSC. In the UTS program, the Associate Diploma counts for half the total. The course offered at UTS represents the second half of the overall requirement, and is offered over three years of part-time study.

The course is not designed to articulate readily to a Bachelor of Engineering degree. Students wishing to graduate with a Bachelor of Engineering are encouraged to apply for enrolment in this degree program directly.

The degree may be awarded with Distinction, Credit or Pass grades depending on overall performance during the course at UTS. Students choose from the following majors:

- Aerospace Operations
- Heating, Ventilation, Airconditioning and Refrigeration
- Manufacturing Engineering.

At present, Aerospace Operations is offered only in Singapore, in association with the Singapore Institute of Aerospace Engineers.

Professional recognition

UTS expects that holders of the Bachelor of Technology degree will qualify for membership of the Institution of Engineers, Australia in the category of Engineering Technologist.

Industrial experience

Industrial experience in the specialist strand prior to entering the course is not required but preference in selection will be given to students who are working in this sector and who have the support of their employer. Students must accumulate 90 weeks of approved industrial experience prior to or during the course.

Admission

The entry requirement is a TAFE Associate Diploma or equivalent, in a field relevant to the program. Students will be selected on the basis of their previous academic performance in an Associate Diploma course, previous industrial experience, and an indication of support from their current employer.

Attendance pattern

Students attend classes on two evenings a week for 14 weeks each semester. The overall course length is three years, or 6 semesters.

Course structure

The course comprises a core program, taken by all students, and a series of specialist strands or majors of which students select one. The program comprises 72 credit points overall. The core comprises 42 credit points, consisting of seven subjects each of 6 credit points. The majors each comprise 30 credit points, made up of both 3 credit points and 6 credit points subjects.

Core program

Engineering Materials
Numerical Methods
Information Technology
Professional Development
Engineering Communication and Documentation
Business for Technologists (Finance, Economics and Marketing)
Engineering Management

The overall course sequence for each major is as follows:

Major in Aerospace Operations

Major code: 03

Stage 1		
48072	Information Technology	6cp
48401	Aerospace Operations 1	6cp
Stage 2		
48071	Numerical Methods	6cp
48402	Aerospace Operations 2	6cp
Stage 3		
48074	Engineering Communication and Documentation	6cp
48403	Aerospace Operations 3	6cp
Stage 4		
48070	Engineering Materials	6cp
48404	Aerospace Maintenance and Management	6cp

Stage 5

48075	Engineering Management	6cp
48405	Design Awareness for the Aero Industry	6cp

Stage 6

48073	Professional Development	6cp
25353	Business for Technologists	6cp

Major in Heating,Ventilation, Airconditioning and Refrigeration

Major code: 02

Stage 1

48072	Information Technology	6cp
48304	Building Construction Technology	6cp

Stage 2

48071	Numerical Methods	6cp
48301	Mechanical Services	6cp

Stage 3

48074	Engineering Communication and Documentation	6cp
48302	Computer Aids for Airconditioning Design	6cp

Stage 4

48070	Engineering Materials	6cp
79370	Law and Contracts	3cp
48303	Service Control Systems	3cp

Stage 5

48075	Engineering Management	6cp
48305	Airconditioning Design	6cp

Stage 6

48073	Professional Development	6cp
25353	Business for Technologists	6cp

Major in Manufacturing Engineering

Major code:01

Stage 1

48072	Information Technology	6cp
48201	Manufacturing Process Systems	6cp

Stage 2

48071	Numerical Methods	6cp
48202	Inspection and Instrumentation	6cp

Stage 3

48074	Engineering Communication and Documentation	6cp
48204	Maintenance Management	3cp
48206	Quality for Manufacture	3cp

Stage 4

48070	Engineering Materials	6cp
79370	Law and Contracts	3cp
48203	Technological Change and Strategic Planning	3cp

Stage 5

48075	Engineering Management	6cp
48205	Design for Manufacture	6cp

Stage 6

48073	Professional Development	6cp
25353	Business for Technologists	6cp

The above course arrangements came into operation in 1997. For students who commenced a Bachelor of Technology degree course in 1996 or earlier, the arrangements existing at that time remain in operation. Detailed information is available from the BTech Program Director or the Undergraduate Programs Office.

Other facilities available

Facilities available to students enrolled for Bachelor of Engineering are equally available to those enrolled for Bachelor of Technology. Information can be found under Bachelor of Engineering, Diploma in Engineering Practice in this handbook. In particular, the sections on the Industrial Liaison Office, Eligibility for Austudy, Engineering Learning and Design Centres, Other support centres, and International exchange programs.

COMBINED DEGREE COURSES

Bachelor of Engineering, Graduate Certificate in Engineering Practice

Course code: E004

Abbreviation: BE Graduate Certificate in Engineering Practice

Students enrolled in the BE DipEngPrac, who have more extensive and advanced experience of engineering practice than would normally be attained in two six-month periods, may be eligible to transfer to the combined award of BE and Graduate Certificate in Engineering Practice.

This opportunity would normally become available on completion of the first period of enrolled work experience, Engineering Experience 1, and the associated review subject, Engineering Practice Review 1. During these subjects, a student may have demonstrated a level of experience, work-based competency and professional formation equal to (or beyond) that required for the Diploma in Engineering Practice – that is, the level required in Engineering Experience 2 and Engineering Practice Review 2. For this to be possible, students would normally have to have been employed for a substantial period in an organisation that allowed them to practice at professional or near-professional level. In this event, the student would be invited to enrol for their second period of recognised work experience in the subject Professional Experience, and to undertake the associated review subject Professional Review.

These subjects support learning during advanced workplace experiences at professional level. They assist development as a professional engineer by evaluating employment-and practice-related issues, developing high-level communication, documentation and review skills, and facilitating preparation of the candidate's personal portfolio for assessment of competencies towards professional registration.

The award of Graduate Certificate in Engineering Practice requires completion of:

48121	Engineering Practice Preview 1	3cp
	or	
48141	Engineering Practice Preview 2	3cp
48110	Engineering Experience 1 (Minimum 22 weeks work experience)	0cp
	or	
48130	Engineering Experience 2 (Minimum 22 weeks work experience)	0cp
48122	Engineering Practice Review 1	3cp
	or	
48142	Engineering Practice Review 2	3cp
48150	Professional Experience (Minimum 22 weeks work experience)	0cp
48160	Professional Review	tba

plus two subjects, totalling 12 credit points, from an approved list of postgraduate Engineering subjects – these would normally be undertaken as part of the Electives component;

and all other requirements for the award of BE DipEngPrac.

Again, UTS expects to negotiate with the Institution of Engineers, Australia, full credit for the Graduate Certificate towards NPER-3 registration (refer to Professional Recognition in the section describing the BE DipEngPrac).

A student who has been admitted to UTS with advanced standing in Engineering Experience, and who has not been required to enrol in Engineering Experience 1 and Engineering Practice Review 1, should seek advice from the Associate Dean Undergraduate Programs or from the Director of the Engineering Practice Program.

Bachelor of Engineering, Bachelor of Arts in International Studies, Diploma in Engineering Practice

Course code: E002

Abbreviation: BE BA DipEngPrac

Offered jointly by the Faculty of Engineering and the University's Institute for International Studies, this program leads to the combined degrees of Bachelor of Engineering and Bachelor of Arts in International Studies, and the Diploma in Engineering Practice. The BE may include any of the Majors described above.

The purpose of the program is to develop skills for leadership in the professional practice of engineering in an international setting. It reflects a belief in the international character of engineering, and the conviction that Australian professionals can benefit from early development of an international perspective and a fluency in cross-cultural interactions.

The program links the BE DipEngPrac with the study of a language and culture other than English, and the practice of engineering in one or more overseas countries as well as in Australia. Each student in the program spends a full year overseas, normally their fifth year of enrolment. Half the year is spent studying engineering at university, and half gaining experience in industry, both in the language of the host country. During the first four years, students undertake extensive preparation in the language and culture of the country they will visit. Following their return, they undertake comparative work on Australian and overseas engineering practice, and also provide briefings to outgoing students and to international exchange students visiting UTS.

Some students also choose to take their first period of engineering experience overseas, during their second or third year of enrolment. Most take this first period in Australia.

Admission

Students normally enter the program direct from high school, and are selected on the basis of academic performance, basic proficiency in one of the target languages, commitment to a career in engineering, and demonstrated aptitude for leadership. The language proficiency may have been gained at high school, or through private study or family background. Application is made through UAC in the normal way, and there is a selection interview.

The minimum TER has been set at 80, and the TER for the relevant BE major must also be met. Quotas may have to be set for particular combinations of engineering major and language, based on availability of work experience in the countries concerned.

In normal circumstances, no exemptions are available in the program. The aim is to assist each student to develop their capabilities to the fullest possible extent.

Attendance and duration

Attendance is normally on the sandwich pattern, although students may transfer to part-time attendance for limited periods at certain stages. Overall duration is normally six years, although it may be possible to complete in less than this.

The program involves nine semesters of academic work in Australia plus one six-month period of engineering experience, and one year overseas comprising both academic work and engineering experience. Students are encouraged to take a full program of subjects during their overseas academic semester. If this is not possible, there is latitude during the remaining two semesters in Australia to make up any shortfall. A student failing to complete either engineering or arts subjects overseas, to a satisfactory standard, may be required to complete alternative studies at UTS.

Program arrangements

The program requires a total of 240 credit points of academic subjects, including those taken overseas, plus the normal minimum of 48 weeks of engineering experience. Engineering and International Studies are interwoven throughout the program, and the combined degree is awarded on completion. It is not possible to take the BA in International Studies separately, or to complete either degree at an intermediate point. However, a student unable for any reason to continue with International Studies could transfer to the normal BE DipEngPrac.

The first four years of the program include a sequence of six preparatory subjects in the language and culture of the country selected by each student. The overseas year includes further intensive exposure to language and

culture, study of academic subjects at a host university, and study of the practice of engineering in the host country, preferably in conjunction with a period of employment in industry. UTS has partner universities and industry contacts in several countries, and is steadily extending the network. Some of the partner universities are listed under International Exchange Programs, above; there are other partnerships specific to the BA in International Studies, including Zhejiang University in China and Tokyo Institute of Technology in Japan.

For the purpose of calculating HECS, the course is deemed equivalent to five years of full-time academic study. No tuition fees are payable to overseas universities.

Overseas travel and living costs are the responsibility of each student. However, there are a number of industry sponsorships and scholarship schemes which have so far, in conjunction with paid work experience, covered most costs.

The program focuses principally but not exclusively on Pacific Rim countries. Languages offered for study to date include Chinese (Mandarin), French, German, Indonesian, Italian, Japanese, Korean, Malaysian, Spanish and Thai. Others may be added.

The standard program for the combined degree is shown in the following diagram.

BE (any Major), BA in International Studies, DipEngPrac – standard program

Sem 1	Engineering for Sustainability (core)	core subject	core subject	Language and Culture 1[1]	
Sem 2	Informatics (core)	core subject	fields of practice subject	Language and Culture 2[1]	
Sem 3	Engineering Communications (core)	fields of practice subject	fields of practice subject	Language and Culture 3[1]	
Sem 4	Risks & Uncertainties in Engineering (core)	fields of practice subject	fields of practice subject	Language and Culture 4[1]	
Sem 5	Engineering practice subjects (may be taken in semester 4 or 5)				Portfolio
Sem 6	Engineering Economics & Finance (core)	fields of practice subject	fields of practice subject	fields of practice subject	
Sem 7	Engineering Management (core)	fields of practice subject	Modernisation and Social Change[1]	Language and Culture 5[1]	
Sem 8	Technology Assessment (core)	fields of practice subject	fields of practice subject	Language and Culture 6[1]	
Sem 9	Engineering practice subjects (overseas)				
Sem 10		fields of practice subject (overseas)	fields of practice subject (overseas)	Electives subject[1] (overseas)	
Sem 11		fields of practice subject	fields of practice subject	Electives subject/ fields of practice subject	
Sem 12		Capstone project	fields of practice subject/ Capstone project	Contemporary Society[1]	

[1] These are 8 credit-point subjects. All other subjects are rated 6 credit points.

Bachelor of Engineering, Bachelor of Business

Course code E005

Abbreviation: BE BBus

Offered for the first time in 1999 by the Faculties of Engineering and Business, this program leads to a combined degree: Bachelor of Engineering, Bachelor of Business. Admission to the course gives students the right to undertake the engineering degree in any of the majors on offer (presently Civil, Civil and Environmental, Computer Systems, Electrical, Environmental Systems, Mechanical, Software or Telecommunications) and similarly the business degree with any major (Accounting, Banking, Finance, International Business, Management, Marketing, and Tourism).

The purpose of the course is to provide students willing to take on the challenge of a five-year program the opportunity of completing the core and major components of both the engineering and business degrees. In addition, the course includes a semester-length work experience component integrated into the engineering academic program through the subjects Engineering Practice Preview 1, Engineering Experience 1 and Engineering Practice Review 1. Students will, if they wish, be able to gain the award BE BBus DipEngPrac by undertaking one further semester of integrated work experience. Graduates with this combination of qualifications can expect to have a wide range of career opportunities spanning the two disciplines. Obvious opportunities exist for graduates in the application of advanced technology in commercial settings to enhance business competitiveness. Other attributes of engineering graduates such as a systems perspective and skill in the use of quantitative modelling techniques will provide further business career opportunities. For graduates choosing to practice as engineers, the business knowledge will prove invaluable in providing a sound foundation for entrepreneurial initiatives and the commercialisation of engineering innovations.

Special features

Students normally enter this course directly from high school. The UAI threshold is the set by the BBus or the highest cut-off major in the BE DipEngPrac, whichever is higher. In the first two semesters students undertake all subjects in the engineering degree and one additional business subject. The business subject can be done in the Winter and Summer sessions if this is preferred. In Stage 3 the bulk of the program is made up of business subjects. This pattern continues until the first semester of the fourth year when students spend a full semester obtaining off-campus experience in the practice of engineering. The course concludes with three further semesters of mixed engineering and business subjects, culminating in the engineering Capstone Project and the syndicate based Business Strategy subject. To provide maximum flexibility for students, for example to accommodate periods of full or part-time employment beyond the required semester length work experience in the fourth year, subjects can be taken in any order and at any rate, subject only to meeting the subject prerequisite requirements. The standard program for the double degree is shown in the following diagram.

BE (any major), BBus (any major) – standard program

Sem 1	Engineering for Sustainability	Mathematical Modelling 1	Physical Modelling		Introduction to .....[1]	International Business Environment
Sem 2	Informatics	Mathematical Modelling 2	fields of practice		fields of practice	Accounting A
Sem 3	Engineering Communication	Microeconomics	Financial Markets	Marketing Principles	Accounting B	Business Law
Sem 4	Uncertainties and Risks in Engineeirng	fields of practice	fields of practice		fields of practice	Business Finance
Sem 5	Engineering Management	fields of practice	fields of practice		fields of practice	Macroeconomics
Sem 6	Engineering Practice Preview 1	fields of practice	fields of practice		Business major 1	Business major 2
Sem 7	Engineering Experience semester					
Sem 8	Engineering Practice Review 1	fields of practice	fields of practice		Business major 3	Business major 4
Sem 9	fields of practice	fields of practice	fields of practice		Business major 5	Business Strategy
Sem 10	Capstone Project	Business major 6	Business major 7		Business major 8	

[1] Students msut enrol in the subject which corresponds to their major.

Bachelor of Science in Applied Physics, Bachelor of Engineering, Diploma in Engineering Practice

Course code: NP04

Abbreviation: BSc BE DipEngPrac

There is a strong inter-relation between the progress of advanced electrical engineering and developments in applied physics, and a demonstrated need for professionals with a strong understanding, and experience, in both areas. This double-degree program is designed to provide opportunities for students interested in science, the scientific basis of engineering and technology, and the technology itself. An interest in careers with a strong research and innovation component will be a key graduate attribute.

Graduates will be particularly suited to multi-disciplinary, team-oriented projects because of their deep insights into issues from more than one point of view. Applied physics is philosophically oriented towards the needs of industry, with much of the academic content covering advanced technical skills, as found both in research laboratories and in high technology industry. The program is strongly practice based throughout, in keeping with the focus in all UTS Engineering degrees. Students will thus be able to include references to both areas in their portfolio.

Particular fields of study may include medical technology, energy and applied optics, computer interfacing and control, environmental management, communications and space science, instrumentation and control, computer modelling in a wide variety of fields, mathematical physics, electro-magnetics and electromagnetic design, imaging, and management consulting.

The in-depth first principles, modelling and problem solving skills in the science component will add value to the skills of design and system modelling for engineering work. Those choosing scientific and applied-scientific research careers will have the insight needed to direct their activities in the ways that will be most productive for industry and for the community at large, in terms of what is practically and commercially realisable. A major aim is to equip graduates to fill the critical need for today of evaluating, and where appropriate moving, technology efficiently from the laboratory to the market place. Business consulting will thus also be an option.

Special features

The degree of overlap between the two professions, especially in the underlying mathematics, computing and science, enables considerable economies in the time taken to complete both degrees.

The two programs are integrated from Stage 1, and the requirements for the award of an Applied Physics degree are completed after the standard six academic semesters. During this period students will undertake at least one semester of work-based engineering practice, generally in an applied science environment relevant to electrical engineering, which will contribute towards the requirements for the award of the DipEngPrac. The second engineering practice semester will take place after completion of the Applied Physics degree.

Both degrees contain a considerable component emphasising sustainability, written and oral communication skills, and team skills. This course will have in total one of the strongest computer modelling contents available at UTS with elements from mathematics, physics and electrical engineering.

At the completion of the Applied Physics degree, students may choose to shift their emphasis into the areas of telecommunications or computer systems. The program aims to tailor the last three semesters for these students to their individual interests and aspirations, keeping in mind prerequisite requirements. This will also include the sub-major/elective component of the last three stages. However, it is hoped that a significant number of students will be motivated to pursue research-oriented careers involving high-level electrical engineering, and applied physics. One outcome will then be a source of students for a number of advanced research areas at UTS in Electrical Engineering and Applied Physics, often jointly with industry collaborators.

Possible sub-majors A number of 24cp sub-majors are being considered to give students the option of using their electives to study a specific field in depth. These include biomedical technology and medical physics, power and energy, materials and chemistry, mathematics, computing and finance, and earth sciences and environment.

The standard program for the double degree is shown in the following diagram.

BSc (Applied Physics), BE DipEngPrac – standard program

Sem 1	Engineering for Sustainability (core)	Physics 1C	Mathematical Modelling 1	Chemistry 1C	
Sem 2	Informatics (core)	Physics 2	Mathematical Modelling 2	Chemistry 2C	
Sem 3	Software Development (fields of practice)	Physics 3	Applied Physics 1	Electronics (fields of practice)	
Sem 4	Engineering Communication (core)	Physics 4	Computational Maths and Physics	Circuit Analysis (fields of practice)	Portfolio
Sem 5	Engineering practice subjects (may be taken in semester 5 or 6)				
Sem 6	Uncertainties & Risks in Engineering (core)	Quantum and Solid State Physics	Applied Physics 2	Signals & Systems (fields of practice)	
Sem 7	Engineering Economics & Finance (core)	Electromagnetics & Optics	Applied Physics 3	Introductory Digital Systems	
Sem 8	Engineering practice subjects (may be taken in Semester 8 or 9)				
Sem 9	Engineering Management (core)	Power Systems[1] (fields of practice)	Digital Systems[1] (fields of practice)	Data Acquisition & Distribution (fields of practice)	
Sem 10	Technology Assessment (core)	Analogue & Digital Control[1] (fields of practice)	Power Electronics[1] (fields of practice)	Submajors/electives	
Sem 11	Submajors/electives	Capstone project	Submajors/electives	Submajors/electives	

[1] These subjects may be replaced by others drawn from the Electrical Engineering, Telecommunications Engineering and Computer Systems Engineering Majors.

Engineering practice subjects shown in semesters 4 and 8 for illustration only.

INTERNATIONAL EXCHANGE PROGRAMS

Engineering is an international profession. Most practice standards are now international, and draw upon international experience. Australian engineering projects depend on products and services sourced overseas, and Australian products and services depend on overseas markets. Most of the major issues facing engineers, and the socio-economic issues to which engineering can contribute, are global or regional in character. Any person commencing an engineering career in Australia today can expect major involvement with overseas engineering, and is likely to practice overseas at some time. Early international experience is an important formative influence, and an excellent investment, for any aspiring engineer.

All UTS Engineering students have the opportunity to study and work overseas, by participating in the Faculty's Student Exchange program, and are strongly encouraged to do so. Subject to conditions, students gain full academic credit for studies completed at an overseas university, and may obtain overseas work experience which satisfies UTS engineering course requirements.

The Student Exchange program operates between the Faculty of Engineering and the following universities:

California State University, Sacramento, USA

Chonnam National University, Korea

Halmstad University, Sweden

Huazhong University of Science and Technology, China

Institut National des Sciences Appliquées de Lyon, France

Institut National des Sciences Appliquées de Toulouse, France

Institut Teknologi Bandung, Indonesia

King Mongkut's Institute of Technology, Thonburi, Thailand

Kungl Tekniska Högskolan (Royal Institute of Technology), Sweden

Kyushu Institute of Technology, Japan

Mikkeli Polytechnic, Finland

Nagoya Institute of Technology, Japan

Nanyang Technological University, Singapore

Pontífica Universidad Católica de Chile

The Technical University of Budapest, Hungary

Shanghai University, China

The Swiss School of Engineering for the Timber Industry, Switzerland

The University of Electro-Communications, Tokyo, Japan

University of Waterloo, Canada.

Students participating in the Exchange program are exempt from paying tuition fees at the host university, but are required to pay the usual UTS fees (such as Union fees) and Australian HECS. They are also required to arrange appropriate general and health insurances, and to meet their own living and travel costs. Some overseas universities can arrange accommodation at attractive rates, and students can often obtain paid work experience which both meets UTS degree requirements and helps defray living costs.

Some universities require participating students to develop foreign language skills prior to departure from Australia. The UTS Institute for International Studies offers one-semester electives in language studies, and in the study of contemporary societies in parts of the non-English-speaking world (see below). Students may be able to credit one or more of these electives towards their engineering degree.

Each university participating in the Student Exchange program has particular strengths. Selection of a particular university requires careful consideration and planning well in advance. Faculty staff can provide advice about student exchange opportunities and about ways to develop appropriate language skills and cultural awareness. For further information students should contact the Undergraduate Programs Office.

Further opportunities, and additional university partnerships, are available to selected students through the combined award of Bachelor of Engineering, Bachelor of Arts in International Studies, Diploma of Engineering Practice.

In addition to these formal programs, international opportunities are continually arising, and are often initiated by students themselves. The Faculty is willing to recognise and facilitate any arrangement consistent with its objectives. Any student wishing to propose or explore such opportunities should contact the Director, International Engineering Program.

INTERNATIONAL STUDIES ELECTIVES

The UTS Institute for International Studies offers electives in language studies and in the study of contemporary societies in parts of the non-English-speaking world. All subjects are taught over one semester, and have a value of 8 credit points.

Language studies

Students wishing to take language studies as a credited part of their degree are required to enrol through the Institute for International Studies, whether the language studies are undertaken at UTS or elsewhere. The Institute teaches some language programs at UTS, has made arrangements with other universities for some language programs to be taught to UTS students, and can make special arrangements for individual students to attend specific language programs where appropriate. Some twenty different languages are available at present, and others can be arranged.

Contemporary society

The Institute also offers a series of subjects providing introduction to the contemporary societies, politics, economics and culture of the countries of East Asia and South-East Asia, Latin America and Europe that are the areas of specialisation of the Institute. Subjects on China, Japan, South-East Asia, Hong Kong, Taiwan, Latin America and Europe are available. There are no prerequisites for any of these Contemporary Society subjects, which are taught in English.

Further information is available from the *Institute for International Studies Handbook*, or through the Faculty's Director, International Engineering Program.

Postgraduate courses

THE GRADUATE SCHOOL OF ENGINEERING

The Graduate School of Engineering (GSE) was established in 1993 to give focus and leadership to the wide range of graduate programs offered by the Faculty of Engineering at UTS. The School has responsibility for developing and managing postgraduate coursework and research programs within the Faculty, including the administration of award studies, and for maintaining UTS Engineering as an international node offering a wide range of professional development opportunities to engineers and other graduates. In fulfilling these responsibilities, the School draws on the Faculty's close links with industry to offer distinctive programs highly regarded by engineering-dependent enterprise.

In 1998, approximately 100 research students and 500 coursework students were enrolled in the GSE.

Details of all GSE courses are provided in this handbook. Information is given on the objectives, structure, content and duration of the courses, together with admission requirements and rules governing progression. Information is also provided on teaching and supervisory staff.

Graduate award courses may be taken by coursework or research. The School supports research conducted throughout the Faculty; specifically, through its management of postgraduate research, encouragement of individual researchers and research teams, facilitation of interdisciplinary research, and sponsorship of visits to UTS Engineering by internationally renowned experts.

In addition to award courses, the School provides opportunities for continuing professional development through studies undertaken on a non-award basis.

The following information is intended to assist graduates to plan and complete their studies within the Faculty of Engineering. Additional information produced by the School can be obtained through the Internet and from other publications, or by direct inquiry. Inquiries relating to graduate studies within the Faculty are always welcome.

Staff and location of facilities

The Graduate School of Engineering provides a first point of contact for inquiries from current and prospective students, together with a range of services relating to graduate program management.

The GSE offices are located on Level 7, of Building 2. This connects with Building 1 at the City Campus, Broadway. The postal address is:

Graduate School of Engineering
University of Technology, Sydney
PO Box 123
Broadway NSW 2007 Australia
Tel: (+612) 9514 2022
Fax (+612) 9514 2549

The School Office is generally open between 9.00 am to 5.00 pm Monday to Friday. Voicemail, fax or email contact may be made at any time. Information on GSE courses and programs is also available on the internet at *http://www.eng.uts.edu.au/gse/*

GSE staff are as listed below:

Head of School
Associate Professor Jim Parkin
Telephone: (+612) 9514 2638
Fax: (+612) 9514 2549
Email: jim.parkin@uts.edu.au

Graduate Studies Officer
Ms Beate Buckenmaier
Telephone: (+612) 9514 2590
Fax: (+612) 9514 2549
Email: beate.buckenmaier@uts.edu.au

Graduate Students Adviser
Ms Robyn Saunders
Telephone: (+612) 9514 2606
Fax: (+612) 9514 2549
Email: robyn.saunders@uts.edu.au

Secretary
Ms Enid Tu
Telephone: (+612) 9514 2022
Fax: (+612) 9514 2549
Email: enid.tu@uts.edu.au

Postgraduate studies in engineering, by research or coursework, are coordinated by GSE Program Directors. In 1999, it is expected that programs will be available in each of the majors listed below. Further advice can be obtained from the appropriate Director.

For a major in Computer Systems Engineering please contact Dr David Lowe or Mr John Leaney at the numbers shown above.

RESEARCH AREAS AND ASSOCIATED CENTRES

Faculty research is varied and utilises modern laboratories and research facilities on the City Campus, Broadway. These are supported by extensive computing facilities and library services. The laboratories have excellent back-up workshops and expert support staff. Many opportunities exist for professional development through challenging, well resourced research programs.

Current Research

Current research interests and opportunities are summarised briefly below:

Civil and Structural Engineering: engineering materials, soils and foundation engineering/science, water engineering, road materials, public health engineering, environmental risk assessment, local government engineering, structural analysis and design, timber engineering, prestressed and reinforced concrete, steel structures, construction and project management, FEM and computer applications, concrete technology, regional planning, road and transportation engineering, stormwater management, structural dynamics, motion and vibration control and earthquake engineering.

Environmental Engineering: solid-liquid separation techniques for water and wastewater treatment, fundamental and applied research related to using new chemicals in removing specific pollutants such as organics and herbicides, development of new and compact hybrid systems for water and wastewater treatment, membrane technology, solid waste and sludge management, green waste recycling, domestic wastewater treatment systems, specific industrial wastewater treatment, hazardous waste treatability, characterisation of specific soils in engineering context, neutralisation of acid sulphate soils and environmental risk assessment.

Computer Systems Engineering: information theory as applied to position-fixing systems, multimedia/hypermedia, software engineering, image processing.

Telecommunications Engineering: image processing, intelligent networks, ATM networks, protocol engineering, digital transmission, teletraffic engineering, multiple access schemes, spread spectrum communication, neural networks, microwave processing of materials, microwave circuit design, antennas, mobile communications, EM wave propagation, microwave applications in medicine, satellite communications, digital signal processing in communications, power electronics, instrumentation and data acquisition systems, microhydroelectric control and instrumentation, power systems analysis, adaptive multi-variable control, speech and image coding, multimedia/hypermedia, robotics, neuro-fuzzy systems. Adaptive signal processing in communications, electromagnetic interference, human visual perception, signal compression, signal processing for environmental imaging, data fusion.

Electrical Engineering: electrical machines and industrial drives, numerical analysis of electromagnetic fields, magnetic components in power electronic systems, magnetic testing, power electronics, instrumentation and data acquisition systems, micro-hydroelectric control and instrumentation, power systems analysis, adaptive multi-variable control, speech and image coding, multi-media/hypermedia, robotics, neuro-fuzzy systems.

Mechanical Engineering: advanced design, air-conditioning and refrigeration, kinematics and dynamics, energy conservation, control engineering, computational and experimental fluid dynamics and turbomachinery, slurry flows, heat transfer, machine tools, computer-integrated manufacturing, computer-aided engineering robotics, experimental and finite element stress analysis, internal combustion engines and alternative fuels, product and process development, occupational health and safety.

In addition, research topics that are generic to engineering as a discipline; those that are inter-disciplinary in nature but with an essential engineering involvement, such as engineering innovation, environmental engineering, biomedical engineering, energy planning and policy, telecommunications planning and policy, risk-analysis and management, systems engineering, socio-technical systems, asset management, sustainable design, regional development technology, engineering communication and engineering documentation; and those which focus on international and Australian practice and management of engineering, including engineering ethics, are also supported. Candidates who wish to pursue research in engineering management would normally be accommodated.

Overall, the Faculty's current research spans a range of well established specialist fields, together with an increasing number of inter- and intra-faculty fields with other faculties.

Research management

Research management within the Faculty is coordinated through two GSE committees.

The Faculty **Research Degrees Committee** is responsible under delegations from the Faculty Board in Engineering for recommendations relating to the admission, progression and examination of research degree candidates, together with the development of policies and practices across the Faculty to assist candidates and enhance outcomes.

The **Research Management Committee** is responsible for enhancing research outcomes in the Faculty. It has responsibility *(inter alia)* for developing, implementing and maintaining the Faculty's Research Management Plan, including program allocations and infrastructure development funded by the Faculty; the collection and dissemination of research information; and the promotion of research partnerships with industry and other bodies.

Research Centres

The Faculty of Engineering is associated with several major Centres, which also offer research opportunities in engineering and related fields. The centres include:

The **Australian Graduate School of Engineering Innovation (AGSEI)** (formed jointly by UTS, the University of Sydney and a number of industry partners during 1992). AGSEI's establishment has been funded in part by the Commonwealth Government's Advanced Engineering Centres scheme, under policies intended to 'increase higher education's contribution to Australia's design and engineering capacities and to assist in the development of internationally competitive, value-added industries'.

AGSEI's purpose is to help Australian enterprises build wealth-creating capability by combining the best of engineering and management into an effective culture of innovation. Its structure provides a basis for industry-university educational partnerships.

AGSEI offers modular course programs, multidisciplinary in nature and strongly interactive with industry. These are of interest to professionals in all sectors and from a range of disciplines, including engineering. Initially at least, programs are being directed at the experienced professional levels.

AGSEI builds specifically on the capability of engineers, and focuses on the organisation and application of engineering effort to innovation and business performance. Its programs cover topics central to the process of engineering such as product and process innovation, strategic planning, technology management, project management, system and concurrent engineering, quality management, design, information engineering, computer-aided engineering, logistics engineering, human resources and change management, communication, professional and business ethics, manufacturing, project financing, risk management, integrated marketing, contract management, engineering economics, legal and government interfaces.

Participants may aggregate course modules towards the award of the Master of Engineering Practice and other postgraduate awards through the Faculty of Engineering and other faculties of UTS.

AGSEI subjects may be taken as part of the normal range of subjects offered by the GSE.

Inquiries may be made to:

Professor Vernon Ireland
AGSEI Ltd, Australian Technology Park
Cornwallis Street, Eveleigh
(PO Box 1686, Strawberry Hills, NSW 2012)
Telephone: (+612) 9209 4111
Fax: (+612) 9319 3088
Email: V.Ireland@agsei.usyd.edu.au

National Centre for Groundwater Management (operated jointly with the Faculty of Science). Research areas include: contaminated land evaluation and rehabilitation; groundwater quality management strategies for industrial, agricultural and urban use; contaminant transport and water resource modelling; optimisation; groundwater geophysics and remote sensing; and hydraulic modelling, with applications such as irrigation management.

Inquiries may be made to:

Professor Michael Knight
Centre Director
Room 1715, Building 1, City Campus
Telephone: (+612) 9514 1984
Fax: (+612) 9514 1985
Email:
groundwater.management@uts.edu.au

Centre for Local Government Education and Research (UTS, NSW TAFE, and the NSW Local Government Industry Training Committee; within UTS, the Centre has links with several Faculties including Engineering and Business). Research areas relating to local government include: local and regional policy (development, planning, assessment), strategic planning and management, values and ethics, community participation.

Inquiries may be made to:

Ms Roslyn Crichton
Acting Centre Director
Room 1714, Building 1, City Campus
Telephone: (+612) 9514 2643
Fax: (+612) 9514 2274

Cooperative Research Centre on Satellite Systems

The Cooperative Research Centre for Satellite Systems was established in 1997 to design and build robust and innovative satellite systems and has a budget of $56 million over seven years, including contributions from research and industry participants. Participants in the CRC include UTS, the CSIRO, University of South Australia, La Trobe University, Queensland University of Technology, University of Newcastle, Auspace Limited, VIPAC Scientists and Engineers Pty Ltd, Curtin University of Technology, the Defence Science and Technology Organisation, the ARIES Consortium, MITEC Pty Ltd, D-Space Ltd and Optus.

Associate Professor Sam Reisenfeld of the Faculty of Engineering is the Director of the UTS branch of the Cooperative Research Centre (CRC), and UTS will also be represented on the CRC management board. UTS is in the telecommunications group of the CRC structure with the specific role to design and develop Ka band microwave earth stations to be used with the Fedsat-1 satellite. Federation Satellite One (Fedsat-1) will be a low cost micro satellite, conducting telecommunication, space physics, remote sensing and engineering experiments. The Ka band is a new commercial band in the higher end of microwave spectrum being utilised by a number of low earth orbit satellite business ventures for global direct satellite access to the Internet and Internet based services. The Ka band is 30 Gigahertz on the uplink from earth to the satellite and 20 Gigahertz from the satellite to the earth station. The two frequencies are used to separate received signals from transmitted signals. Using the Ka Band requires the development of new communication techniques, which UTS will be working on.

The Deputy Director of the UTS Satellite Systems group is Dr Ananda Mohan Sanagavarapu and the team comprises eight academics, one support staff, one postdoctoral fellow, and four PhD students. Several master's thesis and final year project students are also working on projects related to CRC. The CRC will also closely cooperate with the Sydney Microwave Design Resource Centre of UTS.

Inquiries may be made to:

A/Prof Sam Reisenfeld
Room 1/2512, Building 1, City Campus
Tel (+612) 9514 2448
Fax: (+612) 9514 2435
Email: sam.reisenfeld@uts.edu.au

Dr Ananda Mohan Sanagavarapu
(nee Ananda S Mohan)
Telecom Group, Faculty of Engineering
University of Technology, Sydney
Building 1, City Campus
PO Box 123, Broadway
Sydney, NSW 2007

Tel (+612) 9514 2447
Fax (+612) 9514 2435
Email: ananda@eng.uts.edu.au

Centre for Biomedical Technology (operated jointly with the Faculties of Science, Mathematical and Computing Sciences, and Nursing). Research areas relevant to engineering include: cardiac electrophysiology and technology, medical imaging, bio-mathematical modelling, medical instrumentation, diet management and optimal control of diabetes mellitus, optimal cancer therapies, and nursing-technology interfaces.

Inquiries may be made to:

Associate Professor Hung Nguyen
Centre Director
Room 2517, Building 1, City Campus
Telephone: (+612) 9514 2451
Fax: (+612) 9514 2435
Email: htn@eng.uts.edu.au

Centre for Materials Technology (jointly with the Faculty of Science). Research topics relating to engineering include: development, characterisation and applications of advanced materials, including composites; materials processing, industrial applications of microwave energy, new carbons and cements.

Inquiries may be made to:

Professor Mick Wilson
Centre Director
Room 428, Building 4, City Campus
Telephone: (+612) 9514 1761
Fax: (+612) 9514 1628
Email: mick.wilson@uts.edu.au

Institute for Coastal Resource Management. Inquiries should be made directly to the Faculty of Science.

Centre for Aquaculture (jointly with the Faculty of Science). Research areas relevant to engineering include: modelling of prawn aquaculture ponds, and waste effluent treatment.

Inquiries may be made to:

Dr Peter Montague
Director
Room 1713, Building 1, City Campus
Telephone: (+612) 9514 1490
Fax: (+612) 9514 1491
Email: peter.montague@uts.edu.au

The Sydney Microwave Design and Resource Centre was established in 1988 as a joint initiative of UTS, the University of Sydney, and Hewlett Packard Australia. It assists researchers and Australian companies to develop or extend their use of advanced microwave capabilities, through access to professional services and state-of-the-art modelling, design and measurement facilities. It participates in inter-disciplinary investigations and research (for example, in microwave processing, materials characterisation and customised process applicators), in addition to its programs across the two universities in microwave communications, electro-magnetic interference and antennas.

Inquiries should be directed to:

Dr Ananda Mohan Sanagavarapu
Room 1/2512A, Building 1, City Campus
Telephone: (+612) 9514 2447
Fax: (+612) 9514 2435
Email: ananda@eng.uts.edu.au

CONTINUING PROFESSIONAL EDUCATION

Most subjects offered through the Graduate School of Engineering are available in single-subject mode, class sizes permitting, with their successful conclusion creating the possibility of advanced standing credit under existing Faculty policies.

All enrolments on this non-award basis incur full-cost recovery fees, currently $200 per credit point for the majority of GSE subjects.

In addition, in-house short courses, seminars, workshops and other professional development programs are offered from time to time, frequently in response to corporate invitations or opportunities arising from visits by international experts.

Engineers and others requiring further information on continuing professional opportunities through the Faculty of Engineering are invited to contact the Graduate Students Adviser at any time.

INFORMATION FOR STUDENTS

The following information is only an outline. Additional information is provided to all students upon enrolment.

Applications for admission

Intending graduate students must lodge an application for admission by the due date (where appropriate). Separate application forms are available for:

Graduate coursework awards (Graduate Certificates, Graduate Diplomas and Master's degrees by Coursework)

Master's degrees by Thesis

Doctoral degree programs

Research degrees

In general, applications for most Doctoral and Master's by Thesis programs will be accepted at any time and applicants advised of a decision soon thereafter.

For applications completed in accordance with University and Faculty instructions, a decision should be expected within six weeks. However, failure of applicants to supply all the required information may extend decision processes considerably.

Applicants are advised to apply well in advance of the time they hope to commence their research, following discussion of research possibilities with potential supervisors. Please refer also to the detailed information on these courses in the following pages.

Coursework degrees

UTS application forms for coursework awards may be requested (by phone, mail or in person) from the Graduate School of Engineering, Level 7, Building 2 at City Campus; from the UTS Information Service, Level 4, Building 1, City Campus or the Inquiry Office, Level 5, Kuring-gai Campus.

Admission to courses is competitive and applicants are advised to exercise care in completing the application form. The offer of a place will be determined principally on the basis of information supplied in this application.

Applications must be submitted to:

UTS Information Service
University of Technology, Sydney
Level 4, Building 1, Broadway
Telephone (+ 61 2) 9514 1990

Postal Address:
PO Box 123
Broadway NSW 2007

Late applications

Applications may be accepted for some postgraduate courses after the closing date. Applicants should contact the UTS Information Service to check which courses are still open.

The following conditions apply to all late applicants:

1. Subject to availability of class places, late applicants will be considered for offers only after on-time applications have been considered;
2. The nominal closing date for late applications is 31 January or 30 June 1999. However, the University reserves the right to close late applications at any time for any course without prior notice.

English proficiency

Applicants whose tertiary education was conducted in a language other than English will be required to demonstrate proficiency in the English language. The most effective way of doing this is by obtaining a satisfactory result in a recognised English test.

UTS accepts the results from two tests:

- the **IELTS (International English Language Testing System) test**: an international test of English that is offered through Australian Education Centres and British Council Offices overseas. The IELTS test is available in Australia in all capital cities and many regional centres. For further information on IELTS contact UTS International Programs on Level 5, Building 1 at the City Campus in person, or by telephoning (+ 61 2) 9514 1531.

  A satisfactory result on the IELTS test is a minimum overall band score of 6.5 with a minimum of 6.0 in the writing section.

- the **Combined Universities Language Test (CULT)** conducted by the Institute of Languages at the University of New South Wales. A minimum mark of 65% is required.

An application for admission will not be considered until proficiency in English has been demonstrated.

Documentation

Original documentation or a certified copy is required to support all applications. Failure to submit required documentation may delay or

even jeopardise an applicant's admission to a course. Details of the documentation required are given on the application form. Applicants who are uncertain of the documentation required should contact the UTS Information Service.

Applicants with overseas qualifications are advised to contact the UTS Information Service to determine whether their qualifications lie within the University's assessment guidelines.

Those applicants who are subsequently advised that their qualifications lie outside the guidelines, may contact the following body to request an educational assessment of their qualifications:

National Office of Overseas Skills Recognition (NOOSR)
PO Box 25, Belconnen, ACT 2616
Telephone: freecall 1800 02 0086

As the processing of a NOOSR assessment may take some weeks, applicants are advised to contact the UTS Information Service well before the 1999 closing date for assessment advice.

All applicants submitting documentation for assessment are encouraged to apply well in advance of the course closing date. Applicants who are applying for admission solely on the basis of professional qualifications and/or relevant experience are particularly encouraged to make an early application, as it is often necessary to interview such applicants.

Result of application

Applicants who apply by the appropriate closing dates will be advised of the outcome of their applications by mail in late December 1998/January 1999.

Charges and fees

Student Service Charges

All students are required to pay compulsory student charges at enrolment. In 1998, these charges were as follows:

Students' Association	$A48
UTS Union (Semester Fee)	$A99
UTS Union (Entrance Fee) (non-refundable)	$A20
Student Accommodation Levy	$A55
Student identification card charge (non-refundable)	$A15
Total[1]	**$A237**

[1] Compulsory student charges are subject to revision for 1999 and are payable in each calendar year of enrolment.

The Union semester fee component is now collected on a per semester basis. The total showing above is the standard fee payable before the start of first semester of study. For a second semester of the current academic year, students will receive a second statement at the start of that semester for the balance i.e. A$99.00.

Students will be exempt from Union Fees if they hold and can produce either a UTS Union Life Membership Card, or a Certificate of Exemption at the time specified for enrolment. For further information, contact the University Union on (+612) 9514 1145.

Course fees

In addition to the above charges, most Australian-resident students are required to contribute towards the cost of their postgraduate education, either through the Higher Education Contribution Scheme (HECS) or through the payment of postgraduate course fees. Currently, some students studying for higher degrees by research are exempt from these requirements.

Students admitted to the Graduate School of Engineering in 1999 will be required to pay course fees, according to a schedule which will be available late in 1998. The schedule will be provided on inquiry to the Graduate School of Engineering, the Kuring-gai Student Centre or from the UTS Information Service, Level 4, Building 1, Broadway. Full information on fees is included with the application form, and with offers of admission.

The basis for calculating postgraduate course fees is EFTSU (equivalent full-time student units). For candidates in degrees by coursework, each subject has a credit point rating and 1.0 EFTSU = 48 credit points (cp); this represents a full study load for one year. The majority of graduate subjects in Engineering are rated at 6cp, so full-time attendance typically involves four subjects per semester. The fee schedule shows, for each course, the fee per EFTSU, per credit point, and for the course overall. Fees for individual subjects are pro rata with their credit point ratings.

As a guide, typical semester fees in 1998 for both full-time and part-time attendance were calculated on a schedule fee of $150 per credit point of study undertaken. Certain specialist courses carry higher fee rates.

Students may be able to claim payment of course fees as a tax deduction, and should contact the Australian Taxation Office to discuss their specific situation.

Exemption from course fees based on financial hardship or disadvantage – Equity Scholarships

A number of places will be available on a fee-exemption basis, for students commencing in 1999. These will provide exemption from course fees on grounds of financial hardship or disadvantage. A student granted exemption from course fees will incur HECS liability, on a deferred-taxation basis. The number of fee-exemption places available is limited. Students must complete the form 'Application for Equity Scholarship' available from the UTS Information Service or the University Graduate School at Broadway, the Kuring-gai Student Centre, or the Graduate Students Adviser at the Graduate School of Engineering, and submit it with their application for admission. Note also that exemption is from the course fee only, not from Student Service Charges.

Information for fee-paying overseas applicants

Students from countries outside Australia are able to enrol in full-time postgraduate programs on a fee-paying basis. Fees for courses offered to fee-paying overseas students in 1999 will range from A$11,000 to A$15,000 per annum, depending on the course. For further information on fee arrangements for overseas students, contact the UTS International Programs Office on (+612) 9514 1531.

Scholarships

Students wishing to undertake full-time study leading to the award of a Master's or PhD degree may be eligible for a scholarship at UTS. Scholarships available are listed below:

Scholarships for Research programs

Australian Postgraduate Award (Research)

University Doctoral Research Scholarship

R L Werner Postgraduate Research Scholarship

Scholarships for study overseas

Please contact the UTS Graduate School.

Overseas Postgraduate Research Scholarship Scheme

Citizens from all overseas countries (excluding New Zealand) are eligible. Further information and application forms are available from the International Programs Office, Level 5, Building 1 at the City campus.

Further information may be obtained from the Postgraduate Studies and Scholarships Office, University Graduate School, Level 5, Building 1 on (+612) 9514 1521.

Semester patterns

The Academic Year of the University is divided into two main semesters: Autumn (March-June) and Spring (August-November). For 1999, some subjects may also be offered in a Summer session (December 1998-February 1999).

All courses have their major intake in March, at the beginning of the academic year. Places are available in the second semester beginning in August, and potential mid-year applicants should contact the Graduate Students Adviser in April for initial advice.

Research candidates may commence their studies at any time during the year.

Enrolment

Enrolment for postgraduate programs involving coursework takes place in late January or early February for the Autumn Semester, and in late July for the Spring Semester. Complete enrolment details are forwarded to successful applicants. Enrolment must be in person.

Students from outside the Sydney basin may complete formal enrolment procedures by mail.

Enrolment for Doctoral and Master's by Thesis degrees, for those who do not apply in the normal admission period, is arranged through the Office of the University Graduate School, Level 5, Building 1, Broadway Campus.

Deferment of enrolment

Deferment of enrolment is not allowed for graduate courses.

Attendance and academic credit

Attendance patterns for coursework degrees in any year will vary with the choice of subjects; normally, full-time or part-time attendance can be offered. Most subjects are offered in the evening. In some cases, however, it is necessary for part-time students to attend the University one afternoon a week or for blocks of attendance at other times.

Class attendance requirements vary with the courses. For many subjects, attendance during one semester at a weekly two or three-hour session is the standard requirement. Where appropriate, graduate subjects are also offered on a block attendance or intensive short course basis or in distance mode.

Subjects offered in a block mode require attendance at the University for a block of full-day study (usually 2-3 days) on a small number of occasions (usually three) during the semester. The interval between blocks allows time for self-directed study and application work.

Subjects offered in distance mode normally require no attendance at the University. Contact with lecturers is by email, fax or telephone.

Each subject, including research and project subjects not requiring regular class attendance, has a credit point rating denoting its academic value towards the award.

Duration of courses

PhD degrees are normally a minimum of two years duration on a full-time basis and three years duration on a part-time basis if the candidate holds a Master's degree by research, or three years full-time, and four years part-time for candidates with a Bachelors degree or a Master's degree by pure coursework.

Master's degrees by research and thesis are normally a minimum of four semesters' duration on a full-time basis, or six semesters on a part-time basis. In some cases, a student with appropriate advanced study and/or relevant work experience may be permitted to complete the degree in a shorter time.

Master's degree by coursework are normally of two and a half or three semesters' duration on a full-time basis, or five or six semesters part-time. Some Master's degrees can be completed in one year (12 calendar months) by studying during the Summer semester (December-February).

Rules governing the courses

Students are subject to the Rules prescribed by the University for the course in which they are enrolled, and to the general rules of the University in the UTS Calendar. Special note should be made of the Faculty's interpretation of the rules concerning Unsatisfactory Performance.

A student enrolled for a coursework award who:

1. records two failures; or
2. over any period of two semesters, fails to meet any concurrent experience or other requirements prescribed for the degree; or
3. fails to meet any additional course requirements prescribed under Rule 3.2.5 or rule 3.2.6, within the period set down at the time of admission

will be required to show cause why registration should not be discontinued. The student must respond in writing, and the decision will be made by the relevant Committee of the Graduate School of Engineering.

A student enrolled for a Research degree who receives two unsatisfactory progress reports from his/her supervisors, or a PhD student who fails to satisfy the requirements of the Doctoral Assessment after a prescribed period of candidature (currently twelve months for a full-time student), will be required to show cause why registration should not be discontinued. The student must respond in writing, and the decision will be made by the relevant Committee of the Graduate School of Engineering.

Leave of absence

Leave of absence is not normally granted to students who have not completed the requirements for at least one subject in their course. Leave of absence during candidature for one award is normally limited to a total period of two years. Application should be made on the appropriate Leave of Absence form.

Advanced standing

Advanced Standing is granted in accordance with University rules described in the 1999 UTS Calendar. Exemptions from subjects are granted on the basis of the successful recent completion of equivalent graduate level subjects.

Applications for advanced standing can be made at any time on the standard UTS Subject Exemption Form and submitted to the GSE Graduate Students Adviser, together with supporting documentation including relevant subject syllabi.

Advice will be given at enrolment upon request, but approval cannot be guaranteed at that time. Students are advised to seek advanced standing advice prior to enrolment if possible.

RESEARCH DEGREES

The degrees of Doctor of Philosophy (PhD) and Master of Engineering (ME) by Thesis are offered in areas of current research, through programs in the Faculty.

Doctor of Philosophy

Course code: EP99

Abbreviation: PhD

The degree of Doctor of Philosophy may be awarded to candidates who have completed an individual program of supervised research and submitted a thesis embodying the results of the work. The thesis must constitute a distinct contribution to knowledge, whether by original investigation or by review, criticism or design. A formal course of study or other work may also be prescribed.

The Faculty's overall policy is one of close interaction with industry and the profession, and of seeking to contribute directly to the advancement of Australian engineering practice. Consequently, research programs of applied nature, and fundamental studies which involve a direct relationship with industry, are strongly encouraged. The greater proportion of research conducted by Faculty staff is supported from industry sources. There are a number of equally active programs of more basic research supported by granting agencies, and it is University policy to increase support from these sources.

Duration and candidature

Doctoral degree candidature may be undertaken on a full-time or part-time basis. The work may be carried out either on University premises, at a site external to the University, or some combination of both. For full-time candidates, the program is normally of at least four semesters' duration for the holder of a Master's degree by research and six semesters for a holder of a Bachelor's degree or a Master's degree by coursework. For part-time candidates, the program is normally of at least six semesters' duration for the holder of a Master's degree by research and eight semesters for the holder of a Bachelor's degree or a Master's degree by coursework.

For Doctoral students there is a formal assessment of their progress at the end of the first two semesters for both full-time and part-time candidates.

The Doctoral Assessment is conducted in accordance with University Rule 3.5.7.

The objectives of the assessment are to ensure that: the candidate has gained the prerequisite knowledge and skills to allow successful and timely completion of the proposed research program; and the candidate's progress is consistent with completion of the research program in the prescribed time and demonstrates potential to complete the work to doctoral standard. Candidates who, for any reason, are not equipped with requisites necessary to bring the proposed research program to a successful completion or have not demonstrated sufficient aptitude, are made aware of this assessment before they invest further time and money. Where it is proposed (at candidate's instigation) that the nature or scope of the research program be changed significantly, there is continued commitment by the Faculty for provision of adequate human and physical resources, including proper supervision.

Admission requirements

To qualify for admission to PhD candidature, applicants should hold a Bachelor of Engineering degree with Second Class Honours Division 1, or a Master of Engineering degree, from UTS or the former NSWIT; or must hold another qualification or meet other requirements deemed to be equivalent. Alternatively, an applicant may be permitted to register as a Master's degree student for the purpose of preparing for admission to Doctoral candidature, and may be permitted to transfer to Doctoral candidature upon satisfying prescribed requirements. Details are set out in the *UTS Calendar*.

Applicants for admission to research degree programs in Engineering should preferably have a minimum of two years' experience in employment related to the course or program they wish to undertake.

Applications

In addition to the completed application form and supporting documentation, applicants must submit a covering letter indicating (a) why they wish to undertake the program and (b) the names, addresses and phone numbers of two professional referees. The application and/or the letter must indicate (c) the proposed research topic and (d) the name of a member of academic staff with whom the topic has been discussed and who is willing to supervise the candidate's work; and should

also include (e) any evidence of ability to conduct research and to complete a substantial project.

For part-time candidature, the application must also include (f) a statement from the applicant's employer, indicating the level of the employer's support for the application and the time allocation of the candidate to the research project.

It is important that formal applications are lodged after the intending candidate has made suitable inquiries within the Faculty. This is necessary in order to clarify an appropriate research area and to ensure that supervision is available, together with any equipment and laboratory facilities that may be required. Applications which are not supported by an indication of the proposed research topic and the name of a prospective supervisor will not be accepted.

Applications for PhD candidature are accepted at any time and are not subject to set closing dates (although their acceptance may be subject to admission quotas and to resource availability).

Research areas – inquiries

Initial inquiries may be made with the Graduate Students Adviser. Academic advice on research is also available from the members of:

Faculty Research Degrees Committee
Professor J A Reizes
Associate Dean Research
Room 2/511B, Level 5, Building 2
Telephone: (+612) 9514 2742
Fax: (+612) 9514 2633
Email: john.reizes@uts.edu.au

Civil and Structural Engineering
Associate Professor Bijan Samali
Room 2/7070, Level 7, Building 2
Telephone: (+612) 9514 2023
Fax: (+612) 9514 2549
Email: bijan.samali@uts.edu.au

Computer Systems Engineering
Dr Kit-Ka Fung
Room 1/2225, Level 22, Building 1
Telephone: (+612) 9514 2394
Fax: (+612) 9514 2435
Email: kkf@eng.uts.edu.au

Electrical Engineering
Dr Joe Zhu
Room 1/1823, Level 18, Building 1
Telephone: (+612) 9514 2318
Fax: (+612) 9514 2435
Email: joe@eng.uts.edu.au

Environmental Engineering
Dr Prasanthi Hagare
Room 2/520, Level 5, Building 2
Telephone: (+612) 9514 1952
Fax: (+612) 9514 2633
Email: prasanthi.hagare@uts.edu.au

Mechanical and Manufacturing Engineering
Dr Guang Hong
Room 2/619, Level 6, Building 2
Telephone: (+612) 9514 2677
Fax: (+612) 9514 2633
Email: guang.hong@uts.edu.au

Telecommunications Engineering
Dr Ananda Mohan Sanagavarapu
Room 1/2512A
Telephone: (+612) 9514 2447
Fax: (+612) 9514 2435
Email: ananda@eng.uts.edu.au

National Centre for Groundwater Management
Professor Michael Knight
Room 1/1715, Level 17, Building 1
Telephone: (+612) 9514 1984
Fax: (+612) 9514 1985
Email:
groundwater.management@uts.edu.au

Most intending PhD candidates will be able to relate their research interest to one or more of the Faculty's existing research areas and they may contact the relevant researchers directly to discuss their application.

Inquiries about interdisciplinary topics should be directed in the first instance to the Graduate School of Engineering.

Fees

Under current policies, Australian-resident candidates commencing a UTS doctoral course through the Faculty of Engineering in 1999 will be exempt from HECS payments for studies completed in minimum time.

Students permitted to extended their candidature beyond the maximum time may be required to pay a fee to the University.

Master of Engineering (by thesis)

Course code: EP98

Abbreviation: ME

The degree of Master of Engineering (by thesis) may be awarded to candidates who have completed an individual program of supervised work and submitted a thesis embodying the results. A formal course of study or other work may also be prescribed.

In keeping with the Faculty's overall policies, the accent is on applied research and development work, although basic research proposals are also welcomed and supported. Topics which involve close cooperation with industry are strongly encouraged, and a majority of current candidates are engaged in topics which are actively supported by their employers.

The degree has been established to provide practising engineers with an opportunity to pursue, in depth, the solution of an engineering problem which requires individual effort beyond the scope of a Bachelor's degree. The thesis must be a distinct contribution to knowledge in the area covered by the research. Its contents may report the results of an original investigation, review or criticise some aspect of engineering knowledge, or present an engineering design or solution involving the application of new or known techniques to an engineering problem of significance.

For Master's students there will be a formal assessment of their progress at the end of the first two semesters for both full-time and part-time candidates.

The Master's assessment will be conducted in accordance with University rule 3.4.15.

The objectives of the assessment are to ensure that: the candidate has gained the prerequisite knowledge and skills to allow successful and timely completion of the proposed research program; and the candidate's progress is consistent with completion of the research program in the prescribed time and demonstrates potential to complete the work to a master's standard. Candidates who, for any reason, are not equipped with requisites necessary to bring the proposed research program to a successful completion or have not demonstrated sufficient aptitude, are made aware of this assessment before they invest further time and money. Where it is proposed (at candidate's instigation) that the nature or scope of the research program be changed significantly, there is continued commitment by the Faculty for provision of adequate human and physical resources, including proper supervision.

Duration and candidature

Candidature may be on a full-time or part-time basis. The work may be carried out either using Faculty facilities, or in an industrial location. For full-time candidates, the program is normally of at least four semesters' duration from the time of registration as a Master's degree candidate. For part-time candidates, duration is normally at least six semesters. Candidates who are specially qualified in the relevant discipline may be allowed to complete the program in less than the minimum time.

Admission requirements

To qualify for admission to candidature for Master's degree (by thesis), applicants must hold a Bachelor of Engineering degree from UTS or the former NSWIT, or another qualification deemed to be equivalent. In special circumstances, engineers who do not possess a degree or equivalent may be admitted to the program if they can provide evidence of general and professional qualifications which will satisfy the UTS Graduate School Board that they possess the educational preparation and capacity to pursue graduate studies.

Applicants who do not meet the requirements for admission to candidature for Master's degree (by thesis) may be admitted as Master's qualifying students, for the purpose of preparing for candidature. Further details are given in the Rules relating to Master's Degree (by thesis) Students, set out in full in the *UTS Calendar.*

Research areas – inquiries

Initial inquiries may be made with the Graduate Students Adviser. Academic advice on research is also available from the members of:

Faculty Research Degrees Committee
Professor J A Reizes
Associate Dean Research
Room 2/511B, Level 5, Building 2
Telephone: (+612) 9514 2742
Fax: (+612) 9514 2633
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Civil and Structural Engineering
Associate Professor Bijan Samali
Room 2/7070, Level 7, Building 2
Telephone: (+612) 9514 2023
Fax: (+612) 9514 2549
Email: bijan.samali@uts.edu.au

Computer Systems Engineering
Dr Kit-Ka Fung
Room 1/2225, Level 22, Building 1
Telephone: (+612) 9514 2394
Fax: (+612) 9514 2435
Email: kkf@eng.uts.edu.au

Electrical Engineering
Dr Joe Zhu
Room 1/1823, Level 18, Building 1
Telephone: (+612) 9514 2318
Fax: (+612) 9514 2435
Email: joe@eng.uts.edu.au

Environmental Engineering
Dr Prasanthi Hagare
Room 2/520, Level 5, Building 2
Telephone: (+612) 9514 1952
Fax: (+612) 9514 2633
Email: prasanthi.hagare@uts.edu.au

Mechanical and Manufacturing Engineering
Dr Guang Hong
Room 2/619, Level 6, Building 2
Telephone: (+612) 9514 2677
Fax: (+612) 9514 2633
Email: guang.hong@uts.edu.au

Telecommunications Engineering
Dr Ananda Mohan Sanagavarapu
Room 1/2512A
Telephone: (+612) 9514 2447
Fax: (+612) 9514 2435
Email: ananda@eng.uts.edu.au

National Centre for Groundwater Management
Professor Michael Knight
Room 1/1715, Level 17, Building 1
Telephone: (+612) 9514 1984
Fax: (+612) 9514 1985
Email:
groundwater.management@uts.edu.au

Fees

Under current policies Australian-resident part-time candidates commencing a UTS Master's by Research course through the Faculty of Engineering will be liable to pay HECS. Commencing Australian-resident full-time candidates in 1999 may be exempt from HECS for studies completed in minimum time.

Students permitted to extend their candidature beyond maximum time may be liable to pay a fee to the University.

Inquiries

Initial inquiries should be made with the Graduate Students Adviser. Academic inquiries, such as the selection of an appropriate research topic, should be directed to the relevant members of the Faculty Research Degrees Committee.

SPECIALIST COURSEWORK AWARDS

Specialist courses by coursework are offered by the Faculty in several fields. Each of these courses include core subjects: that is, subjects which must be completed satisfactorily during studies for the award.

Students in any specialist course receive preference in the allocation of class places in core subjects. Students taking popular subjects through elective studies will be allowed to enrol when places are available.

Master of Engineering Management

Course code: EP85

Abbreviation: MEM

The Master of Engineering Management program places a greater emphasis on the interface between technology and management than does the traditional MBA. Whilst the MEM program is formally administered by the Faculty of Engineering, there is close collaboration with the Faculty of Business and the Australian Graduate School of Engineering Innovation in its presentation and development.

The MEM program provides opportunity for engineers who seek career prospects in engineering management to undertake a formal course of relevant study at the Master's degree level. The course is designed for engineers or scientists who perform, or who aspire to perform, management tasks while maintaining currency in their technical specialities.

Graduates from the MEM with a suitable group of electives may apply for the **MBA in Engineering Management** and complete that degree with a further six MBA core subjects. Refer to the *Faculty of Business Handbook* for details.

Duration

The course requires 60 credit points of study. The program is structured for evening attendance, block attendance or distance mode. Extra intensive classes may be held in the university breaks. Most students taking two subjects per semester require between two and two and a half years to complete the degree.

Overseas students

The MEM course is also available to fee-paying overseas students on a full-time basis, taking approximately one and a half years to complete.

Admission requirements

An applicant for admission to candidature for the Master of Engineering Management degree should:

1. be a graduate in Engineering of the University of Technology; or
2. hold a degree or equivalent from another higher education institution in engineering or other technological/applied science field deemed to be equivalent in standard to the Bachelor of Engineering degree at UTS; or
3. hold a Graduate Certificate or Graduate Diploma in engineering at a level of performance deemed by the Faculty Board in Engineering to be satisfactory evidence of an ability to undertake Master's candidature (typically 60% average).

Applicants should have two years of relevant work experience, or one year of structured industrial experience equivalent to that required for the BE degree at UTS.

Applicants are also required to submit a covering letter indicating why they wish to undertake the course and a detailed curriculum vitae.

Course structure

Core

A minimum of 36 credit points must be completed from the following subjects:

49003	Economic Evaluation	6cp
49001	Judgment and Decision Making	6cp
22747	Accounting for Managerial Decisions	6cp
21813	Managing People	6cp
49002	Project Management	6cp
49004	Systems Engineering for Managers	6cp
49309	Quality Planning and Analysis	6cp

Electives

The remaining 18-24 credit points of electives may be completed from the following.

49052-49076 Graduate Project	18-24cp
Graduate subjects from the Faculty of Engineering	6cp each
Other approved graduate UTS subjects from the Faculties of Business, Law, and other Universities	6cp each
Approved graduate subjects from AGSEI	6cp each
Approved AGSEI Workshops and Short Courses	2/3/4cp each

Not less than 50 per cent of total credit points must be completed through subjects offered by the Faculty of Engineering.

UTS subjects are generally presented in the evenings and AGSEI subjects in one week blocks. Apart from 49004, all the subjects named above are available in distance mode if requested. AGSEI subjects 49602 and 49604 are also in distance mode.

Fees

Fees apply to this course. A schedule of approved fees is available on inquiry to the GSE Graduate Students Adviser.

telephone (+612) 9514 2606

Inquiries

Initial inquiries should be made to:

The Graduate Students Adviser
Ms Robyn Saunders
Room 7082, Level 7, Building 2
Telephone (+612) 9514 2606
Fax (+612) 9514 2549
Email: robyn.saunders@uts.edu.au

Academic inquiries should be made to:

A/Prof Bob Spencer
Room 606, Level 6, Building 2
Telephone (+612) 9514 2660
Fax (+612) 9514 2655
Email: bob.spencer@uts.edu.au

MBA (Engineering Management)

The Faculty of Business, in cooperation with the Faculty of Engineering offers a version of the MBA suitable for engineering managers. It is structured in the following way:

Business Administration Core

28701	Business and the Changing Environment	6cp
21813	Managing People	6cp
25706	Economics for Management	6cp
22747	Accounting for Managerial Decisions	6cp
24734	Managerial Marketing	6cp
25742	Financial Management	6cp
21720	Employment Relations	6cp
21715	Strategic Management	6cp

Engineering Specialisation – any eight of the following subjects

49001	Judgment and Decision Making	6cp
49002	Project Management	6cp
49004	Systems Engineering for Managers	6cp
49006	Risk Management in Engineering	6cp
49012	Project Management Support Systems	6cp
49013	Managing Information Technology in Engineering	6cp
49021	Evaluation of Infrastructure Investments	6cp
49122	Ecology and Sustainability	6cp
49309	Quality Planning and Analysis	6cp
49318	Manufacturing Systems Management	6cp

This degree may be entered directly through the Faculty of Business or after completing a Faculty of Engineering MEM or MEStud. With a suitable choice of subjects from the MEM or MEStud, advanced standing may be granted for up to ten subjects from the MBA.

Master of Environmental Engineering Management

Course code: EP89

Abbreviation: MEEM

The Master of Environmental Engineering Management is designed to enable engineers and other technical specialists to take a leadership role in the field of environmental engineering. It combines a set of key subjects that contain information on the nature of environmental problems together with engineering techniques for their solution. This is supplemented by management and policy subjects to empower the engineer, or technical specialist, to lead multidisciplinary teams working in the field of environmental engineering.

Duration

The course require 60 credit points of study. The program is structured for evening attendance, block attendance or distance mode. Most students taking two subjects per semester require between two and two and a half years to complete the degree.

Overseas students

The MEEM course is also available to fee-paying overseas students on a full-time basis, taking approximately one and a half years to complete.

Admission requirements

Normally, a degree in engineering or other technological/applied science field plus two years experience. Candidates without a degree, but with suitable experience, may enrol in the Graduate Certificate in Environmental Engineering and Management and later transfer to the MEEM with full credit for completed subjects.

Course structure

Group A

A minimum of 6 subjects must be completed from the following:

49121	Environmental Assessment and Planning	6cp
49122	Ecology and Sustainability	6cp
49123	Waste and Pollution Management	6cp
49124	Water Quality Management	6cp
49125	Environmental Risk Assessment	6cp
49126	Environmental Management of Land	6cp
66025	Contaminated Site Management	6cp

Group B

A minimum of 2 subjects must be completed from the following:

49001	Judgment and Decision Making	6cp
49002	Project Management	6cp
49003	Economic Evaluation	6cp
49108	Local Government Law	6cp
49023	Energy and Environmental Economics	6cp

Open electives or graduate project

An additional 2 subjects may be taken from the above list of subjects, approved graduate subjects from UTS or other universities, or 49050 Graduate Project.

The Graduate Certificate in Environmental Engineering and Management consists of subjects 49121, 49122, 49123 and 49124.

Master of Engineering in Groundwater Management

Course code: E057

Abbreviation: ME

This course is offered through the National Centre for Groundwater Management and in collaboration with the Faculty of Science.

It is designed to enable students to develop specialist skills in the area of groundwater management including aspects of geology, hydrology, hydraulics and resource management. This provides a multi-disciplinary perspective to issues of groundwater management.

Duration

The course is structured on a block attendance pattern and laboratory work during Autumn semester and project work during Spring semester. The course is offered on a full-time and part-time basis.

The course is also available in distance mode which has an additional residential component.

Admission requirements

Applicants must possess a degree in engineering from UTS or an equivalent qualification. Applicants are required to submit a curriculum vitae.

Course structure

Semester 1 – Autumn

49550	Computing for Groundwater Specialists	0cp
49551	Surface Hydrology and Groundwater	6cp
49555	Groundwater Modelling	6cp
66014	Hydrology	6cp
66015	Hydrogeochemistry	6cp
	Elective 1	6cp
	Elective 2	6cp

Semester 2 – Spring

44152	Groundwater Engineering Project F/T	24cp
44156	Groundwater Engineering Project P/T	12cp

Electives available

49554	Groundwater Computing	6cp
66016	Geophysics and Remote Sensing of Groundwater Resources	6cp
66017	Geopollution Management	6cp
66018	Groundwater Geophysics	6cp
66025	Contaminated Site Management	6cp
	An approved subject offered elsewhere	6cp

Inquiries

Inquiries should be made to:

Professor Michael Knight
Room 1715, Level 17, Building 1
Telephone (+612) 9514 1984
Fax (+612) 9514 1985
Email:
groundwater.management@uts.edu.au

Graduate Diploma in Engineering in Groundwater Management

Course code: E061

Abbreviation: GradDipE

This course is designed for students working in the area of groundwater resource management.

Duration

The course requires attendance in a pattern similar to the Master of Engineering in Groundwater Management. However, the project work of the Spring semester is shorter and must be completed by the end of the teaching semester.

This course is also available in distance mode and has a similar residential component to the Master's course.

Admission requirements

Applicants should possess a degree in engineering from UTS or hold equivalent qualifications. Applicants with other qualifications relevant to groundwater resource development may be accepted for admission, subject to approval by the Faculty Board.

Course structure

Semester 1 – Autumn

49550	Computing for Groundwater Specialists	0cp
49551	Surface Hydrology and Groundwater	6cp
49555	Groundwater Modelling	6cp
66014	Hydrogeology	6cp
66015	Hydrogeochemistry	6cp
	Elective 1	6cp
	Elective 2	6cp

Semester 2 – Spring

44153	Groundwater Engineering Project F/T	12cp
44157	Groundwater Engineering Project P/T	6cp

Electives

As for Master of Engineering in Groundwater Management course.

Attendance

The course is offered on a block mode attendance pattern and students may extend their enrolment over more than one year.

Inquiries

Inquiries should be made to:

Professor M Knight
Room 1715, Level 17, Building 1
Telephone (+612) 9514 1984
Fax (+612) 9514 1985
Email:
groundwater.management@uts.edu.au

Graduate Diploma in Local Government Engineering

Course code: EP64

Abbreviation: GradDipLGE

The objective of this course is to equip the professional engineer involved with local government – in particular local government employees, developers, consultants, employees in government enterprises and state public servants – with the understanding and expertise required for efficient and effective engineering development and/or management of technical services for which local government is responsible.

Graduates from this course will be well equipped to operate within the legal framework of a more open and responsive level of local government, having due regard to social, economic and environmental issues.

Duration

This course is offered in a block attendance pattern of study. The normal attendance pattern is based on two subjects per semester requiring a minimum of four semesters to complete the course.

Admission requirements

Professional engineers making application to enter the course must hold a Bachelor's Degree in Civil Engineering or an equivalent qualification acceptable to the Institution of Engineers, Australia, and must have obtained a minimum of two years' work experience in local government or similar.

A comprehensive curriculum vitae is to be submitted, together with a detailed description of work experience, and evidence of eligibility for graduate membership of the Institution of Engineers, Australia. Applicants must also submit two letters with their application: one outlining why they wish to undertake the course, and the other indicating the level of support from their employer.

In special circumstances, engineers and other technical professionals who have been employed in senior positions with local government and who do not possess a degree (or equivalent) may be admitted to the course of study if they submit evidence of professional qualifications and experience which satisfies the Faculty that they possess the educational base and capacity to pursue graduate studies. Consideration will be given to applicants possessing a degree in an area allied to civil engineering, e.g. surveying, where applicants are employed in, or as expert consultants by, local government, and have considerable experience at a senior technical or managerial level.

In certain circumstances an applicant may be required to attend for interview. It may be necessary in some cases to pursue an area of study to prepare for admission to the course, namely the Graduate Certificate in Engineering.

Course structure

Core

49103	Management & Industrial Relations	6cp
49104	Asset Maintenance Management	6cp
49105	Water Supply and Wastewater Management	6cp
49106	Road Engineering Practice	6cp
49108	Local Government Law	6cp
49121	Environmental Assessment and Planning	6cp

Electives

49102	Traffic and Transportation	6cp
49107	Storm Runoff Regulation	6cp

Additional electives will be on offer from other Graduate School programs for block mode attendance; these may include subjects offered in the Environmental Engineering and Management program area.

Consideration will be given to accumulation of credit points for the electives strand by completing approved specialist short courses offered by the Centre for Local Government Education and Research, other universities and

professional bodies. These short courses must be undertaken whilst enrolled in the Graduate Diploma in Local Government Engineering course.

Attendance

The block attendance pattern of study currently consists of three sessions per semester. Each session involves three days of full-day attendance covering two subjects per semester. Selected subjects are offered in distance mode.

Fees

Fees apply to this course. A schedule of approved fees is available on inquiry to the Graduate Students Adviser.

telephone (+612) 9514 2606

Inquiries

Initial inquiries should be made to:

The Graduate Students Adviser
Ms Robyn Saunders
Room 7082, Level 7, Building 2
Telephone (+612) 9514 2606
Fax (+612) 9514 2549
Email: robyn.saunders@uts.edu.au

Academic inquiries should be made to:

Mr Ken Halstead
Room 522, Level 5, Building 2
Telephone (+612) 9514 2640
Fax (+612) 9514 2633
Email: ken.halstead@uts.edu.au

Graduate Certificate in Environmental Engineering and Management

Course code: EP54

Abbreviation: not applicable for Graduate Certificates

Environmental engineering and management is high on the political agenda. It also has a high professional priority. The Code of Ethics of The Institution of Engineers, Australia reminds its members that their responsibility '... for the welfare, health and safety of the community shall at all times come before their responsibility to the profession, to sectional or private interest or to other Engineers'. This responsibility applies equally to scientists, town planners and other professionals working in this field. They have a compelling duty to ensure that the adverse effects of development on the total environment are minimised.

This course of four subjects deals with the broad aspects of environmental management relevant to practising professionals in engineering science, planning, architecture, law, surveying, health and building. Completing the course will develop a background and competence in environmental management.

More specifically, it will develop an awareness of understanding the human impact on the environment with respect to waste minimisation and water quality management. It will develop professional skills required to work as part of an integrated team responsible for environmental planning and management.

Duration

This course is offered on a block attendance pattern of study or by distance. The normal attendance pattern is based on two subjects per semester requiring a minimum of two semesters to complete the course.

Admission requirements

Normal educational qualification for admission is a Bachelor's degree in engineering, science, design, architecture, building, surveying or planning. Equivalent qualifications will be considered on their merits.

Provisional admission for graduates from disciplines other than those above will be available provided their education contained an adequate introduction to mathematics and physical sciences. Each application in these categories will be used as a selection criterion if acceptable applications outnumber available places.

Articulation with Master's program

Work undertaken under this Graduate Certificate enrolment may be credited towards a Master's degree provided the requirements of the Master's degree are met in full, in terms of subject coverage and project weighting. However, completion of the requirements for the Graduate Certificate in Environmental Engineering and Management does not guarantee admission to Master's candidature.

Course structure

Semester 1 – Autumn		
49123	Waste and Pollution Management	6cp
49124	Water Quality Management	6cp
Semester 2 – Spring		
49121	Environmental Assessment and Planning	6cp
49122	Ecology and Sustainability	6cp

Attendance

The block attendance pattern of study currently consists of three sessions per semester. Each session involves three days of full-day attendance covering two subjects per semester. Subjects may also be taken in distance mode.

Fees

Fees apply to this course. A schedule of approved fees is available on inquiry to the Graduate Students Adviser.

telephone (+612) 9514 2606

Inquiries

Initial inquiries should be made to:

The Graduate Students Adviser

Ms Robyn Saunders
Room 7082, Level 7, Building 2
Telephone (+612) 9514 2606
Fax (+612) 9514 2549
Email: robyn.saunders@uts.edu.au

Academic inquiries should be directed to:

Dr Pam Hazelton
Room 512, Level 5, Building 2
Telephone (+612) 9514 2661
Fax (+612) 9514 2633
Email: pam.hazelton@uts.edu.au

Graduate Certificate in Engineering Management

Course code: EP57

Abbreviation: not applicable for Graduate Certificates

Many working engineers and technologists do not have the time to commit to a full Master's course. However, the demand for management knowledge amongst engineers is increasing. The Graduate Certificate in Engineering Management is designed to provide a four-subject package of management knowledge which can be tailored by the student to fit their immediate needs. All the subjects are taken from the Master of Engineering Management (MEM) and may be credited towards the MEM on successful admission to that program.

Duration

The course requires 24 credit points of study. Subjects may be taken in the evening or by distance mode over one or two semesters.

Overseas students

The Graduate Certificate in Engineering Management is available to fee-paying overseas students on a full-time basis, taking one semester to complete.

Admission requirements

An applicant for admission to candidature for a Graduate Certificate in the Faculty of Engineering should:

1. be a graduate in engineering of the University of Technology, Sydney; or
2. hold a degree or equivalent from another higher education institution in engineering or other technological/applied science field deemed to be equivalent in standard to the Bachelor of Engineering at UTS; or

3. for those applicants without formal qualifications, produce such other evidence of general and professional qualifications sufficient to show that the applicant possesses the educational preparation and capacity to pursue graduate studies.

Applicants should have two years of relevant work experience, or one year of structured industrial experience equivalent to that required for the BE degree at UTS.

Applicants are also required to submit a covering letter indicating why they wish to undertake the course and a detailed curriculum vitae.

Course structure

24 credit points of study required. A minimum of 18 credit points from the core of the MEM and the remainder from the core or electives.

Fees

Fees apply to this course. A schedule of approved fees is available on inquiry to the Graduate Students Adviser

telephone (+612) 9514 2606

Inquiries

Initial inquiries should be made to the Graduate Students Adviser:

Ms Robyn Saunders
Room 7082, Level 7, Building 2
Tel (+612) 9514 2606
Fax (+612) 9514 2549
Email: robyn.saunders@uts.edu.au

Academic inquiries should be directed to:

A/Prof Bob Spencer
Room 606, Level 6, Building 2
Telephone (+612) 9514 2660
Fax (+612) 9514 2655
Email: bob.spencer@uts.edu.au

COURSEWORK AWARDS – GENERAL

An extensive range of coursework programs is available through the GSE, on a Faculty-wide basis, leading to the general awards of Master of Engineering (by coursework), Master of Technology, Master of Engineering Practice, Graduate Diploma in Engineering, and Graduate Certificate in Engineering.

Master of Engineering (by coursework)

Course code: EP81

Abbreviation: ME

Aims of the Course

The course provides opportunity at Master's level for professionally qualified engineers, including recent graduates, to extend in depth and breadth the knowledge and skills gained from their undergraduate studies.

Each program must be designed to enhance technological knowledge pertaining to one or more fields of engineering. The completion of subjects and project work at advanced level is central to this requirement.

The course offers program flexibility combined with opportunities for articulation from a sub-Master's (i.e., Graduate Certificate or Graduate Diploma) to a Master's level award.

Duration

Programs may be completed on a full-time basis in three academic semesters, or in 12 calendar months by studying during the summer months (December to February). Completion on a part-time basis requires two to three years.

The credit point requirement for course completion is 60 credit points (see below).

Admission Requirements

An applicant for admission to candidature for the Master of Engineering degree shall either:

1. be a graduate in engineering of the University of Technology, Sydney; or
2. hold a degree or equivalent from another higher education institution deemed to be equivalent to the Bachelor of Engineering degree at UTS; or

3. hold a Graduate Certificate or Graduate Diploma in Engineering at a level of performance deemed by the Faculty Board in Engineering to be satisfactory evidence of an ability to undertake Master's candidature (typically 60 per cent average).

Applicants should have two years of relevant work experience, or one year of structured industrial experience equivalent to that required for the BE degree at UTS.

Applications for admission by internal transfer of candidature from a Graduate Certificate or Graduate Diploma in Engineering may be considered following completion of subjects totalling at least 18 credit point at a level of performance deemed by the Faculty Board in Engineering to satisfactory evidence of an ability to undertake Master's candidature (typically 60 per cent average).

Attendance

Attendance may be on a full-time or part-time basis. Classes are usually held in the evenings, in block and/or distance mode.

Degree requirements and course structure

A candidate for the degree shall complete coursework subjects and a major individual project, totalling 60 credit points.

The program of study for each candidate shall have regard to the purpose and coherence of subject selection and the integration of course and project work. Within this framework, the Faculty Board in Engineering, on advice from its Graduate School, may from time to time introduce program majors that require students to complete a number of prescribed subjects with or without opportunity for electives. In these cases, the area of program concentration will be recognised on the candidate's academic record.

Subjects selected shall be drawn from those offered by the Faculty of Engineering of UTS, other faculties of UTS, other faculties of engineering (including the University of Sydney, the University of New South Wales and the University of Western Sydney), and other institutions approved by the Academic Board. Not less than 50 per cent of total credit points must be completed through subjects offered and/or a capstone project supervised by the Faculty of Engineering of UTS. The capstone project must be supervised by a principal supervisor who is a member or adjunct member of academic staff of the Faculty of Engineering of UTS.

Subjects shall generally be from among those designated as postgraduate. Undergraduate subjects may be included only where they were not included in the course leading to a candidate's primary qualification and where they can be shown to represent material relevant to career development. Undergraduate subjects may not in any event total more than 12 credit points.

Credit

Subjects taken through any faculty of UTS shall be credited towards the degree at the credit point values established for them by the University.

The credit point weighting for the capstone project will lie within the range 18–24 credit points.

The following provisions are additional to the University's normal Advanced Standing provisions:

Credit to be granted for subjects taken through providers other than UTS shall be determined by the Faculty Board in Engineering, on the advice of the Head of the Graduate School of Engineering.

Postgraduate subjects offered by the Faculty of Engineering of the University of Sydney, the University of New South Wales and the University of Western Sydney, or other universities by arrangement, may be credited towards the degree to a maximum value of 24 credit points.

Program and subject availability

The Faculty offers program majors in specialised fields relating to its research activities. These may change from time to time in number or available areas of study.

Programs are available in fields relating to each of the Faculty's main discipline areas and its associated teaching Centres (Centre for Local Government Education and Research, National Centre for Groundwater Management and the Australian Graduate School of Engineering Innovation); and in other inter- or intra-faculty fields through the Graduate School of Engineering. Advice on available program majors in any year may be obtained initially on inquiry to the Faculty of Engineering, through the Graduate Students Adviser.

Subjects offered by the Faculty of Engineering and available to ME candidates, and illustrative examples of program majors, appear in this handbook. Attention should be paid to the prerequisite requirements of particular subjects. Subjects offered by other faculties of UTS are published in the respective faculty handbooks. Inquiries with respect to these, and to subjects offered by other institutions, may be directed in the first instance to the Graduate Students Adviser in the Faculty of Engineering.

Program selection

Each candidate's program of study shall be determined in consultation with an academic adviser and shall require the approval of the Head of the Graduate School of Engineering or other person designated by the Faculty Board in Engineering. Approval shall include arrangements for the supervision of project work.

Each individual program must comprise a coherent selection of subjects and project work of demonstrable relevance to the aims of the course set out above.

The Head of the Graduate School of Engineering – or a candidate's academic adviser – will consult with other faculties to identify subjects offered by them that may be relevant to an individual program. Approval to take subjects offered by other universities, within the limits established above, will normally be granted in circumstances where an equivalent subject is not available through UTS.

Prior to undertaking the capstone project, each candidate will be required to submit a comprehensive project definition, as a basis from which the objectives and scope of the work will be agreed, together with the credit point value to be given to the project.

Assessment

The award of the degree will be ungraded.

In existing UTS subjects, assessment procedures will be as already established or as modified by the appropriate authority from time to time.

Emphasis will be placed where appropriate on self-directed experiential learning and criterion-referenced assessment in the development and review of the Faculty's postgraduate subjects.

Supervision of capstone project

Responsibility for supervision of the capstone project for the degree will rest with the Head of the Graduate School of Engineering, or with a person designated by the Head of the Graduate School as Director, Graduate Projects.

The capstone project must be supervised by a principal supervisor who is a member or adjunct member of staff of the Faculty of Engineering of UTS. Industry-based projects are strongly encouraged, particularly for part-time candidates with employer sponsorship, and will require formal co-supervisory arrangements.

Candidates and supervisors of project work are expected to follow principles and practices consistent with the University's Code of Practice for Master's Research Students and Supervisors, and described in the Graduate Project Guide Notes available from the Faculty of Engineering through the Graduate Students Adviser.

Fees

Fees apply to this course. A schedule of approved fees is available on inquiry to the GSE Graduate Students Adviser.

telephone (+612) 9514 2606

Inquiries

Inquiries should be made to:

Graduate Students Adviser
Ms Robyn Saunders
Room 7083, Level 7, Building 2
Telephone (+612) 9514 2606
Fax (+612) 9514 2549
Email: robyn.saunders@uts.edu.au

Master of Technology

Course code: EP71

Abbreviation: MTech

Aims of the course

The course provides a qualification at Master's level, in engineering or engineering-related areas, for persons professionally qualified as engineering technologists or as practitioners in fields related to engineering. It also provides a qualification at Master's level in areas combining engineering with another discipline.

The course offers program flexibility combined with opportunities for articulation from a sub-master's (Graduate Certificate/Graduate Diploma) to a Master's level award. Each individual program should be designed to build on the candidate's previous qualifications and experience, either to develop a particular field of technology in depth or to explore relationships and interdependencies between technology, engineering, and other disciplines and professions. The completion of subjects and project work at advanced level is central to these objectives.

In some individual cases, the course may provide opportunity to satisfy the educational requirements set by the Institution of Engineers, Australia, for registration as a professional engineer. In this regard, detailed advice should be sought before enrolment.

Duration

Programs may be completed on a full-time basis in three academic semesters, or in 12 calendar months by studying during the summer months (December to February). Completion on a part-time basis requires two to three years.

Admission Requirements

An applicant for admission to candidature for the Master of Technology degree shall either:

1. hold the degree of Bachelor of Engineering of the University of Technology, Sydney or the New South Wales Institute of Technology; or
2. hold a Bachelor or Honours degree from UTS or NSWIT, requiring 4 years full-time study for completion, in a cognate discipline (such as Applied Science, Computing Building); or
3. hold a Bachelor or Honours degree or equivalent from another higher education institution, deemed to be equivalent to 1. or 2.,

and shall have a minimum of three years practical experience, at a level commensurate with the above qualifications, in capacities that have involved close contact with engineering.

Applicants who have completed a first degree requiring less than 4 years full-time study are required to undertake a period of academic preparation, equivalent to the requirements applying to the award of a Graduate Diploma. Prior learning from continuing professional education, professional experience and professional achievement is taken into account.

In selection for places, preference will be given to applicants who can show that their chosen program of study will assist them in furthering a demonstrable employment responsibility or career objective.

Applications for admission by internal transfer of candidature from a Graduate Certificate or Graduate Diploma in Engineering may be considered, following completion of subjects totalling at least 18 credit points at a level of performance approved by the Faculty Board in Engineering as evidence of ability to undertake Master's candidature.

Attendance

Attendance may be on a full-time or part-time basis. Classes are usually held in the evenings, in block and/or distance mode.

Degree requirements and course structure

A candidate for the degree shall complete coursework subjects and a major individual project totalling 60 credit points.

The program of study of each candidate shall have regard to the purpose and coherence of subject selection and the integration of course and project work.

Subjects selected shall be drawn from those offered by the Faculty of Engineering of UTS, other faculties of UTS, other faculties of engineering (including the University of Sydney, the University of New South Wales and the University of Western Sydney), and other institutions approved by the Academic Board. Not less than 50 per cent of total credit points must be completed through subjects offered and a capstone project supervised by the Faculty of Engineering at UTS. The

capstone project must be supervised by a principal supervisor who is a member or adjunct member of academic staff of the Faculty of Engineering of UTS.

Subjects shall generally be from among those designated as postgraduate and shall include as a minimum postgraduate subjects totalling 48 credit points. Undergraduate subjects may be included only where they were not included in the course leading to a candidate's primary qualification and where they can be shown to represent material relevant to career development.

Credit

Subjects taken through any faculty of UTS shall be credited towards the degree at the credit point values established for them by the University.

The credit point weighting for the capstone project will lie within the range 18–24 credit points.

The following provisions are additional to the University's normal Advanced Standing provisions:

Credit to be granted for subjects taken through providers other than UTS shall be determined by the Faculty Board in Engineering, on the advice of the Head of the Graduate School of Engineering.

Postgraduate subjects offered by the faculties of engineering of the University of Sydney, the University of New South Wales, and the University of Western Sydney, or other universities by arrangement, may be credited towards the degree to a maximum value of 24 credit points.

Program and subject availability

The Faculty offers program majors in specialised fields. These may change from time to time in number or available areas of study. Program selection is not confined to these majors.

Programs are available in fields relating to each of the Faculty's main discipline areas and its associated Centres (Centre for Local Government Education and Research, National Centre for Groundwater Management, and the Australian Graduate School of Engineering Innovation); and in other inter- or intra-faculty fields through the Graduate School of Engineering.

Subjects offered by the Faculty of Engineering and available to MTech candidates, and illustrative examples of program majors, appear in this handbook. Attention should be paid to the prerequisite requirements of particular subjects. Subjects offered by other faculties of UTS are published in the respective faculty handbooks. Inquiries in respect of these, and of subjects offered by other institutions, may be directed in the first instance to the Graduate Students Adviser in the Faculty of Engineering.

Program selection

Each candidate's program of study shall be determined in consultation with an academic adviser and shall require the approval of the Head of the Graduate School of Engineering or other person designated by the Faculty Board in Engineering. Approval shall include arrangements for the supervision of project work.

Each individual program must comprise a coherent selection of subjects and project work, of demonstrable relevance to the aims of the course set out above.

The Head of the Graduate School of Engineering – or a candidate's academic adviser – will consult with other faculties to identify subjects offered by them that may be relevant to an individual program. Approval to take subjects offered by other universities, within the limits established above, will normally be granted in circumstances where an equivalent subject is not available through UTS.

Prior to undertaking the capstone project, each candidate will be required to submit a comprehensive project definition, as a basis from which the objectives and scope of the work will be agreed together with the credit point value to be given to the project.

Assessment

The award of the degree will be ungraded.

In existing UTS subjects, assessment procedures will be as already established or as modified by the appropriate authority from time to time.

Emphasis will be placed where appropriate on self-directed experiential learning and criterion-referenced assessment in the development and review of the Faculty's postgraduate subjects.

Supervision of capstone project

Responsibility for supervision of the capstone project for the degree will rest with the Head of the Graduate School of Engineering, or with a person designated by the Head of the Graduate School as Director, Graduate Projects.

The capstone project must be supervised by a principal supervisor who is a member or adjunct member of staff of the Faculty of Engineering of UTS. Industry-based projects are strongly encouraged, particularly for part-time candidates with employer sponsorship, and will require formal co-supervisory arrangements.

Candidates and supervisors of project work are expected to follow principles and practices consistent with the University's Code of Practice for Master's Research Students and Supervisors, and described in the Graduate Project Guide Notes available from the Faculty of Engineering through the Graduate Students Adviser.

Fees

Fees apply to this course. A schedule of approved fees is available on inquiry to the Graduate Students Adviser

telephone (+612) 9514 2606

Inquiries

Inquiries should be made to:

Graduate Students Adviser
Ms Robyn Saunders
Room 7083, Level 7, Building 2
Telephone (+612) 9514 2606
Fax (+612) 9514 2549
Email: robyn.saunders@uts.edu.au

Master of Engineering Practice

Course code: EP86

Abbreviation: MEP

Aims of the Course

The course provides opportunity, through cooperative education, for practising engineers to extend in depth and breadth the knowledge gained through their undergraduate studies and initial professional experience. Individual course programs are selected from the range of graduate subjects offered by the Faculty of Engineering at UTS, other faculties at UTS, and other institutions approved by the Academic Board.

Each program must be designed to enhance capability in the professional practice of engineering, and understanding of the context in which engineering is practised. It must relate to a real industrial or professional setting, normally that of the enterprise in which the candidate is employed; to the other professions which form the overall enterprise; and to the contribution of engineering to the enterprise and to the social and economic context in which it operates. A program may, but need not, include in-depth extension of technological knowledge; but this alone will not be sufficient.

Attendance and duration

Attendance may be on a full-time or part-time basis. Classes are usually held in the evenings, in block and/or distance mode.

The nominal duration of the course is 3 years part-time or 1.5 years full-time.

Admission requirements

An applicant for admission to candidature for the Master of Engineering Practice shall either:

1. be a graduate in Engineering of the University of Technology, Sydney or the New South Wales Institute of Technology; or
2. hold a degree or equivalent from another higher education institution, deemed to be equivalent to the Bachelor of Engineering degree of UTS.

In addition, applicants will normally be expected to demonstrate experience in the practice of engineering that meets the requirements, as laid down from time to time, for corporate membership of the Institution of

Engineers, Australia. A minimum of two years of relevant work experience is required. In selection for places, preference will be given to applicants who can show that their chosen program of study will assist them in furthering a demonstrable employment responsibility or career objective.

Applications for admission by internal transfer of candidature from a Graduate Certificate or Graduate Diploma in Engineering may be considered, following completion of subjects totalling at least 24 credit points at a level of performance approved by the Faculty Board in Engineering as evidence of ability to undertake a Master's candidature.

Degree requirements and course structure

A candidate for the degree shall complete coursework subjects and a major project totalling not less than 72 credit points.

The program of study for each candidate shall relate to the practice of engineering at an experienced professional level and shall have regard to the purpose and coherence of subject selection, the integration of course and project work, and the inclusion of substantial elements of interaction with professional practice.

Subjects selected shall be drawn from those offered by the Faculty of Engineering of UTS, other faculties of UTS, and other providers as noted below. Not less than 24 credit points must be completed through subjects offered and/or project work supervised by the Faculty of Engineering of UTS. The major project must be supervised by a Principal Supervisor who is a member or adjunct member of staff of the Faculty of Engineering of UTS.

Subjects shall generally be from among those designated as postgraduate. Undergraduate subjects may be included only where they were not included in the course leading to a candidate's primary qualification and where they can be shown to represent material relevant to career development. Undergraduate subjects may not in any event total more than 12 credit points.

Credit

The following provisions are additional to the University's normal Advanced Standing provisions.

Subjects taken through any faculty of UTS are credited towards the degree at their normal credit-point values established by the University. Credit to be granted for subjects taken through providers other than UTS is determined by the Faculty Board in Engineering.

Postgraduate subjects offered by the faculties of engineering of the University of Sydney and the University of New South Wales may be credited towards the degree to a maximum value of 36 credit points.

Subjects offered by the Australian Graduate School of Engineering Innovation Limited (AGSEI) may be credited towards the degree to a maximum value of 48 credit points, provided that

1. AGSEI has current recognition by the Academic Board of UTS as a suitable provider (such recognition is current in 1998); and
2. The Faculty Board in Engineering of UTS has approved each AGSEI subject unit concerned, and the arrangements for any project work.

The Academic Board may from time to time accredit other providers, and the Faculty Board in Engineering may accredit their programs, in a similar way.

Subject availability

Subjects offered by the Faculty of Engineering and other faculties of UTS, and available for inclusion in programs of study within the Master of Engineering Practice course, are published in the respective faculty handbooks. Inquiries in respect of subjects and project work offered by other institutions may be directed in the first instance to the Graduate Students Adviser in the Faculty of Engineering.

Program selection

Each candidate's program of study is determined in consultation with an academic adviser, and requires the approval of the Head of the Graduate School of Engineering or other person designated by the Faculty Board in Engineering. Approval must include arrangements for project supervision.

Each individual program must comprise a coherent selection of subjects and project work, of demonstrable relevance to the aims of the course set out above.

The philosophy of the course is one of cooperative education. Programs should maximise opportunity for industrially reinforced learning, based on adaptation and application of material provided through coursework. From time to time, the Faculty may introduce new subjects based upon

existing postgraduate subjects but including an applications project for which additional credit may be appropriate.

The Head of the Graduate School of Engineering – or a candidate's academic adviser – will consult with other faculties to identify subjects offered by them that may relate to the practice of engineering and to the interfaces between engineering and other disciplines. In programs involving areas of advanced engineering technology, and subject to the requirement for cohesion within each program and to the overall aims of the course, candidates will be encouraged to consider the value of subjects offered by other universities which complement those available at UTS.

Prior to undertaking the major project, each candidate will be required to submit a comprehensive project definition, as a basis from which the objectives and scope of the work will be agreed together with the credit point value to be given to the project.

Assessment

The award of the degree will be ungraded.

In existing UTS subjects, assessment procedures will be those normally applying to each subject.

In new subjects developed for the Master of Engineering Practice course, assessment will accord with the range of standard UTS practice but will allow for employer moderation where a component of the assessed work has been undertaken in an employment situation. In these circumstances, assessment practices consistent with self-directed experiential learning will be adopted.

Special regard will be paid to the encouragement and recognition of team work in selected subjects, particularly those of a cross-disciplinary nature. Where team activity is subject to assessment, the approach used will seek to ensure that each individual contribution is properly identified.

Candidates will be required to prepare and submit an individual written report for their major project, and to present and defend its findings in a seminar, preferably involving employer participation. In subjects offered by other institutions, the assessment practices will be as established by those institutions. In deciding whether to approve a subject offered by another institution for credit towards the degree, the Faculty Board in Engineering will have regard to the method of assessment.

Supervision of major projects

Responsibility for supervision of the major project for the degree will rest with the Head of the Graduate School of Engineering, or with a person designated by the Head of the Graduate School as Director of Studies for the MEP.

As noted, the major project must be supervised by a Principal Supervisor who is a member or adjunct member of staff of the Faculty of Engineering of UTS. Industry-based projects are encouraged, and will require formal co-supervisory arrangements.

Fees

Full fees apply to this course. A schedule of approved fees is available on inquiry to the Graduate Students Adviser.

telephone (+612) 9514 2606

Fees for subjects undertaken through the Australian Graduate School of Engineering Innovation Ltd (AGSEI) are payable to AGSEI, at levels determined by AGSEI.

Inquiries

Inquiries should be made to:

Graduate Students Adviser
Ms Robyn Saunders
Room 7083, Level 7, Building 2
Telephone (+612) 9514 2606
Fax (+612) 9514 2549
Email: robyn.saunders@uts.edu.au

Master of Engineering Practice

(presented in work-based learning mode)

Course code: EP90

Abbreviation: MEP

Graduate Diploma in Engineering

(presented in work-based learning mode)

Course code: EP65

Abbreviation: GradDipE

Graduate Certificate in Engineering

(presented in work-based learning mode)

Course code: EP58

Abbreviation: not applicable for Graduate Certificates

The aims of these articulated courses and the regulations applying to them are generally similar to those described above for the conventional Master of Engineering Practice. The Master of Engineering Practice is a 72 credit point course, the Graduate Diploma is 45 credit points and the Graduate Certificate is 24 credit points. Candidates for these degrees will not normally apply as individuals but as part of a cohort sponsored by their organization. The course structures are highly flexible and negotiable, and designed to achieve both personal and corporate objectives.

Course structure

The course structure will be flexible. One core unit, Proposal and Portfolio in Engineering, will need to be completed by all students attempting any of the degrees. The Proposal and Portfolio in Engineering provides the details of each individual's proposed award, their Learning Agreement and the evidence supporting their claim for recognition of current capability. The Proposal and Portfolio in Engineering component will determine the exact structure of a student's award. While this may be varied during the student's progression to their chosen award, the changes will need to be agreed by student, the student's academic adviser at UTS, and their workplace supervisor. The academic adviser will be a member of UTS academic staff or a member of AGSEI staff appointed as an academic adviser by UTS. To complete the requirements of the Proposal and Portfolio, prospective students will enrol in a Proposal and Portfolio qualifying course, worth 9 credit points. On successful completion of this course participants will be able to enrol in the Graduate Certificate, Graduate Diploma and Master's Degree, as appropriate, with advanced standing for the Proposal and Portfolio in these awards. Students will also need to complete a Professional Engineering Work Study (PEWS) 1, 2 or 3 of at least 6 credit points to qualify for an award. The PEWS comprises an action research component which is mandatory for all awards.

Details of each award

Graduate Certificate in Engineering

The Graduate Certificate in Engineering will provide foundation studies at postgraduate level and an important entry point for applicants who have not completed an engineering degree but who have had extensive work experience (usually more than 5 years), and can demonstrate a capacity to successfully participate at graduate level.

The Graduate Certificate is a 24 credit point award, providing an introduction to an area of engineering, agreed between the candidate, the candidate's employer and UTS:AGSEI. It provides an introduction to the field of study and a means of assessing a participant's ability to proceed to further graduate level of study.

The course of study will comprise:

1.	Credit for Completion of Proposal and Portfolio in Engineering	9cp
2.	Accredited Prior Learning	
	WBL based	0–9cp
	or, formal subjects	0–9cp
3.	Formal subjects	0–9cp
4.	Professional Engineering Work Study 1	6–15cp

Total credit points required to complete the award: 24 credit points

It is noted that WBL Research Methods is not compulsory in the Graduate Certificate.

Graduate Diploma in Engineering

The Graduate Diploma in Engineering comprises 45 credit points which may be made up of the 24 credit point awarded for the Graduate Certificate in Engineering plus an additional 21 credit points of approved

learning. The aims of the Graduate Diploma are to develop the individual's capability to perform a high level of analysis and synthesis in an area of engineering learning, agreed between the candidate, the candidate's employer and the Faculty of Engineering supervisor, or the representative of AGSEI operating on the Faculty's behalf.

This course would provide a second important entry point for applicants who have not completed an engineering degree but who have had extensive work experience (usually more than 5 years), and can demonstrate a capacity to successfully participate at graduate level.

Transfer from the Graduate Certificate in Engineering will require a completion of a new Proposal and Portfolio in Engineering. However, a total of 9 credit points will be accrued for the two awards.

The completed Proposal and Portfolio in Engineering is the trigger for the enrolment of a participant in the Graduate Diploma in Engineering and will also enable the Faculty to plan the staffing requirements generated by the applicant's proposed course of study. The course of study will comprise:

1.	Credit for Completion of Proposal and Portfolio in Engineering	9cp
2.	Accredited Prior Learning	
	WBL based	0–24cp
	or, formal subjects	0–24cp
3.	WBL Research methods 1	6cp
4.	Formal subjects	0–24cp
5.	Professional Engineering Work Study 1 & 2	6–30cp

Total credit points required to complete the award: 45 credit points

Master of Engineering Practice

The Master of Engineering Practice will provide advanced studies at post graduate level and an important entry point for applicants who have completed an undergraduate degree in engineering or a graduate certificate or diploma.

The Master's level program is designed to enable candidates to achieve an advanced level of understanding in a field of study and practice to equip them for the demands and responsibilities of middle to senior management roles in an engineering corporation or consultancy. The precise content of the course will be drawn from an area of engineering learning, agreed between the candidate, the candidate's employer and the Faculty of Engineering supervisor, or the representative of AGSEI operating on the Faculty's behalf. The Master of Engineering Practice comprises 72 credit points which may include the 45 credit points from the Graduate Diploma in Engineering, plus an additional 27 credit points.

Applicants must complete a Proposal and Portfolio in Engineering. A new Proposal and Portfolio in Engineering will be required to progress from the Graduate Certificate in Engineering, or the Graduate Diploma in Engineering, to the Master of Engineering Practice. However a total of 9 credit points will be accrued for the two awards.

The course of study will comprise:

1.	Credit for Completion of Proposal and Portfolio in Engineering	9cp
2.	Accredited Prior Learning	
	WBL based	0–30cp
	or, formal subjects	0–30cp
3.	WBL Research methods 1 & 2	12cp
4.	Formal subjects	0–30cp
5.	Professional Engineering Work Study 1, 2 and 3	21–51cp

Total credit points required to complete the award: 72 credit points

Articulation

Articulation between Graduate Certificate, the Graduate Diploma in Engineering and the Master of Engineering Practice degree will be possible. A new Proposal and Portfolio in Engineering will have to be completed in each case. It is not proposed at this stage to allow candidates to freely move between the Work-Based Learning awards and other post graduate awards in the Faculty of Engineering. Exceptions are possible with the approval of the Head of the Graduate School of Engineering.

The Role of the Employer

A prospective candidate would normally approach the employer, or be approached by the employer, to seek a place in a Work-Based Learning program. On enrolment in a Qualifying Subject, the applicant would commence preparation of their Proposal and Portfolio in Engineering under the joint guidance of the employer and a representative of the UTS:AGSEI WBL Management Committee. The awards will be jointly administered by the candidate's employer and UTS, or the candidate's employer and AGSEI, (acting on behalf of UTS). UTS would have

approval of academic standards and the employer's representatives would approve the general topics of investigation.

Admission requirements

These are identical to those required for the conventional Master of Engineering Practice, Graduate Diploma in Engineering, and Graduate Certificate of Engineering. See Graduate Diploma in Engineering (EP61) and Graduate Certificate in Engineering (EP51).

Fees

Full fees apply to this course. These fees will normally be structured as part of a contract between UTS and the employer.

Inquiries

Initial inquiries should be made to the Graduate Students Adviser:

Ms Robyn Saunders
Room 7082, Level 7, Building 2
Telephone (+612) 9514 2606
Fax (+612) 9514 2549
Email: robyn.saunders@uts.edu.au

Academic inquiries should be directed to:

Mr Ravindra Bagia
Room 1/2423, Level 24, Building 1
Telephone (+612) 9514 2432
Fax (+612) 9514 2432
Email: ravin.bagia@eng.uts.edu.au

Master of Engineering Studies

Course code: EP88

Abbreviation: MEStud

Master of Engineering Studies (Honours)

Course code: EP91

Abbreviation: MEStud (Hons)

The Master of Engineering Studies provides an opportunity for recently graduated engineers to pursue further studies in their chosen field of endeavour. The degree is structured in such a way that a student may choose a program of study that will deepen the body of knowledge acquired in the first degree or expand knowledge boundaries into policy and engineering management areas. The program of study chosen by the student will be framed within a Graduate Program Major and supervised by an experienced director in that field.

The Master of Engineering Studies (Honours) is an extension, in the form of a research project, of the program of studies chosen by students. Students who have performed well in the coursework program will be permitted to transfer into the MEStud(Hons) where they will be given the opportunity to complete a research project in their major.

Duration

The MEStud will require two semesters of full-time study or four semesters of part-time study. Those students who wish to take Honours will require at least one further semester to complete the degree.

Admission requirements

An undergraduate degree in engineering or other technological/applied science field or a Graduate Certificate in engineering is required for entry to the course. Candidates with a first or second class honours degree or equivalent require no experience. Otherwise two years of relevant experience is required.

Course structures

Master of Engineering Studies

Eight graduate subjects offered by the Faculty of Engineering (48 credit points). Students will normally nominate a major at enrolment which will require the completion of five subjects within a particular Graduate Program Major as described in this handbook. The major will be noted on the academic transcript.

Master of Engineering Studies (Honours)

On completion of the requirements of the MEStud. at credit level or above, a student may transfer to the MEStud(Hons) group. In addition to the 48 credit points at credit level the candidate will be required to complete a 24 credit point research project over a period of a least one semester.

Graduate Program Majors

Graduate Program Majors available within the Faculty of Engineering in 1999 are listed below.

- Control Engineering
- Energy Planning and Policy
- Engineering Management
- Environmental Engineering and Management
- Groundwater Management
- Information Systems Engineering
- Local Government Engineering
- Manufacturing Engineering and Management
- Software Engineering
- Structural Engineering
- Telecommunications Engineering
- Water Engineering

Each of these Graduate Program Majors is managed by a Program Director who will advise the student on assumed prior knowledge and a suitable combination of graduate subjects. Where a student transfers to the MEStud(Hons) group, that student will normally be required to have completed 49041 Engineering Research Methodology and to complete the Research Project using the body of knowledge contained in the chosen Graduate Program Major.

Fees

Fees apply to this course. A schedule of approved fees is available on inquiry to the Graduate Students Adviser.

telephone (+612) 9514 2606

Inquiries

Initial inquiries should be made to the Graduate Students Adviser:

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Email: robyn.saunders@uts.edu.au

Academic inquiries should be directed to:

Associate Professor Jim Parkin
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Email: jim.parkin@uts.edu.au

Graduate Diploma in Engineering

Course code: EP61

Abbreviation: GradDipE

Graduate Certificate in Engineering

Course code: EP51

Abbreviation: not applicable for Graduate Certificates

Aims of the courses

The objective of each of these courses, offered on a Faculty-wide basis, is to provide practising professional engineers or technologists with an opportunity to extend their engineering knowledge beyond the subject areas covered in their first qualification, and/or to update their knowledge and skills in line with recent advances in engineering, technology and business practice; and to provide graduates in cognate disciplines with the opportunity to undertake formal study in appropriate areas of engineering.

The courses may also be of value to immigrant engineers, already professionally qualified in their countries of origin, who are seeking orientation to Australian conditions and practice.

Duration

The Graduate Diploma requires completion of subjects, totalling 45 credit points, and may be taken on a two-semester, full-time basis or on a four-semester, part-time basis.

The Graduate Certificate requires completion of subjects totalling 24 credit points and may be taken on a two-semester, full-time basis or a two-semester, part-time basis.

Admission requirements

An applicant for admission to candidature for a Graduate Certificate or Graduate Diploma in the Faculty of Engineering should:

1. be a graduate in engineering of the University of Technology, Sydney; or
2. hold a degree or equivalent from another higher education institution deemed to be equivalent to the Bachelor of Engineering degree at UTS; or
3. for those applicants without formal qualifications, produce such other evidence of general and professional qualifications sufficient to show that the applicant possesses the educational preparation and capacity to pursue graduate studies.

Applicants should have two years of relevant work experience, or one year of structured industrial experience equivalent to that required for the BE degree at UTS.

Attendance

Attendance may be on a full-time or part-time basis. Classes are usually held in the evenings, in block and/or distance mode.

Course structure

Students design their own program to suit individual needs. Program details are determined prior to enrolment, in consultation with, and with the approval of, an academic adviser appointed by the Head of the Graduate School. There is opportunity to choose from the broad range of graduate and undergraduate subjects offered by the University's nine faculties, class-size quotas permitted.

The program of study for each candidate shall have regard to the purpose and coherence of subject selection. Within this framework, the Faculty Board in Engineering, on advice from its Graduate School, may from time to time introduce program majors that require students to complete a number of prescribed subjects with or without opportunity for electives. In these cases, the area of program major will be recognised on the candidate's academic record.

At least 60 per cent of the content of any individual program shall consist of subjects offered by the Faculty of Engineering.

Undergraduate subjects may be included only where they were not included in the course leading to a candidate's primary qualification and where they can shown to represent material relevant to career development. They may not in any event total more than 60 per cent of the content of any individual program, as determined by the credit points awarded on completion of each subject.

Subject selection should be clearly related to a professional theme involving either an expansion of knowledge beyond the areas covered in the student's first degree, or an advance in skills resulting from the result developments in engineering and associated technologies and management practices.

Transfer to Master's Degree

Work undertaken under Graduate Diploma or Graduate Certificate enrolment may be credited towards a Master's degree provided the requirements of the Master's degree are met in full. Advanced standing can be obtained for not more than 67 per cent of the credit points required for the Master's (generally 40 credit points maximum).

Completion of the requirements for the Graduate Diploma or Graduate Certificate in Engineering does not guarantee admission to Master's candidature. Eligibility for consideration may be subject to the attainment of a certain level of performance – typically, a Weighted Average Mark in completed subjects of at least 60 per cent over 18 credit points.

Fees

Fees apply to these courses. A schedule of approved fees is available on inquiry to the Graduate Students Adviser.

telephone (+612) 9514 2606

Inquiries

Inquiries should be made to:

Graduate Students Adviser

Ms Robyn Saunders
Room 7082, Level 7, Building 2
Telephone (+612) 9514 2606
Fax (+612) 9514 2549
Email: robyn.saunders@uts.edu.au

GRADUATE PROGRAM MAJORS

Majors are available in ME, MTech, MEStud, Graduate Diplomas and Certificates.

The Graduate School of Engineering (GSE) offers an extensive range of programs by research and/or coursework through its award and non-award courses. A selection of these designated as 1999 program majors are described below. Information on other specialist research areas can be obtained from individual members of academic staff (see section titled Teaching Staff).

Program majors have been developed to match the needs of engineers and other professionals. They provide opportunities for advanced studies and professional development in engineering and cross-disciplinary areas between engineering and other disciplines. All GSE program majors are differentiated by their focus, structure, presentation, attendance flexibility, assessment practices and multiple entry/completion options.

Students completing two thirds of the credit points required for a MEStud, a general ME, MTech degree, diploma or certificate from any one of the graduate program majors listed will be entitled to have the name of the major listed in the degree transcript (not the testamur). A Graduate Project within the major will be deemed to contribute the relevant number of credit points towards the two thirds requirements for listing.

For the Energy Planning and Policy major to be shown on the transcript, students will be required to complete subjects 49021, 49022, 49023, 49024 and 49029.

For the Telecommunications major to be shown on the transcript, students will be required to complete subjects 49201, 49202, 49203, 49204 and 49205.

For the Software Engineering major to be shown on the transcript, students will be required to complete subjects 49233, 49234, 49235, 49236, 49237, 49217 and 49225.

For a Computer Systems major to be shown on the transcript, students will be required to complete subjects from the Software Engineering and Information Systems programs.

GSE program majors reflect current research strengths and interests in the Faculty of Engineering, and change with time. It is expected that all of the program majors listed below will be offered in 1999. However, the availability of individual subjects in any year will be influenced by student demand, arrangements with visiting lecturers, scheduling within the University, and policies on class sizes.

Provision has been made in all general award courses for candidates to undertake other (non-GSE) subjects with the approval of an academic adviser. In particular, undergraduate subjects offered by the Faculty may be taken as credit towards all general awards. Candidates who have completed their first degree at another university, or who have been practising for some years without periods of formal study, are strongly recommended to seek academic advice on the appropriateness of including selected undergraduate subjects in their programs.

In addition, opportunities are available in all general courses to undertake other approved subjects offered by other faculties at UTS, AGSEI and other universities.

Majors

Control Engineering

49261	Biomedical Instrumentation	6cp
49271	Computer Architecture	6cp
49272	Adaptive and Multivariable Control	6cp
49273	Random Signal Theory	6cp
49274	Advanced Robotics	6cp
49275	Neural Networks and Fuzzy Logic	6cp
49276	Sliding Mode Control	6cp
49377	Process Control Studies	6cp

Academic inquiries

A/Prof H Nguyen
Co-Director
Control Engineering Graduate Program
Room 2517, Level 25, Building 1
Telephone (+612) 9514 2667
Fax (+612) 9514 2435
Email: htn@eng.uts.edu.au

Energy Planning and Policy

Core subjects (Master's program major) include

49021	Evaluation of Infrastructure Investments	6cp
49022	Energy Resources and Technology	6cp
49023	Energy and Environmental Economics	6cp
49024	Energy Modelling	6cp
49029	Environmental Policy for Energy Systems	6cp

Recommended subjects

49025	Methods for Energy Analysis	3cp
49026	Electricity Sector Planning	6cp
49027	Energy Demand Analysis and Forecasting	6cp
49028	Policy and Planning of Energy Conservation	6cp
49032	Sustainable Technological Development	6cp
49321	Energy Conversion	6cp

Academic inquiries

Dr D Sharma
Director
Energy Planning and Policy Graduate Program
Room 7088, Level 7, Building 2
Telephone (+612) 9514 2422
Fax (+612) 9514 2549
Email: deepak.sharma@eng.uts.edu.au

Engineering Management

49001	Judgment and Decision Making	6cp
49002	Project Management	6cp
49003	Economic Evaluation	6cp
49004	Systems Engineering for Managers	6cp
49005	Technological Change	6cp
49006	Risk Management in Engineering	6cp
49009	Engineering in Australian Society	6cp
49010	Engineering Ethics	6cp
49011	International Engineering	6cp
49012	Project Management Support Systems	6cp
49013	Managing IT in Engineering	6cp
49044	Engineering Communication and Documentation	6cp
49306	Quality Systems – Implementation and Accreditation	6cp
49309	Quality Planning and Analysis	6cp
49381	Applications of Optimisation in Engineering	6cp

Note: Selected subjects from the Engineering Management concentration can frequently be combined with studies in another program concentration.

Academic inquiries

A/Prof Bob Spencer
Director
Engineering Management Graduate Program
Room 2-606, Level 6, Building 2
Telephone (+612) 9514 2660
Fax (+612) 9514 2655
Email: bob.spencer@uts.edu.au

Environmental Engineering and Management

49121	Environmental Assessment and Planning	6cp
49122	Ecology and Sustainability	6cp
49123	Waste and Pollution Management	6cp
49124	Water Quality Management	6cp
49125	Environmental Risk Assessment	6cp
49126	Environmental Management of Land	6cp

Academic inquiries

Dr Pam Hazelton
Director
Environmental Engineering and Management Graduate Program
Room 512, Level 5, Building 2
Telephone (+612) 9514 2661
Fax (+612) 9514 2633
Email: pam.hazelton@uts.edu.au

Groundwater Management

49550	Computing for Groundwater Specialists	0cp
49551	Surface Hydrology and Groundwater	6cp
49554	Groundwater Computing	6cp
49555	Groundwater Modelling	6cp
66025	Contaminated Site Management	6cp
66018	Geophysics	6cp
66015	Hydrogeochemistry	6cp
66014	Hydrogeology	6cp

Academic inquiries

Prof M Knight
Director
National Centre for Groundwater Management
Telephone (+612) 9514 1984
Fax (+612) 9514 1985
Email:
groundwater.management@uts.edu.au

Information Systems Engineering

49031	Information Structures, Perception and User-Interface Design	6cp
49241	Hypermedia Technologies	6cp
49242	Mono Media Technologies	6cp
49243	Development of Hypermedia Information Systems	6cp
49214	Unix and C	6cp
49244	Hypermedia Programming	6cp
49245	Hypermedia Systems and Architecture	6cp

Candidates are encouraged to take information science and visual communication subjects offered by other faculties, as part of the Master's program.

Academic inquiries

Dr David Lowe
Director
Information Systems Engineering Graduate Program
Room 2226, Level 22, Building 1
Telephone (+612) 9514 2526
Fax (+612) 9514 2435
Email: david.lowe@uts.edu.au

Local Government Engineering

49102	Traffic and Transportation	6cp
49103	Management and Industrial Relations	6cp
49104	Asset Maintenance Management	6cp
49105	Water Supply and Wastewater Management	6cp
49106	Road Engineering Practice	6cp
49107	Storm Runoff Regulation	6cp
49108	Local Government Law	6cp
49121	Environmental Assessment and Planning	6cp

Academic inquiries

Mr K Halstead
Director
Local Government Engineering Graduate Program
Room 522, Level 5, Building 2
Telephone (+612) 9514 2640
Fax (+612) 9514 2633
Email: ken.halstead@uts.edu.au

Manufacturing Engineering and Management

49308	Rapid Response Manufacturing	6cp
49309	Quality Planning and Analysis	6cp
49318	Manufacturing Systems Management	6cp
49319	Product Modelling and Analysis	6cp
49320	Industrial Tool Design and Manufacture	6cp
49002	Project Management	6cp
49306	Quality Systems – Implementation and Accreditation	6cp
49325	Computer Aided Mechanical Design	6cp
49324	Instrumentation and Condition Monitoring	6cp
49312	Advanced Flow Modelling	6cp
49326	Heat Transfer and Equipment Design	6cp
49322	Air Conditioning	6cp

Academic inquiries

A/Prof R M Spencer
Director
Manufacturing Engineering and Management Graduate Program
Room 606, Level 6, Building 2
Telephone (+612) 9514 2660
Fax (+612) 9514 2655
Email: bob.spencer@uts.edu.au

Software Engineering

Graduate subjects (Graduate Certificate)

49211	Software Engineering Principles	6cp
49212	Object Oriented Languages	6cp
49213	Human Machine Interfaces and Software Implementation	6cp
49214	Unix and C	6cp

Graduate subjects

49233	Software Requirements Specification	9cp
49234	Real Time Object-Oriented Software Development	9cp
49235	Real Time Operating Systems	3cp
49237	Software Quality and Configuration	3cp
49217	Software Verification and Validation	6cp
49225	Software Project Management	6cp
49236	Software Development Project	6cp

Notes: Credit for subjects completed in the Graduate Certificate will not be available in either the Graduate Diploma or the Master's degree, as there is no overlap of material between subjects.

To meet the needs of an emerging discipline, this program depends heavily on its industry partner, Thomson-CSF.

Subject availability depends on demand.

Subjects offered in either the Graduate Certificate, or the Master's may be taken as part of a general course, subject to prerequisites.

Academic inquiries

Mr J Leaney
Co-Director
Software Engineering Graduate Program
Room 2221A, Level 22, Building 1
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Fax (+612) 9514 2435
Email: jrleaney@eng.uts.edu.au

Structural Engineering

49131	Medium Span Bridges	6cp
49132	Stability of Structures	6cp
49133	Steel and Composite Design	6cp
49134	Structural Dynamics	6cp
49135	Wind Engineering	6cp
49136	Application of Timber in Engineered Structures	6cp
49141	Advanced Geomechanics	6cp
49142	Advanced Ground Modification	6cp
49151	Advanced Concrete Technology	6cp
49152	Damage and Repair of Concrete Structures	6cp
49047	Finite Element Applications in Structural Mechanics	6cp
49323	Vibration Analysis: Theory and Applications	6cp
49137	Railway Engineering	6cp

Academic inquiries

A/Prof B Samali
Co-director
Structural Engineering Graduate Program
Room 7079, Level 7, Building 2
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Fax (+612) 9514 2633
Email: bijan.samali@uts.edu.au

Telecommunications Engineering

49273	Random Signal Theory	6cp
49201	Integrated Services Network	6cp
40202	Communication Protocols	6cp
49203	Telecommunications Signal Processing	6cp
49204	Advanced Teletraffic Engineering	6cp
49205	Transmission Systems	6cp
49206	Advanced Studies in Electromagnetic Compatibility	6cp
49207	Wave Propagation for Microwave and Mobile Communications	6cp
49208	Telecommunications Management	6cp

Academic inquiries

Dr Michael Eckert
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Fax (+612) 9514 2435
Email: meckert@ee.uts.edu.au

Water Engineering

49107	Storm Runoff Regulation	6cp
49111	Coastal Engineering	6cp
49112	Urban Stormwater Flood Management	6cp
49113	Urban Stormwater Pollution Management	6cp
49114	Statistical Hydrology	6cp
49124	Water Quality Management	6cp
49551	Surface Hydrology and Groundwater	6cp
49554	Groundwater Computing	6cp
49555	Groundwater Modelling	6cp

Academic inquiries

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Water Engineering Graduate Program
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Subject descriptions

UNDERGRADUATE SUBJECTS

Subject descriptions are listed in numerical order. Information includes subject number, subject name, number of credit points (e.g. 6cp), type of subject (e.g. capstone project, engineering practice, core, fields of practice, elective), prerequisites and corequisites, if any, and a summary of learning objectives and content.

Key to abbreviations used in subject descriptions

The following abbreviations have been used to indicate where a subject forms a prescribed or recommended part of a major or course.

CE	Civil Engineering Major
CEE	Civil and Environmental Engineering Major
CSE	Computer Systems Engineering Major
ESE	Environmental Systems Engineering
EE	Electrical Engineering Major
ME	Mechanical Engineering Major
SE	Software Engineering
TE	Telecommunications Engineering Major
BEBA	Bachelor of Engineering, Bachelor of Arts in International Studies, Diploma in Engineering Practice
BEBBus	Bachelor of Engineering, Bachelor of Business
BScBE	Bachelor of Science, Bachelor of Engineering, Diploma in Engineering Practice
BT	Bachelor of Technology

25353

Business for Technologists

Offered by the Faculty of Business
BT
6cp; prerequisite: 48071 Numerical Methods; subject coordinator: Ms W Bui (Faculty of Business)

This subject introduces the basic economic principles to provide the student with an understanding of the business operating environment. Financial ratio analysis, financial mathematics and valuation process are then presented as essential tools for financial decision-making in the area of capital investment analysis, cost of capital, financing mix, capital structure and financial planning and forecasting.

This subject also covers the basic principles of marketing. It develops an understanding of the processes of market research and customer selection, product development, pricing strategies, promotional strategies and the distribution of goods and services to all sectors of the economy.

Assessment: assignments 15 per cent; case study 25 per cent; mid-semester exam 30 per cent; final exam 30 per cent.

31425

Principles of Software Development

Offered by the Faculty of Mathematical and Computing Sciences
SE, BEBA, BEBBus,
6cp; prerequisite: 48220 Informatics, corequisite: 48430 Software Development
Fields of Practice: Computer Systems Engineering Program

The specification and implementation of stacks, queues, lists, and trees are discussed as abstract data types. Formal mathematical specification of software, and program correctness are discussed. Program testing methods are emphasised throughout the subject, as are aspects of software quality such as usability.

31514

Computing Theory

Offered by the Faculty of Mathematical and Computing Sciences
SE, BEBA, BEBBus,
6cp; prerequisite: 31425 Principles of Software Development
Fields of Practice: Computer Systems Engineering Program

This subject introduces students to some of the theory underlying computing science. It includes such topics as formal methods and computational complexity.

31862

Principles of Human Computer Interaction

Offered by the Faculty of Mathematical and Computing Sciences
SE, BEBA, BEBBus,
6cp; prerequisite: 48440 Software Engineering
Fields of Practice: Computer Systems Engineering Program

Introduces students to the fundamental knowledge required to understand the nature and scope of HCI, the contribution to HCI of human factors, language and communications, and ergonomics, and the role of HCI in the software and systems design and development process. Approaches to incorporate HCI into the software design and systems development process will be examined with an emphasis on how HCI can ensure more usable software and systems.

32107

Formal Reasoning for Software Development

Offered by the Faculty of Mathematical and Computing Sciences
SE, BEBA, BEBBus,
6cp; prerequisite: 48440 Software Engineering, 48122 Engineering Practice Review 1
Fields of Practice: Computer Systems Engineering Program

This subject promotes a methodology where correctness is established before efficiency is considered. Specification languages allow the precise description of systems, while abstracting away from implementation concerns. Formal refinement allows programs to be developed from specifications, while preserving correctness. Semantics of languages provide a basis for reasoning about their correct implementation. Reasoning about concurrency is difficult; formal models of concurrency will be introduced.

32108

Specialist Topics in Artificial Intelligence

Offered by the Faculty of Mathematical and Computing Sciences
SE, BEBA, BEBBus,
6cp; prerequisite: 48440 Software Engineering
Fields of Practice: Computer Systems Engineering Program

This subject covers some important areas of artificial intelligence and their applications. These areas include, broadly, knowledge representation, problem solving, planning, knowledge-based systems, dealing with uncertainty, explanation facilities, machine learning, and applications of AI. The subject quickly introduces students to the basic AI techniques and then deals with individual topics in-depth. The subject may specialise in one or more sub-areas of AI.

31931

Software Quality Assurance

Offered by the Faculty of Mathematical and Computing Sciences
SE, BEBA, BEBBus,
6cp; prerequisite: 48440 Software Engineering, 48122 Engineering Practice Review 1
Fields of Practice: Computer Systems Engineering Program

Aims to provide students with the practical knowledge and skills that are necessary to effectively measure and control the quality of software products. Major topics are quality assurance principles, quality metrics, verification, validation and testing, implementing quality assurance, and software engineering methods and tools.

33130

Mathematical Modelling 1

Offered by the Faculty of Mathematical and Computing Sciences
CE, CEE, CSE, ESE, EE, ME, SE, TE, BEBA, BEBBus, BScBE
6cp; prerequisites: there are no formal prerequisites, but knowledge at the level of NSW HSC of 3-unit Mathematics is assumed; corequisite: 68037 Physical Modelling
Core

On completion of this subject students should be able to: understand the relevance of mathematics to engineering science and practice; understand the way in which mathematics can supply useful tools and resources to model real world problems; use mathematical terminology and concepts; use formal and informal language to demonstrate understanding of these concepts; demonstrate a high level of skill in the computational techniques of the subject; demonstrate understanding of the theoretical results which justify the use of these techniques; communicate the above knowledge clearly, logically and critically; use the computer algebra system *Mathematica* to perform calculations and explore mathematical ideas relevant to the subject content; be able to apply

the subject matter covered in lectures, tutorials and assignments to previously unseen problems; be aware of the historical context of mathematical development.

Topics include the following: presentation of a collection of physical problems; functions and their relationship to measurement and the interpretation of physical results; differentiability; differential equations arising from physical problems; solution by series; growth and decay problems; oscillatory motion; trigonometric functions and inverse trigonometric functions; integration; the logarithm function; inverse functions; methods of integration; and introduction to nonlinear oscillations.

The computer algebra system *Mathematica* will be used throughout the subject as an aid to computation, graph plotting and visualisation.

33132

Mathematical Modelling 1 (2 semester mode)

Offered by the Faculty of Mathematical and Computing Sciences
CE, CEE, CSE, ESE, EE, ME, SE,TE, BEBA, BEBBus, BScBE
6cp; prerequisites:There are no formal prerequisites, but a knowledge of 3-unit Mathematics is assumed; corequisite: 68036 Physical Modelling (2 semester mode)
Core

Refer to 33130 Mathematical Modelling 1 for subject description.

33190

Mathematical Modelling for Science

Offered by the Faculty of Mathematical and Computing Sciences
6cp; 6hpw; no formal prerequisite but a knowledge of 2 Unit HSC Mathematics is assumed

Functions and their relationship to scientific experiments. Differentiability. Differential equations arising from scientific problems. Solution by series. Radioactive decay and exponential functions. Oscillatory motion and trigonometric functions. Integration. The logarithm function. Inverse functions. Inverse trigonometric functions. Solution of differential equations by integration and inverse functions. The computer algebra system *Mathematica* will be used for symbolic, graphical and numerical computations.

33230

Mathematical Modelling 2

Offered by the Faculty of Mathematical and Computing Sciences
CE, CEE, CSE, ESE, EE, ME, SE,TE, BEBA, BEBBus, BScBE
6cp, prerequisites: 33130 Mathematical Modelling 1 or 33132 Mathematical Modelling 1 (2 semester mode)
Core

On completion of this subject students should be able to: understand the relevance of mathematics to engineering science and practice; understand the way in which mathematics can supply useful tools and resources to model real world problems; use mathematical terminology and concepts; use formal and informal language to demonstrate understanding of these concepts; demonstrate a high level of skill in the computational techniques covered in the subject content; demonstrate understanding of the theoretical results which justify the use of these techniques; communicate the above knowledge clearly, logically and critically; use the computer algebra system *Mathematica* to perform calculations and explore mathematical ideas relevant to the subject content; be able to apply the subject matter covered in lectures, tutorials and assignments to previously unseen problems and proofs; be aware of the historical context of mathematical development.

Topics include the following: linear algebra; solutions to sets of equations resulting from particular problems; the need to develop a variety of ways of solving sets of equations; matrices and determinants, eigenvectors and eigenvalues; a standard treatment of vectors building on that given in Physical Modelling; partial derivatives using waves and temperature distributions as illustrative examples; optimisation; the method of least squares; multiple integrals and their applications; probability with a focus on the determination of the reliability of a system of components in various engineering contexts; variance, skewness and kurtosis; probability distributions, conditional probability and bivariate probability.

The computer algebra system *Mathematica* will be used throughout the subject as an aid to computation, graph plotting and visualisation.

33290

Computing and Mathematics for Science

Offered by the Faculty of Mathmatical and Computing Sciences
6cp; 6hpw; prerequisite: 33190 Mathematical Modelling for Science

In the computing component of this subject students will study a range of computing modules designed to give them basic computing application skills and some more advanced modules appropriate to their particular discipline. The mathematics component will include studies of simultaneous linear equations and their occurrence in scientific problems; methods for solving these equations using matrices and determinants; eigenvalues and eigenvectors; vectors in two and three dimensions; products of vectors; spatial geometry and coordinate systems; functions of several variables; partial derivatives; optimisation; method of least squares. The computer algebra system *Mathematica* will be used for symbolic, graphical and numerical computations.

33390

Mathematics and Scientific Software

Offered by the Faculty of Mathmatical and Computing Sciences
6cp; 4hpw; prerequisite: 33290 Computing and Mathematics for Science

Methods of Integration. Double and triple integrals and their application to scientific problems. The use of spherical and cylindrical coordinates. Linear algebra and its relationship to boundary value problems. Inner products and orthogonality. Separation of variables. Fourier series. An introduction to C and *Mathematica* programming in the context of problems from this subject and its prerequisite.

33490

Computational Mathematics and Physics

Offered by the Faculty of Science and the Faculty of Mathematical and Computing Sciences
6cp; 5hpw; prerequisites: 68201 Physics 2; 33390 Mathematics and Scientific Software

This subject highlights the role of computational methods in the solution of models for physical systems. The mathematics strand provides a context for which computational techniques can be developed. Boundary value problems and partial differential equations, vector calculus and analysis of complex variables are needed to describe a wide variety of 'real world' problems and basic physics phenomena. The computational tools that will be developed to complement these analytical techniques include numerical integration methods, Fourier techniques and matrix manipulations.

Students will develop not only sophisticated modelling skills, but also will have gained insights into the process of modelling and the ability to make value judgments on model predictions. This is a generic skill that is very transferable to other fields. You will have developed a set of computational utilities that you will be able to re-use in later subjects and project work. A small group project spanning both components of the subject will form a major part of the assessment.

48006

Capstone Project (6cp)

CE, CEE, ESE, ME, SE,TE, BEBA, BEBBus
6cp; prerequisites: 48320 Engineering Management, and at least 84cp of fields of practice subjects; corequisites: 48142 Engineering Practice Review 2; 48270 Technology Assessment

Objectives of the capstone project are: to bring together and integrate knowledge and skills gained in the course as a whole, including engineering principles, planning and design, ethics, management, and communication, and to apply these to an initially unstructured problem formulated by each student in consultation with an adviser; to reinforce and develop competencies that have not been sufficiently emphasised in the student's choice of subjects or engineering practice to date; to define a substantial engineering study or design task, place it in context, and carry it to completion within a specified time and to a professional standard; to complete a comprehensive written and bound report that places the project in context, defines its objectives, and describes the work done and the resulting conclusions or recommendations; to provide a bridge to the student's professional future, and opportunity to demonstrate professional competencies and capabilities; to provide scope to demonstrate initiative and creativity, and take pride in achievement.

Each student is required to undertake a substantial engineering project, normally during their final year of study, and to prepare a formal report describing the work performed and the resulting conclusions and recommendations. The work is planned and carried

out under the supervision of a member of academic staff. Both the work and the report must meet professional engineering standards. The project may be in any area of engineering. Students may choose a topic relating to their experience in engineering practice, or an area of interest which they wish to study in detail. Typical projects might take any of the following forms: literature review – a study of the available literature and a state-of-the-art appraisal of an area of engineering; design – the complete design of a substantial engineering artefact or system; experimental investigation – a comprehensive laboratory investigation or testing program; research and development – original research of a fundamental or applied nature, or development of a new application of a particular technology; computer-based analysis – development or use of computer software to study the behaviour of an engineering solution; project management – planning and management of a substantial engineering project, normally in a workplace, business or community context; combining technical and management skills; impact analysis, planning, system design – study and analysis of an engineering solution in its economic, social and environmental context, integrating the engineering dimension with cross-disciplinary interfaces, and optimising overall system design, normally interactive with other professions.

48012

Capstone Project (12cp)

CSE, EE, BEBA, BEBBus, BScBE
12cp; prerequisites: 48260 Engineering Management, at least 84cp of fields of practice subjects; corequisites: 48142 Engineering Practice Review 2; 48270 Technology Assessment

Refer to the subject description for 48006 Capstone Project.

48070

Engineering Materials

BT
6cp
subject coordinator: Mr W J Dartnall

This subject builds on the knowledge of chemistry and materials from the Associate Diploma. It provides students with an understanding of the use of materials in the engineering environment.

Chemistry topics include: electronic structure of the atom, periodic table, chemical bonding, states, stoichiometry, thermochemistry, aqueous solutions, metals, electrochemistry, organic chemistry. Materials Science topics include: properties, behaviour, application and testing of common engineering materials. Particular emphasis will be placed on newer materials, including ceramics and composites. Ferrous and non-ferrous metals and plastics will also be treated. In covering these topics specific applications in industry within design and maintenance will be emphasised.

Assessment: assignments 20 per cent; mid-semester examination 30 per cent; final examination 50 per cent.

48071

Numerical Methods

BT
6cp
subject coordinator: Mr W J Dartnall

This subject builds on students' knowledge of mathematics from the Associate Diploma. It assumes a knowledge of introductory calculus. It provides students with an understanding and use of numerical methods in the engineering environment. It lays the foundations to enable students to confidently use numerical techniques in subsequent subjects and the work environment.

Topics include: applications of sequences and series; linear algebra; matrices, vectors and determinants; applications of matrices and vectors; vector algebra in 2-space and 3-space; introduction to vector calculus and applications; curve fitting using least squares methods for polynomials, log-linear and log-log relationships; engineering applications of differential equations (first and second order); numerical methods in linear algebra and in the solution of differential equations; graph theory and optimisation; use of the Simplex method; introduction to combinatorial optimisation; probability and statistics including probability theory, permutations and combinations, probability distributions, binomial, Poisson and normal distributions; sampling, confidence intervals and hypothesis testing.

Assessment: assignments 20 per cent; mid-semester examination 30 per cent; final examination 50 per cent.

48072

Information Technology

BT
6cp
subject coordinator: Mr D M Eager

This subject aims to familiarise the student with the use of basic software and hardware

for computers, especially personal computers, and to start to develop an appreciation of the diverse uses made of computers by engineers. The computer is introduced as an aid to design, communication and as a means for solving engineering problems. The emphasis is on popular personal computers applications and computer-aided design.

Personal computing topics include hardware familiarisation, the operating system, word processing, spreadsheets, databases, visual presentation software and elementary programming.

Computer-aided design (CAD) topics introduce three-dimensional model development as well as the associated documentation and communication of the design. Students explore management issues related to CAD and investigate the role of CAD in the design process and in the overall information needs of an organisation. Practical laboratory sessions incorporate wireframe, surface and solid modelling schemes and demonstrate the power of parametric capability. The combination of practical experience and an understanding of the information and management aspects of CAD, prepare students for making management decisions about CAD.

Assessment: reports 40 per cent; assignments 20 per cent; examinations 40 per cent.

48073

Professional Development

BT

6cp; prerequisites: 48074 Engineering Communication and Documentation; 48203 Technological Change and Strategic Planning; corequisites: 48075 Engineering Management; 48205 Design for Manufacture
subject coordinator: Mr W J Dartnall

This is a core and capstone subject. It has two components: the industrial environment, and a major project.

The industrial component concentrates on people-related aspects of engineering management. The psychology and sociology of small group behaviour are introduced and explored. The subject investigates the engineering sector within Australian industry, covering the following topics: employment analysis, relevant government policies, industrial relations, occupational health and safety, the implications of moving towards ecologically sustainable development.

The major project component involves the preparation by the student of a industry-based project. The project involves an investigation at technologist level giving an opportunity to synthesise knowledge gained in industry with that obtained at UTS by the documentation of a complex work-related problem. The project will include a poster and a seminar presentation.

Assessment: seminar presentation 10 per cent; poster 10 per cent; literature review 20 per cent; major report 50 per cent; and class participation 10 per cent.

48074

Engineering Communication and Documentation

BT

6cp; prerequisite: 48072 Information Technology
subject coordinator: A/Prof H T McGregor

This subject covers the various aspects of the communication process in an engineering context. Students participate in workshop sessions to develop written, oral and graphic skills. Basic communication theory is used as a foundation for practical work in research techniques, designing and producing letters, reports, discussion papers and other engineering documents. Oral skills are developed through conferences, seminars, interviews, meetings, debates and small group discussions. Students consider documentation as both a process and an outcome and develop management strategies to apply basic communication theories to the development of integrated information systems.

Assessment: oral presentations 30 per cent; research paper 30 per cent; major reports 30 per cent; and class participation tasks 10 per cent.

48075

Engineering Management

BT

6cp; prerequisite: 48074 Engineering Communication and Documentation; corequisite: 79370 Law and Contracts
subject coordinator: Mr D M Eager

This subject provides a background in classical management theory. It is a core subject in the Bachelor of Technology program and aims to prepare the student for management positions within Australian industry. The overriding feature is management decision-making by the use of examples in the fundamental functions of management, and a study of the management of uncertainty, risk and change.

Topics covered will include planning; organising; leading and controlling; decision-making; break-even analysis; return on investment; and inventory control.

Assessment: assignments 30 per cent; presentation and report 20 per cent; major reports 40 per cent; and class participation 10 per cent.

48110

Engineering Experience 1

CE, CEE, CSE, ESE, EE, ME, SE,TE, BEBA, BEBBus, BScBE
0cp; prerequisites: 48121 Engineering Practice Preview 1, either 48210 Engineering for Sustainability; or 48220 Informatics; and one of 48310 Introduction to Civil Engineering or 48510 Introduction to Electrical Engineering or 48610 Introduction to Mechanical Engineering or 48720 Introduction to Telecommunications Engineering or 48820 Introduction to Environmental Engineering
ENGINEERING PRACTICE

Engineering educators, as well as engineering employers, have long recognised the value of integrating practical experience with academic studies. Engineering Experience 1 and 2 are zero credit point subjects that support students while they are working in industry or the community for the purpose of gaining experience in the practice of engineering. Engineering Experience 1 provides students with the opportunity to discover engineering workplace culture and to develop their basic technical skills. It is expected that students will gain this level of experience early in their academic program. One semester prior to undertaking the experience students must enrol in the subject Engineering Practice Preview 1. Students may enrol in Engineering Experience 1 for more than one semester while they are working at a basic level and they need not take additional semesters of Engineering Practice Preview 1, however, they are encouraged to progress to higher levels of engineering practice.

Material to be taught and learnt: Each student's experience will be unique. What is learned will be a function of a number of factors affecting the experience. Employer or host organisations are not expected to provide formal training although some may choose to do so. Instead students are required to become active learners and seek opportunities to fulfil the objectives of this experience module. Students are assisted in this process through Engineering Core and Field of Practice subjects and specifically through Engineering Practice Review 1.

48120

Review of Engineering Practice 1

CE, CEE, CSE, EE, ME,TE, BEBA, BSc BE
6cp (exemption process)
ENGINEERING PRACTICE

This subject has been introduced for the purpose of assisting students who commenced before 1998 in the BE course and wish to transfer to the BE DipEngPrac. It is a substitute for the two new 3cp subjects 48121 and 48122. Students who have completed 44 weeks of industrial experience under the old course can apply for an exemption in this subject as a means of simplifying the transfer to the BE DipEngPrac.

48121

Engineering Practice Preview 1

CE, CEE, CSE, ESE, EE, ME, SE,TE, BEBA, BEBBus, BScBE
3cp; prerequisite: nil
ENGINEERING PRACTICE

Engineering Practice Preview 1 helps initiate students to the engineering workplace by guiding them through the employment process, developing the communication and documentation skills appropriate to engineering practice, exploring the nature and culture of the workplace, introducing ethical and social issues, and helping them to plan for their own personal and professional development.

Students will negotiate their learning options from a range of compulsory and optional topics including: The Employment Process, Learning to Learn, Ethics and Social Responsibility, Industrial Relations, Occupational Health and Safety and The Culture of Engineering.

Assessment tasks will be negotiated from a variety of compulsory and optional assignments, many of which can be incorporated into the student's portfolio. Some tasks include: personal resumé, job application letters, employment interviewing, learning style assessment, learning contracts, ethics case study, industrial relations case study. Assessment will essentially be formative to assist students in achieving an acceptable level. However, students will not be able to undertake Engineering Experience 1 until they have passed all the compulsory components of Engineering Practice Preview 1.

48122

Engineering Practice Review 1

CE, CEE, CSE, ESE, EE, ME, SE,TE, BEBA, BEBBus, BScBE
3cp; prerequisite: 48110 Engineering Experience 1
ENGINEERING PRACTICE

Engineering Practice Review 1 guides students through a process of thoughtful reflection and review of their engineering experience. Workplace issues are examined and students are assisted in developing appropriate professional strategies. Students identify the technical and professional advancement that has occurred as a consequence of their experience, and integrate these new ideas with their existing knowledge frameworks. This learning is documented for peer and professional review.

Since each student's work experience will be unique, all students will benefit from sharing and discussing their experiences. What each individual student learns will be a function of a number of factors affecting their workplace experience. However, this subject assists all students to receive a firm grounding in the fundamentals of engineering workplace practice, including: the nature and culture of the engineering workplace, the employment process, ethics and social responsibility, communication and documentation, the application of engineering method, occupational health and safety, industrial relations, and personal and professional development.

Assessment tasks include: evaluation of learning contract, report of workplace experience, group review, logbook and portfolio.

48130

Engineering Experience 2

CE, CEE, CSE, ESE, EE, ME, SE,TE, BEBA, BScBE
0cp, prerequisite: 48141 Engineering Practice Preview 2
ENGINEERING PRACTICE

Engineering Experience 1 and 2 are zero credit point subjects that support students while they are working in industry or the community for the purpose of gaining experience in the practice of engineering. Engineering Experience 2 expects that students will be advanced in their academic studies and be working closely with engineering professionals in order to extend their understanding of the practice of professional engineering and to apply, test and further develop their technical skills. One semester prior to undertaking the experience students must enrol in the subject Engineering Practice Preview 2. Students may enrol in Engineering Experience 2 for more than one semester while they are working at this para-professional level; and they need not take additional semesters of Engineering Practice Preview 2. However, they are encouraged to progress to a professional level of engineering practice.

Material to be taught and learnt: Each student's experience will be unique. What is learned will be a function of a number of factors affecting the experience. Employer or host organisations are not expected to provide formal training although some may choose to do so. Instead students are required to become active learners and seek opportunities to fulfil the objectives of this experience module. Students are assisted in this process through Engineering Core and Field of Practice subjects and specifically through Engineering Practice Review 2.

48140

Review of Engineering Practice 2

CE, CEE, CSE, ESE, EE, ME, SE,TE, BEBA, BScBE
6cp, prerequisites: 48120 Review of Engineering Practice 1 plus an additional 24 weeks of engineering experience at a professional level
ENGINEERING PRACTICE

This subject has been introduced for the purpose of assisting students who commenced before 1998 in the BE course and who have transfered to the BE DipEngPrac. It is used with the permission of the Director of the Engineering Practice Program where the normal process of enrolling in the 3cp subjects 48141 and 48142 would unreasonably delay graduation.

48141

Engineering Practice Preview 2

CE, CEE, CSE, ESE, EE, ME, SE,TE, BEBA, BScBE
3cp; prerequisite: 48122 Engineering Practice Review 1

Engineering Practice Preview 2 helps students to develop as professional engineers by refining employment-related processes, developing the communication and documentation skills appropriate to professional engineering practice, exploring issues of organisational management and commercial practice, examining ethical and

social issues, applying theory in practice and developing strategies for continuing professional development.

Students will negotiate their learning options from a range of compulsory and optional topics including: the nature and culture of professional engineering, the professional employment process, engineering in a global social context, organisational behaviour, management and commercial practice, industrial relations and human resource issues, communication and documentation, leadership and teamwork, occupational health and safety, ethics and social responsibility, experiential learning and knowledge creation, and personal and professional development.

Assessment tasks will be negotiated from a variety of compulsory and optional assignments, many of which can be incorporated into the student's portfolio. Some tasks include: professional resumé, employment and assessment interviewing, learning contracts, ethics case study, industrial relations case study, occupational health and safety case study. Assessment will be formative to assist students in achieving an acceptable level. However, students will not be able to undertake Engineering Experience 2 until they have passed all the compulsory components of Engineering Practice Preview 2.

48142

Engineering Practice Review 2

CE, CEE, CSE, ESE, EE, ME, SE, TE, BEBA, BScBE
3cp; prerequisite: 48130 Engineering Experience 2

Engineering Practice Review 2 helps students to develop as professional engineers by refining employment-related processes, developing the communication and documentation skills appropriate to professional engineering practice, exploring issues of organisational management and commercial practice, examining ethical and social issues, applying theory in practice and synthesising their new experience with their prior learning to develop personal and career objectives. This learning is documented for peer and professional review.

Since each student's work experience will be unique, all students will benefit from sharing and discussing their experiences. What each individual students learns will be a function of a number of factors affecting their workplace experience. However, this subject assists all students to receive a firm grounding in the fundamentals of professional engineering workplace practice, including: engineering in a global environment, organisational behaviour, commercial practice, industrial relations and human resource issues, ethics and social responsibility, communication and documentation, the extension and application of engineering knowledge, occupational health and safety, industrial relations, and personal and professional development.

Assessment tasks include: evaluation of learning contract, report of workplace experience, group review, logbook, and portfolio.

48201

Manufacturing Process Systems

BT
6cp; 3hpw
subject coordinator: Dr J Madadnia

Manufacturing process systems is the foundation subject in the manufacturing strand. This subject provides a broad perspective on Australian and global manufacturing and their interaction. It is presented in a format so as to assist transition from a TAFE to a university learning environment.

A brief history and analysis of manufacturing is presented in an economic and political context. Students explore the scope of manufacturing in Australia through interviews, factory visits, presentations and a professional report. The subject aims to develop an understanding of manufacturing systems, principles and their application.

Topics covered will include development and analysis of manufacturing systems, history and characteristics of manufacturing in Australia, manufacturing processes, global manufacturing, and the evolution of manufacturing in Australia.

Assessment: assignments 30 per cent; seminar presentation and major report 20 per cent; factory visits 10 per cent; and examinations 40 per cent.

48202

Inspection and Instrumentation

BT
6cp; corequisite: 48071 Numerical Methods
subject coordinator: Dr F C O Sticher

This subject introduces the principles and concepts of inspection in the manufacturing environment, and provides exposure to a wide range of measuring instruments used in the manufacturing industry.

Topics include the importance of inspection in manufacturing industry; introduction to measurement; distance, velocity and acceleration measurement; mass, force, strain, torque and pressure measurement; contact and infra-red temperature measurement; measuring dynamic variables; calibration, accuracy and error measurement; fluid quantity and flow measurement; optical and pneumatic comparators; slip gauges, line and end standards; measurement of straightness, flatness and alignment; screw thread measurement; measurement of surface texture; coordinate measuring machines; and other measuring systems.

Assessment: laboratory reports 20 per cent; industrial visit report 10 per cent; seminar presentation and major report 20 per cent; mid-semester examination 20 per cent; and final examination 30 per cent.

48203

Technological Change and Strategic Planning

BT
3cp; prerequisite: 48074 Engineering Communication and Documentation; corequisite: 48070 Engineering Materials
subject coordinator: Mr W J Dartnall

This subject develops awareness that technology is constantly changing and is influenced by economic, political and social issues. It also provides insight into company strategic planning policies and develops an understanding and appreciation of technological change. Students consider ways of coping with changes and turning these changes into opportunities.

Topics include a brief overview of technological change from Sung China to the 20th century; the Industrial Revolution; Kondratieff cycles; invention and innovation; research, design and development; energy and other sources; trading blocks; multinational companies; strategic planning; and sustainable development.

Assessment: seminar presentation 25 per cent; major reports 45 per cent; and class participation 30 per cent.

48204

Maintenance Management

BT
3cp; prerequisite: 48072 Information Technology; corequisite: 48074 Engineering Communication and Documentation
subject coordinator: Dr R B Ward

This subject provides a basic knowledge of the management of maintenance in the manufacturing industry – by an introduction to current procedures, processes, philosophy and equipment, in order to prepare the student for managing the repairs to, replacement of, and value of, industrial assets and property.

Topics include an introduction to the financial considerations of asset management, such as Net Present Value and Depreciation; the economics of repair versus replacement; and how maintenance relates to an enterprise as a whole. Under a range of appropriate conditions it covers items such as the effect of design on maintainability, the relationship between plant availability for production and maintenance, maintenance strategies and their dependence on situations, maintenance planning, condition monitoring, failure analysis, loss control, and the organisation, operation and costing of a maintenance department.

Assessment: seminar presentation 25 per cent; literature review 30 per cent; major reports 30 per cent; and class participation 15 per cent.

48205

Design for Manufacture

BT
6cp; prerequisites: 48072 Information Technology; 48071 Numerical Methods; corequisite: 48203 Technological Change and Strategic Planning
subject coordinator: Ms C P Killen

This subject provides an overview of the complete product development cycle – from the initial concept to the end customer. Integral to this product development cycle is the design–manufacture interface. This subject focuses on the relationship between design and manufacturing. Current philosophies and techniques that are used to improve the design and manufacture of the product form the core content. The subject builds on knowledge and techniques developed in earlier subjects. A comprehensive framework is developed for making decisions in modern manufacturing environments. CAM will be introduced and used to provide the student with an

understanding of the various elements of machine control data programs, the application of CAD/CAM systems in generating part programs and the role of CLDATA and post-processing in the programming task.

Topics include concurrent engineering; quality function deployment; design for manufacture and assembly; design of experiments; material and process selection; decision-making aids; value analysis; process analysis; and computer-aided process planning.

Assessment: projects 60 per cent; examinations 40 per cent.

48206

Quality for Manufacture

BT
3cp; prerequisites: 48071 Numerical Methods; 48202 Inspection and Instrumentation
subject coordinator: Mr W J Dartnall

This subject covers the principles, practices, tools and techniques of Total Quality Management (TQM).

The history of quality control is introduced with mention of such pioneers as Shewart and Deming. Examples are drawn from the work of Shewart and Deming to show the evolution of ideas leading to TQM. Deming's 14 points are discussed along with some of the current philosophies behind TQM. The current practices of TQM are covered. On completion of this course, the student will be able to understand the concept and principles of quality control techniques and implement systems to improve the quality of any process.

Tools and techniques will include Statistical Process Control (SPC), ISO 9000, Australian Standards, benchmarking and experimental design. Certain topics such as Quality Deployment Function (QDF) and Taguchi methods are introduced.

Assessment: assignments 30 per cent; mid-semester examination 20 per cent; final examination 50 per cent.

48210

Engineering for Sustainability

CE, CEE, CSE, ESE, EE, ME, SE,TE, BEBA, BEBBus, BScBE
6cp
Core

Upon completion of this subject, students should be able to demonstrate development in the following areas:

- orientation to university study;
- ability to read critically and write appropriately in a variety of academic contexts;
- appreciation of the social and historical contexts of engineering;
- awareness of different definitions of 'progress';
- awareness of what is 'professionalism';
- appreciation of the role of codes of ethics; and
- appreciation of the principles of sustainability.

This subject takes students on a journey into the past, present and future of engineering and its relationship to society and the environment. They will choose one of several module groups based around broad engineering-related themes.

Within these modules, students will be examining the contributions made by engineers in their respective areas, how they were received by and benefited different groups in society, and what impact they had on the environment. Current and historical case studies from our local communities as well as from other parts of the world will be used to illustrate the different ways in which technologies have evolved and have been valued.

The subject is taught by an interdisciplinary team who will present lectures, and facilitate interactive workshops. Assessment includes individual reflective writing, case study reports, and team-based poster presentation. In each of these assessment tasks, students are assessed both for their learning of key content material and academic skills such as critical reading and analysis, and academic writing and presentation.

48220

Informatics

CE, CEE, CSE, ESE, EE, ME, SE,TE, BEBA, BEBBus, BScBE
6cp
Core

The objectives of this subject are: to develop a deep understanding of the types of engineering problems which can benefit from the use of information and computational tools; to identify these benefits, the types of tools and their appropriateness, strengths and limitations; to develop an understanding of the application of, and specific skills in applying, informatics tools to engineering problems (and in particular in the areas of utilising information, oral and written communication, teamwork, resource management, design processes); and to develop maturity with respect to critical thinking and professional ethics.

Topics include: consideration of issues related informatics tools and categories of informatics tools, types of problems which can benefit from these tools, benefits of using tools, limitation of tools, relevance of tools to different types of problems; consideration of issues related to using tools to identify, structure, conceptualise, visualise, articulate, and reason about engineering problems; consideration of issues related to how tools relate to the culture of engineering, engineering ethics, and critical thinking; specific skills in computing programming fundamentals, and a specific programming language; skills in using operating systems, written and oral communication software, spreadsheets, Internet tools, mathematical modelling tools, databases, teamwork tools, and project management tools.

48230

Engineering Communication

CE, CEE, CSE, ESE, EE, ME, SE,TE, BEBA, BEBBus, BScBE
6cp; prerequisite: 48220 Informatics
Core

On completion of this subject students should be able to: understand basic principles and theories of human communication; research within the various discipline areas that inform the study of communication; write competently in a number of different genres; perform competently in a variety of oral communication situations; understand basic principles and practices of graphic communication; demonstrate their ability to express engineering concepts through graphical communication; demonstrate their ability to 'converse' mathematically; lead and participate in group processes; appreciate the central role of communication in engineering practice.

Topics include: principles and theories of communication; communication in practice; the processes of communication; and communication technology.

48240

Uncertainties and Risks in Engineering

CE, CEE, CSE, ESE, EE, ME, SE,TE, BEBA, BEBBus, BScBE
6cp; prerequisites: 48220 Informatics; 33230 Mathematical Modelling 2
Core

The objectives of this subject are: to develop in students a critical understanding of ideas concerning decision-making under risk, uncertainty, ignorance and indeterminacy (and an appreciation that each person and group has knowledge, attitudes and beliefs about risk and uncertainty which, to the individual or group, are 'rational'); to explore the contexts in which experts, including professional engineers, manipulate problems involving risk and uncertainty; to develop a critical appreciation of the uncertainties and subjectivities inherent in modelling; and to equip students with the ability to select and apply appropriate statistical tools, to acquire additional statistical competencies, and to understand their strengths and limitations.

Topics include: Decision making under risk, uncertainty, ignorance or indeterminacy – history of decision making under risk, uncertainty, etc.; cultural approaches to risk and uncertainty (approaches which emphasise the plurality of rationalities); the modern dependence on or fascination with quantification; historical origins of statistics and risk analysis; new approaches to negotiating risk and uncertainty decisions: the primacy of open process, trust, and valuing contextual knowledge over quantitative risk estimates; the sociology of knowledge; case studies concerning, for example, Chernobyl, lawyers' approaches to knowledge, and probabilistic knowledge; communicating and negotiating uncertainty and risk. Formal definitions of risk, uncertainty, indeterminacy and ignorance – connections to risk management and to sustainability, especially the Precautionary

Principle; connections to communication, safety, reliability, quality, investment risk, measurement, and system performance evaluation; sources of errors; limitations of models as predictive tools; risk transfer, risk modification, and risk avoidance. The role of formal methods of handling risk and uncertainty – standards, codes, and expert or professional knowledge in resolving risk or uncertainty, particularly in engineering and related professions; how models are constructed and used as the basis for codes and standards; examples and connections to the fields of practice/programs; the complexity of engineering decisions and the reductionist approach to classifying problems; ensuring predictability, quality and reliability in the face of the random perturbations and uncertainties inherent in systems. Techniques for modelling and analysing uncertainties and risks – in order to be able to examine some hypotheses about risk and uncertainty, appreciation of the process of and mastery of some of the skills for modelling and analysis will be developed, including: different classifications of mathematical models and modelling methods, e.g. stochastic, deterministic, mixed stochastic-deterministic, parameteric, black box, simulation; linear, nonlinear, lumped parameter, distributed parameter; static, dynamic; regression and correlation analysis; choice of variables and relationships to model; sources of uncertainty propagation in models, e.g. measurement uncertainties, propagation of computational errors, system noise and disturbances, unmodelled variables, non-quantifiable variables and effects; measures of certainty and uncertainty in models, e.g. robustness, confidence intervals, statistical inference based on hypothesis testing; mechanisms for minimising effects of uncertainties in models and systems, e.g. feedback, filters, and redundancy; model verification e.g. tests of goodness of fit; model validation, e.g. statistical forecasting; how decisions are made under uncertainty; different approaches to documenting and communicating the results of statistical modelling and decision making.

48250

Engineering Economics and Finance

CE, CEE, CSE, ESE, EE, ME, SE, TE, BEBA, BScBE
6cp
Core

The objectives are for students to be able to use an understanding of engineering culture to develop an understanding of the relationship between economics and finance and engineering; to gain a working knowledge of macro and micro economic theories in the context of engineering practice, ethics and sustainability; to acquire skills in determining the appropriate use and limitations of various economic and financial models and techniques used to define/manage/analyse engineering activities; to develop competence in identifying and working through the economic and financial aspects of an engineering project/case study; to become aware of the impact of various economic and financial models and techniques on the social and technical dimensions of engineering activity; to integrate economic and financial understanding and fields of practice specialist knowledge in project-based/case study work.

Topics include: a basic understanding of macro economics, micro economics and environmental economics; awareness of the philosophies underpinning economics, and terms and methods used by economists and accountants; analysis of engineering economic models including cost-benefit analysis, multiple-objective analysis etc; skills in assessing and using accounting and financial concepts especially in context of small business but including awareness of management accounting.

48260

Engineering Management

CE, CEE, CSE, ESE, EE, ME, SE, TE, BEBA, BEBBus, BScBE
6cp; prerequisites: 48122 Engineering Practice Review 1 or 48120 Review of Engineering Practice; 48240 Uncertainties and Risks in Engineering
Core

This subject enables students to develop the following: an appreciation that management is integral to engineering in aspects ranging from the personal to the organisational; an awareness of the roles and functions of management – general, engineering and project management; an understanding of the rationale underpinning various engineering

and project management models and tools and the interaction with engineering practice. It introduces and analyses a range of engineering and project management tools, developing an appreciation of their appropriate uses, strengths and weaknesses. Building on awareness developed in earlier subjects, and through work place experiences, it introduces students to the potential impacts of engineers' decisions and management on the community and the client. Students will acquire skills in choosing and using the most appropriate engineering and project management tools for identifiable engineering activities.

Topics include: concepts of general management and engineering and project management and their relationships; systems/product life cycle model and the various contributions which engineers make, or can make, during this cycle; and the contributions of other occupations; models used to visualise the processes occurring during the cycle, and for envisaging management and decision making; the range of tools which can be applied for various purposes during the cycle e.g. to make decisions, manage people, manage resources, audit and account for management of resources, etc; historical development of this range of management, theories, tools, and models, and the arguments for and against them; engineering and project management; and the capabilities required of engineering managers.

48270

Technology Assessment

CE, CEE, CSE, ESE, EE, ME, SE,TE, BEBA, BScBE
6cp; prerequisite 48240 Uncertainties and Risks in Engineering
CORE

The objective of this subject is to provide students with an understanding of the development of impact as a concept, and to gain an appreciation of how it has been specifically constructed within the engineering culture.

Students will consider the concept of impact within the frameworks of technology assessment techniques; acquire an appreciation of and sensitivity to different interpretations of the impact of technologies; examine how different understandings of the concept of impact affect the relationships between technological professions and society; compare and critique methodologies and strategies for dealing with the impacts of engineering activity; develop skills in determining the appropriate use of various techniques used by decision makers to manage/determine the impact of engineering activity; develop skills in involving community in decision making regarding the impact of engineering activity; gain an appreciation of the diversity of engineering practice and its interdependence with other professions; experience and reflect on the interdisciplinary nature of engineering activity.

48301

Mechanical Services

BT
6cp
subject coordinator: Mr D M Eager

This subject provides skills in estimation of building cooling and heating loads; the design of simple airconditioning systems; and the design of piped systems for the circulation of water and refrigerants as heat transfer media. Students will also gain an understanding of the principles of energy and mass transfer underlying mechanical services systems and fundamentals of noise control, water supply and drainage and fire suppression systems.

Assessment: laboratory 5 per cent, seven assignments: four worth 10 per cent each; two worth 15 per cent each; and one worth 25 per cent.

48302

Computer Aids for Airconditioning Design

BT
6cp
subject coordinator: Mr D M Eager

This subject provides an introduction to the use of micro-version software for the following: estimation of cooling and heating loads in buildings; simulation of HVAC system operation and estimation of energy consumption over time; and analysis of distribution of air and heat in complex building spaces by application of computational fluid dynamics. Students will gain familiarity with the application of software programs in common use in Australia. It is expected that they will be able to apply learned skills to design applications and to evaluation of the impact on thermal flows of alternative methods and materials of construction.

Assessment: four equally weighted modelling exercises 80 per cent, and essay 20 per cent.

48303

Service Control Systems

BT
3cp; prerequisite: 48301 Mechanical Services
subject coordinator: Mr D M Eager

This subject provides knowledge of electric control circuits and electric and pneumatic control elements as applied to the design of automatic control systems for air handling and refrigeration systems; and creates an understanding of the selection and application of electronic, programmable logic and direct digital control systems. On completion of the subject it is expected that students will have gained a knowledge of the capabilities and limitations of electric, electronic, pneumatic and computer-based control systems for HVAC applications with an understanding of the types of controllers available to perform automatic control functions. They will also be able to design automatic control systems for HVAC applications and to prepare and understand control diagrams.

Assessment: eight projects of 5 per cent, 7 per cent, 3 per cent, 5 per cent, 15 per cent, 5 per cent, 30 per cent, and 30 per cent.

48304

Building Construction Technology

BT
6cp
subject coordinator: Mr D M Eager

This subject provides a knowledge of the environment in which professional engineers operate in the building industry; and introduces an understanding of the design and construction of building elements and of fundamentals of heat transfer and effects of external conditions on indoor comfort. It explores the requirements of the Building Code of Australia (BCA); discusses influences on the indoor environment such as services coordination and vibration; and introduces fundamentals of vertical transportation within buildings. It is expected that students will acquire an understanding of requirements of the BCA and statutory regulations and a knowledge of principles for the design and construction of building structural elements; space requirements for the integration of services into the building fabric; and heat transfer through the building skin including solar effects on buildings.

Assessment: four major projects of 20 per cent, 30 per cent, 25 per cent, and 25 per cent.

48305

Airconditioning Design

BT
6cp; prerequisites: 48071 Numerical Methods; 48302 Computer Aids for Airconditioning Design; 48070 Engineering Materials
subject coordinator: Mr D M Eager

This subject provides the ability to design large airconditioning systems for buildings and to make rational system and component selection decisions. It covers airconditioning system selection; design for energy efficiency; quality of indoor air; air distribution; piped services; water treatment; and airconditioning system components such as fans, coils, filters and heat rejection equipment. It includes practice in the design of large airconditioning systems through the set of assignments which lead students through the processes of air-conditioning system selection, heat load estimation, and the design of air distribution, refrigerant and heat rejection systems.

Assessment: five equally weighted major assignments of 20 per cent each.

48310

Introduction to Civil Engineering

CE, CEE, BEBA, BEBBus
6cp
Fields of practice: Civil Engineering Program

The objectives of this subject are: to ensure a general understanding of the role of the civil engineer in the provision of basic infrastructure necessary to support the development and maintenance of urban and rural settlement; to provide a sound foundation for further education in the processes of design, construction, operation and maintenance of community infrastructure; to provide an understanding of the need to consider the demands and expectations of the community, whilst having due regard for both the developed and fragile natural environment; to ensure an understanding of the need to develop the necessary individual, inter-disciplinary and multi-disciplinary skills in civil engineering project analysis and development; and to develop effective verbal and written communication skills.

Lecture content includes: civil engineering and the environment, phases of civil engineering work, drawings and specifications, loads and deflection, uses and behaviour of construction material (concrete and steel), building dynamics, soils and civil engineering, soil

retention structures, roads and traffic engineering, water engineering.

Field work and associated design exercise: two sessions (3 hours duration each) of basic surveying and levelling in the field, followed by one 3 hour session of design work involving catchment area calculation, stormwater run-off estimation, longitudinal section plotting, and pipe gradient design using basic formulae. This segment serves as an introduction to surveying, hydrology and urban stormwater management subjects.

Seminar Presentation: two sessions of (2 hours duration each) for presentation of a short discussion paper on a civil engineering topic of individual choice. Use of audio-visual aids is encouraged.

Laboratory Sessions: two sessions of 1-1/2 hours duration involving demonstration of water engineering and building dynamics (Shaker table).

Projects – Discovery: two formal sessions of 3 hours duration and supplementary work in group format to develop experimentation and understanding of the engineering process.

Site Visit: All students must attend an all-day site visit of a civil engineering project or operational facility, to gain an appreciation of the work place. Practising civil engineers and other professionals accompany the students in outlining the necessary skills required to design, construct an engineering project or operational facility. Site visits may include inspection of the following facilities after construction: water treatment plant, wastewater treatment plant, water storage dam and associated power station. Site visits may also include the following during construction: arterial road (freeway/motorway), road bridge, transportation facility (light rail), commercial or industrial building, coastal engineering structure (coal loader or harbour structure).

48320

Surveying

CE, BEBA, BEBBus
6cp
Fields of practice: Civil Engineering Program

The objectives of this subject are to enable students to: become competent in the theory and practice of basis surveying skills; be able to use basic surveying equipment such as levels and theodolites and perform the calculations and reductions of observations associated with such equipment; be aware of the likely errors that may occur during observations and of methods to eliminate, or minimise such errors; be competent in making distance measurements accurately over short distances using tapes and wires and be aware of the advantages of modern developments in this field such as Electronic Distance Measuring Equipment; able to perform a simple traverse and associated calculations to find the misclose and proportional accuracy, and the bearing and distance of one missing line; understand and be able to perform relevant calculations for the engineering applications of surveying (horizontal curves, vertical curves, and areas and volumes); and be aware of field techniques used to enable preparation of a detail and contour plan. The stadia method will be discussed in class and it will be used as a data gathering tool in a practical exercise. The applications of modern computer programs to reduce data for and the plotting of detail and contour plans will be introduced. Services of professional surveyors will be explained, as will engineering situations where surveyors must be engaged.

Topics include: use of equipment such as levels, theodolites and tapes and wires; calculations related to this equipment, as well as traversing, horizontal curve setting out, design of vertical curves, areas and volumes and stadia and contouring; modern developments in surveying; and the role of the professional surveyor.

48321

Statics and Introduction to Design Process

CE, CEE, BEBA, BEBBus
6cp; corequisites: 33130 Mathematical Modelling 1; 68037 Physical Modelling
Fields of practice: Civil Engineering Program

A hallmark of civil engineers is their ability to design and supervise the construction of major projects, such as multistorey buildings, bridges, wharves and jetties, off-shore oil platforms, airports, roads, railways, tunnels, dams, telecommunication towers etc. The failure of any of these projects would have grave social, economic and political consequences, particularly when such failures result in the loss of life. Civil engineers must ensure the safety, integrity and serviceability of all civil engineering structures they are entrusted with.

In order to ascertain that a structure can perform satisfactorily under its design loads, the civil engineer must be able to analyse the

structural behaviour under severe loading conditions. Civil engineering graduates must possess adequate knowledge in the structural mechanics area to competently analyse and design simple structures. By completing this subject, students will: acquire fundamental understanding of equilibrium concepts commonly used in analysis and design of engineered structures; develop their skills to analyse simple structures such as beams and trusses subjected to various loading and support conditions; and acquire an appreciation of the design process and the issues involved in design, taking into account design constraints and the expectation to meet often conflicting design requirements.

Topics are designed to encompass all the fundamental concepts in statics which should be acquired early on. Students are exposed to design issues through the process of designing a simple structure such as a truss.

Content ensures the minimum knowledge needed to embark on more advanced analysis as well as introductory design subjects in subsequent semesters: basic concepts and laws, units, scalars and vectors, vector addition, resultants and components of vectors, rectangular components, resultants using rectangular components; equilibrium of a particle in 2D, free body diagrams, 2D rigid bodies, external and internal forces, principle of transmissibility, moment of a force – Varignon's theorem, moment of a couple, equivalent couples, addition of couples, moving a force to a parallel position; resultant of a force/couple system, equivalent force couple systems, support reactions on 2D bodies; equilibrium of 2D bodies, alternative sets of equilibrium equations; equilibrium of two and three force bodies, statically indeterminate systems – partial and improper constraints; types of beams; distributed loads; equilibrium conditions for beams; internal actions – sign convention, calculating internal actions using equilibrium, equations of internal actions using first principles, diagrams of internal actions in straight beams; equilibrium relations between moment, shear and load; internal forces in pin-jointed structures, pin-jointed trusses – definition, method of joints, method of sections, zero force members; analysis of pin-jointed frames, three-pin arches, curved and bent beams; properties of plane areas – centroid, first and second moment of area, moment of inertia, polar moment of inertia, radius of gyration; concept of stress, uniaxial stresses, shearing stresses, ultimate and allowable stress, factor of safety; concept of strain, normal strain and axial loading, stress-strain diagram, Hook's law, modulus of elasticity, Poisson's ratio, generalised Hook's law; and design of a complete truss structure (e.g. roof truss, footbridge truss) given a set of specifications.

48330

Soil Behaviour

CE, CEE, BEBA, BEBBus
6cp; corequisite: 48331 Mechanics of Solids
Fields of practice: Civil Engineering Program

The objective of this subject is to give a broad based introduction to the geo-sciences and a more rigorous introduction to soil as an engineering material. The subject concludes with a detailed study of the problem of soil settlement behaviour. At the completion of the subject students should: be familiar with the natural processes occurring on the surface of the earth; be able to communicate with geologists, earth scientists and others involved in studying the ground; understand the fundamentals of the behaviour of soil as an engineering material; be aware of those aspects of soil behaviour which have a significant environmental impact; be able to solve a range of soil-related problems especially those involving water flow and soil settlement; have a solid basis for further formal study and self-study in the geotechnical area.

Topics include: introduction to soil engineering – typical problems, the engineer's role; geological fundamentals – classification, composition and structure of rock, engineering properties; geomorphology – soil formation, landforms; nature of soil – particulate nature, classification, clay mineralogy; introduction to soil mechanics – overview, state of vertical stress, effective stress; water in soil – groundwater, seepage and permeability; soil environmental impacts – problems, environmental behavioural aspects and properties; settlement of soils – settlement theory, consolidation testing, stresses under loaded areas, 1D settlement estimation, elastic deformations, rate of settlement.

48331

Mechanics of Solids

CE, CEE, ME, BEBA, BEBBus
6cp; prerequisite: either 48321 Statics and Introduction to Design Process, or 48620 Fundamentals of Mechanical Engineering
FIELDS OF PRACTICE: CIVIL ENGINEERING PROGRAM

The objectives of this subject are to enable students to: acquire fundamental understanding of the behaviour of structural components commonly used in engineered structures and machines; develop skills to help them model and analyse the behaviour of structural and machine components subjected to various loading and support conditions; raise confidence and skill in the use of the principles of equilibrium and material constitutional relationships to develop the basic tools and formulae to facilitate analysis and design of structural and machine components; understand the limitations of what has been learned in this subject.

Content includes: pure bending of beams – flexural stress and strain – calculation of beam loads; shear flow and shear stresses in beams – distribution of shear stresses in beam sections – forces and stresses in shear connectors – maximum allowable load in beams; composite beams – composite columns; slope and deflection of simple beams; column buckling – Euler's equation – end conditions and effective length – combined axial and bending stresses for short columns; torsion of circular shafts, thin-walled closed sections and solid rectangular sections; transformation of plane stresses – Mohr's circle of plane stresses – principal stresses and planes; inelastic bending – stress resultants – yield moment and ultimate moment capacity of elastoplastic sections – elastic and plastic section modulus – plastic hinges; product of inertia, principal axes and principal moments of inertia; unsymmetric bending; combined stresses due to axial force, shear force, bending moments and twisting moment; shear stresses in thin walled sections – shear centre; transformation of plane strains – measurement of strains – strain rosette – relationship between elastic modulus, shear modulus and Poisson's ratio.

48340

Construction

CE, CEE, BEBA, BEBBus
6cp; prerequisite: 48310 Introduction to Civil Engineering
FIELDS OF PRACTICE: CIVIL ENGINEERING PROGRAM

The objective of this subject is to give a broad based introduction to the construction industry and to emphasise the technical and managerial skills needed by engineering professionals working in this area. On completing the subject the student should have a well developed awareness of the equipment, processes and methodology associated with construction work; be able to estimate productivity of earthmoving equipment using cycle time data and correctly balance fleets of machinery; have a basic understanding of preliminary and detailed cost estimating; be able to identify many of the day-to-day problems encountered on construction sites; and be able to participate actively in solving construction problems.

Topics include initial site establishment; earthmoving grading and compaction equipment; shoring of excavations, underpinning; pumps and ground water control; compressors and air tools; formwork and falsework equipment performance, the repetitive cycle of operations and fleet operation; preliminary and detailed estimates and bid considerations.

48341

Structural Mechanics and Component Design

CE, CEE, BEBA, BEBBus
6cp; prerequisites: 33230 Mathematical Modelling 2; 48331 Mechanics of Solids
FIELDS OF PRACTICE: CIVIL ENGINEERING PROGRAM

This subject aims to develop understanding of the behaviour of structural components and simple frames under load. In addition to the principles of equilibrium and linear elasticity, used in prior subjects to analyse simple structural components, students will learn how the principle of conservation of energy and the concept of compatibility can be used to analyse the response of deformable components to load and environmental effects. Students will develop their skills to apply energy principles and compatibility conditions to analyse the stresses and deformations of structural components and of simple redundant frames. The subject also introduces the fundamental concepts of limit state design of structures in concrete steel and timber. These

concepts will be applied to the design of tension and compression members of timber and of steel.

Topics include: concept of work, introduction to strain energy, strain energy density in multi-axial stress states; effects of impact loading on axially loaded members and statically determinate beams; application of the principle of work to the calculation of deflections; concept of virtual work; application of the concept of virtual work to the calculation of deflections of statically determinate beams and frames; maxwell-Betti reciprocal theorem; introduction to structural analysis; redundant structures, degrees of statical indeterminacy and degrees of freedom – kinematic indeterminacy, support conditions, displacement constraints, multiple load paths; method of consistent deformations; compatibility equations, analysis of 1and 2 fold redundant beams and frames; effects of changes in temperature, lack of fit and support settlement; stiffness and flexibility matrices of beam and frame elements; failure theories appropriate for modelling engineering materials; determination of loads, load distributions and load combinations; introduction to concept of limit states – serviceability, strength, stability, durability fire rating; material properties, quality assurance issues, specification and selection of appropriate materials – performance, aesthetics, cost, sustainability and environmental consideration; availability of manufactured materials and products; design of steel tension and compression members to AS4100; design of timber tension and compression members to AS1720.1.

48350

Environmental and Sanitation Engineering

CE, BEBA, BEBBus

6cp; prerequisite: 60101 Chemistry and Materials Science

Fields of practice: Civil Engineering Program

This subject introduces civil engineering students to basic environmental concepts and the environmental consequences of typical engineering activities. It applies material learnt in 48210 Engineering through History and towards Sustainable Futures and 60101 Chemistry and Materials Science to real life situations encountered during planning, designing and implementing civil engineering projects. The subject will help students: develop an awareness of environmental issues; understand the implication of certain processes such as construction within a natural system and to become familiar with both preventive and management strategies to minimise air, water, soil and noise pollution; become familiar with the main aspects of environmental legislation; and understand concepts and design of water pollution control mechanisms.

Main topics are: environmental issues and their importance; pollution due to man-made activities, their types and their effect on natural ecosystems; an introduction to local and global environmental problems; environmental legislation and the importance of conducting environmental impact assessment; problems of waste generation and principles of landfill management; generation and management of toxic wastes; contaminated sites and their remediation; concepts of water pollution control; design of water and wastewater treatment works; and project case studies emphasising environmental issues.

48351

Structural Analysis and Component Design

CE, CEE, BEBA, BEBBus

6cp; prerequisite: 48341 Structural Mechanics and Component Design

Fields of practice: Civil Engineering Program

All engineers who wish to practise as civil engineers in Australia must have a competent knowledge of structural design, to the relevant current Australian Standards, and a competent knowledge of structural analysis to allow the design to be done. Structural analysis is an integral part of the structural design process because it allows engineers to model the behaviour of structures under load and to determine the design actions induced by the applied loads. Earlier structural subjects have introduced students to statics, aspects of the structural design process, the structural behaviour of materials, some simple structural analysis methods and the structural design of tension and compression members in steel and timber in accordance with the relevant Australian Standards.

This subject introduces more involved methods of structural analysis, both by hand and by the use of computer software packages. The competence gained in structural analysis will assist students in gaining experience and competence in the structural design of other structural components. Students will learn about the behaviour of timber, steel and reinforced concrete beams and beam-columns

and of timber and steel connections. They will gain competence in doing the structural design of timber, steel and reinforced concrete beams and beam-columns and of timber and steel connections in accordance with the relevant Australian Standards.

Structural analysis topics: method of moment distribution – revision of major assumptions used in linear elastic structural analysis, degree of indeterminancy, sign convention; physical interpretation of moment distribution; absolute bending stiffness, relative bending stiffness, distribution factors and carry-over factors; application of the method of moment distribution to continuous beams; application of the method of moment distribution to braced frames; application of the method of moment distribution to frames with single sway freedom; introduction to computer applications – introduction to typical commercial analysis programs; aspects of modelling, including global and local coordinate systems, definition of nodes and members, member connectivity, nodal freedom and restraint and releases in members; definition of member and material properties; definition of loads and load combinations; analysis of a continuous beam and a frame on computer and the interpretation of the output.

Component design topics: beams in timber, steel and reinforced concrete – section moment capacities, deflection, long-term effects, shear; lateral-torsional buckling and member moment capacities in timber and steel; uncracked and cracked sections, linear elastic and ERSB behaviour in RC beams; beam-columns in timber, steel and reinforced concrete – second-order effects; section and member interaction; interaction diagrams and slenderness effects for RC beam-columns; connections in timber and steel – nailed and bolted joints in timber; bolted and welded joints in steel, loaded in-plane.

48352

Construction Materials

CE, BEBA, BEBBus

6cp; prerequisite: 60101 Chemistry and Materials Science

Fields of practice: Civil Engineering Program

Civil engineering is carried out by professionals who design, construct, maintain, inspect and manage public works projects. The common materials used in civil engineering applications or in construction are timber, concrete, bitumen, masonry and reinforcing and structural steel. It is essential for civil engineers to have the basic understanding of these construction materials, in relation to their production, properties, testing and application. The main objectives of this subject are to help students acquire the fundamental knowledge on the production, physical and engineering properties of the construction materials; understand the effects of environments on the properties and performance of these materials; become familiar with the relevant Australian and other specifications and standards, in relation to the requirements and testing methods and interpretation of test results; improve analytical and communication skills by presenting the test report; select the material in relation to the specified requirements; develop the awareness of the use of waste materials for construction.

Subject content is designed to meet the objectives in relation to the following construction materials: steel, timber, bituminous materials, concrete, and masonry. Topics include: requirements, selection and standards of construction materials; steel – production, forms, grades, mechanical properties and testing; bituminous materials and mixtures – production, properties and testing; timber – classification, grading, properties and testing; timber products – plywood and glulam; cement and other binders – production, types, composition, properties and testing; waste materials for construction: fly ash, recycled concrete, slag, and others; aggregate: classification, properties and testing; admixtures: types and effects on concrete properties; concrete – uses, mix design, properties and testing of fresh and hardened concrete; masonry units, mortar, grout and plaster; environmental degradation of construction materials including fire attack.

48360

Geotechnical Engineering

CE, BEBA, BEBBus

6cp; prerequisites: 48330 Soil Behaviour; 48340 Construction

Fields of practice: Civil Engineering Program

The aim of this subject is to develop students' technical competence in the analysis of soil masses and of their influence on structures associated with the soil. The analysis of footings, retaining walls and soil slopes are examples. By completing this subject, students should be able to: understand the concept of failure in soil and apply it to the analysis of soil masses; critically appraise a problem in

order to decide which particular analysis should be used; identify the limitations of their analyses and carry out appropriate solution validation; be responsible for the analysis component of a design team; study the relevant literature and learn to apply new, or more complex, methods of analysis; carry out field work in association with subsurface investigations.

Topics include: shear strength theory – Mohr Coulomb failure law; site investigation – planning, field work, techniques; shallow foundations – types, bearing capacity theories, retaining structures – earth pressure theories: Rankine and Coulomb, analysis of gravity walls, cantilever walls, braced excavations; deep foundations – types, load carrying capacity, settlement, group behaviour, lateral loading; slope stability – failure mechanisms, infinite slopes, rotational failure, remedial measures; soil improvement – compaction, soil stabilisation, dewatering, preloading.

48361

Behaviour of Structures and Design

CE, BEBA, BEBBus
6cp; prerequisites: 48351 Structural Analysis and Component Design; 48240 Uncertainties and Risks in Engineering
Fields of practice: Civil Engineering Program

This subject has analysis and design components. The aims of the analysis component are to enable students to acquire a basic understanding of the theory of computer methods of analysis of skeletal structures and its application using commercially available software; reinforce computer modelling skills and develop the ability to verify computer results; develop an understanding of the behaviour of typical skeletal structures when subjected to actual loads; develop an understanding of the difference in behaviour of various structural systems. The aim of the design component is to give students an understanding of the basic concepts underlying the design of reinforced concrete slabs and pre-stressed concrete elements and to achieve some competence in the design of these elements in accordance with the relevant Australian design standards.

The subject encompasses fundamental concepts in two important aspects of structural engineering design: computer analysis and behaviour of skeletal structures, and design of complex structural elements in accordance with the requirements of the relevant Australian design standards.

Topics include computer analysis and behaviour of skeletal structures; revision of computer modelling of structures – coordinate systems, nodal coordinates and degrees of freedom; beam connectivity codes and orientation of local coordinate system; section properties; and loading and load combinations. Students are introduced to the concept of stiffness method of analysis of plane frames and derivation of important equations for continuous beams – comparison of analyses approaches by means of compatible deformations versus force equilibrium; derivation of beam element stiffness matrix for different combinations of end conditions (rigid/pinned); assembly of structure stiffness matrix and load vector; solution for structure displacements and recovery of internal forces and reactions; concepts of geometric non-linear behaviour of structures – non-linear load-deflection behaviour (P-D effects) of simple trusses made of rigid bars and linear elastic springs; concept of bifurcation instability; application of computer modelling to structural behaviour – plane frames (sway, versus non-sway frames); simple three dimensional frames; plane frames subjected to support settlement and temperature loading; second order elastic analysis of plane frames; approximate methods of analysis – sources of inaccuracy inherent in various methods of structural analysis; analysis of rectangular frames subject to vertical loads by assuming points of inflections; and analysis of rectangular frames subject to horizontal loads by the portal and cantilever method.

The subject also covers the design of complex structural elements in accordance with the requirements of the relevant Australian design standards – pre-stressed concrete to AS3600; overview of history of pre-stressed concrete and reasons for its use; elastic analysis of cracked and uncracked sections under severe loads; pre-stress strain; ultimate moment capacity using the Equivalent Rectangular Stress Block to AS3600; deflection; design for shear; reinforced concrete slabs to AS3600 – one way slabs; two way slabs supported on four sides; flat slabs with or without drop panels; punching shear; footings and cantilevered retaining walls.

48362

Hydraulics and Hydrology

CE, CEE, BEBA, BEBBus
6cp, prerequisite: 48641 Fluid Mechanics
Fields of practice: Civil Engineering

The objective of this subject is to give students a knowledge of open channel hydraulics and hydrology, leading to understanding of the scientific foundations and basic principles of these fields, and the ability to apply hydraulic and hydrological methods to engineering applications in an integrated way. Knowledge of fluid mechanics will be consolidated and problem-solving skills in dealing with water engineering tasks will be acquired.

Topics include: open channel hydraulics – types of flow (e.g. steady, uniform), friction equations, rapidly-varied flow, continuity, energy and momentum conservation, gradually-varied flow, water surface profiles, software packages, hydraulic structures (channel appurtenances, culverts, bridge waterways); hydrology – the hydrological cycle, water balances, meteorology and climatology, data collection, statistics, hydrological models, design rainfalls, rainfall-runoff processes, flood estimation models and procedures, software packages, yield analysis, groundwater, environmental hydrology; and integration of hydraulics and hydrology case studies.

48370

Transport in the Environment

CE, CEE, BEBA, BEBBus
6cp; prerequisite: 33230 Mathematical Modelling 2
Fields of practice: Civil Engineering Program

The objectives of this subject are to enable students to understand the following: the relationship between transport and land use; the basic concepts of transportation relating to modelling and design; and the relationship between urban form, energy use and sustainability. Students also learn to design feasible transport schemes using a variety of modes and to evaluate transportation projects in terms of their capacity, cost, environmental impact and equity.

Topics include: landuse transportation interaction; the transportation planning system; environmental impact of transport and issues in ecologically sustainable transport; design principles used in public transport; transport economics, privately funded infrastructure and freight issues; the geometric design, pavement design and the capacity of roads; the needs of pedestrians and cyclists and the overall road safety issue.

48380

Civil and Environmental Engineering Design

CE, BEBA, BEBBus
6cp; prerequisites: 48352 Construction Materials; 48250 Engineering Economics and Finance
Fields of practice: Civil Engineering Program

The objective of this subject is to involve students in the total design process as encountered in a 'true to life' project by taking on the role of a design engineer within a project design team. This process will simulate what happens in multidisciplinary engineering consultancies. The subject will challenge students to consider the interests of all the stakeholders in the formulation of the hierarchy of design goals. It will aim to provide an opportunity to devise creative 'concept designs' and to develop, prepare and document a final design proposal to meet the functional objectives having regard to environmental guidelines, economic constraints and community values. The subject will foster skills and confidence to use all aspects of prior studies and experience to devise, analyse, assess and refine alternative designs.

The subject has as its core the design and documentation of a major civil and environmental engineering project that draws for input on all the main strands of knowledge and competencies developed throughout the course. Typically, the project will involve the design of a major entity and associated facilities and services (e.g. solid waste collection and transfer station; multi-purpose sporting complex; elevated parking station to serve an airport or railhead etc). The project is defined to the student design team by a design brief similar to that which would be supplied to consulting engineers by a client or architect. The project contains four stages:

Stage 1 – Following receipt of the design brief students will be required to assess the information provided, and refine the design objectives and criteria. They will then prepare and evaluate feasible conceptual design options and prepare the preferred option as the conceptual scheme for the final design. Students will be provided with guidance through this process, similar to that which would be given by a senior project engineer

or a director of a consulting engineering practice.

Stage 2 – Students prepare a preliminary design for each major component of the project, based on the approved preferred concept. Each design team makes a presentation describing and assessing their preliminary design schemes in terms of the design objectives and criteria.

Stage 3 – Students develop detailed final designs and documentation for selected components of the scheme, within the context of the overall project, addressing the design objectives and complying with the agreed design criteria and constraints.

Stage 4 – Each group prepares a presentation of their design to a panel of staff to discuss the rationale which underlies the final design. The designs and the content of the presentations will be subjected to critical discussion as part of the oral examination.

48401

Aerospace Operations 1

BT

6cp

This is the first subject in the Aerospace strand and provides an overview of aerospace operations in the aviation industry. Aerospace operations are not seen as unique but as a particular example of a transport system which operates in a commercial, economic and regulatory environment.

Topics include defining the Aerospace industry; what is meant by aerospace operations; historical evolution of air transport with trends in transport aircraft design; fuels; supersonic transport; travel away from Earth; energy and materials as key factors; aspects of management and business practice; introduction to strategic planning applied at the company and national levels in the context of technological change.

Assessment: seminar presentation 25 per cent; literature review 30 per cent; major reports 30 per cent; class participation 15 per cent.

48402

Aerospace Operations 2

BT

6cp; prerequisite: 48401 Aerospace Operations 1

This subject provides students with skills and understanding in various aspects of flight and ground operations. This is the second subject in the Aerospace Operations strand. In this subject students are given the opportunity to analyse system and aircraft performance, and to plan aerospace operations. These activities are central to the objectives of the course overall, and facilitate understanding required of professionals in the industry.

Assessment: seminar presentation 25 per cent; literature review 30 per cent; major reports 30 per cent; class participation 15 per cent.

48403

Aerospace Operations 3

BT

6cp; prerequisite: 48402 Aerospace Operations 2

This subject provides students with a global view of aerospace operations, and allows them to contribute to aerospace operations through integration of material covered throughout the course. The subject considers aerospace as an integral part of the total transport system; aviation law and regulations; systems engineering theory, applied to aerospace operations. This subject also integrates material from other elements of the course to give an overview of aerospace operations. Aerospace operations are not seen as unique but as a particular example of a transport system which operates in a commercial, economic and regulatory environment.

Assessment: seminar presentation 25 per cent; literature review 30 per cent; major reports 30 per cent; class participation 15 per cent.

48404

Aerospace Maintenance and Management

BT

6cp; prerequisite: 48403 Aerospace Operations 3; corequisite: 48070 Engineering Materials

This subject provides students with a global view of aerospace operations, and allows them to contribute to aerospace operations through integration of material covered throughout the course. The subject considers aerospace as an integral part of the total transport system; aviation law and regulations; systems engineering theory, applied to aerospace operations. This subject integrates material from other elements of the course to give an overview of aerospace operations. Aerospace operations are not seen as unique but as a particular example of a transport system which operates in a commercial, economic and regulatory environment. This subject provides the student with an understanding of the philosophies and practices of operational maintenance in the Aerospace Industry. This

subject provides a bridge between line maintenance activities, with which the students are familiar, and the management of the total operation.

Topics covered will include factors influencing maintenance performance, maintenance philosophies and procedures, contracting out, maintenance costs, life cycle costing, maintenance engineering overview, maintenance performance measures, configuration control, maintenance inventory management, ISO 9000 series standards.

Assessment: seminar presentation 25 per cent; literature review 30 per cent; major reports 30 per cent; class participation 15 per cent.

48405

Design Awareness for the Aero Industry

BT

6cp; prerequisites: 48070 Engineering Materials; 48404 Aerospace Maintenance and Management; corequisite: 48075 Engineering Management

This subject provides students with an understanding and appreciation of the design process in general, with particular reference to the Aerospace industry. This subject is the second in the technology strand of the course. It builds on the materials subject and provides insight into the technology management subjects that follow. Engineering technologists are primarily concerned with the management of technology. The students must however be aware of the design process and the constraints and compromises involved, and this subject should give them that awareness.

Topics covered will include the principles of design; design philosophies; design practice; concurrent engineering; design for maintainability; aircraft design philosophies and implications, including basic aircraft strength and systems analysis; materials applications; and the basic mechanics of flight.

Assessment: seminar presentation 25 per cent; literature review 30 per cent; major reports 30 per cent; class participation 15 per cent.

48430

Software Development

CSE, EE, SE,TE, BEBA, BEBBus, BScBE

6cp, prerequisite: 48220 Informatics

Fields of practice: Computer Systems Engineering Program

The objectives of this subject are to: develop in students a critical understanding of issues related to the development of software systems, including understanding of the concepts of software life cycles, processes and software paradigms; software methodologies; software analysis, design, implementation, and testing; and algorithm design and problem solving. It also aims to develop in students the skill to apply analysis and design techniques and programming skills to the development of software systems; and equip them with the ability to acquire new software development skills as required by specific development projects.

Topics include: introduction to the software development life cycle and development processes and models (such as the waterfall model, incremental and iterative development, and the spiral model); introduction to software paradigms and detailed consideration of the purpose and underlying principles of the structured and Object-Oriented paradigms; introduction to concepts of development methodologies and detailed coverage of one specific methodology (including analysis, design and implementation aspects of this methodology); principles and procedures for software testing, verification, validation and debugging; approaches to algorithm design and problem solving; software coding – introduction and detailed coverage of a programming language in order to develop specific skills related to above elements.

Students would have developed fundamental programming skills in the prerequisite subject 48220 Informatics. In order to further develop their programming skills, and to understand the relationships between different programming paradigms, they will be required to develop a deeper understanding of the Java programming language. The object-oriented paradigm will be implemented using the Unified Modelling Language (UML) methodology.

48440

Software Engineering

CSE, SE,TE, BEBA, BEBBus
6cp; prerequisite: 48430 Software Development
Fields of practice: Computer Systems Engineering Program

The objectives of this subject are to: develop in students a critical understanding of issues related to the engineering of large complex software systems; to bring students to the point where they are fluent in the objectives of software engineering; and to ensure that they are competent in techniques to realise software systems utilising appropriate software engineering approaches, tools, and techniques. Students will learn how to develop a set of requirements, apply rigorous software analysis, and to design, code and test their work. On completion of the subject students will be competent to engineer moderately complex software systems, as members of a software development team.

Topics include: software engineering concepts, including software projects, planning, management, processes, methodologies, etc; software requirements engineering; formal methods for software engineering; adaptation of software development methodologies to suit specific projects; validation and verification; software estimation and costing; configuration management; software project planning, budgeting, quality assurance (including walkthroughs and reviews, etc.); software development CASE tools. The subject uses a problem-based learning approach with students working in small teams. A set of lectures is combined with workshops where students apply the techniques introduced.

Assessment is based on a series of mastery and advanced assessment tasks.

48441

Introductory Digital Systems

CSE, EE, SE,TE, BEBA, BEBBus, BScBE
6cp; prerequisites: 48520 Electronics; 48430 Software Development
Fields of practice: Computer Systems Engineering Program

The objectives of this subject are to enable students to: master the fundamentals of digital and programmable electronic circuits and their engineering applications; master the hardware architecture of a typical small computer system; understand the principles of low level programming and gain an ability to write simple assembly code. Students will be introduced to the basics of concurrent and real time application programming. The subject will develop a simple register-based computer incorporating I/O and interrupts.

Topics include: digital sequential circuits; state diagram and its application in the design of digital circuits; basic hardware architectures of the digital computer in terms of its building blocks; how hardware integrates with software at the machine level; low level language programming; internal architecture and design of a typical register-based central processing unit and a main memory subsystem, and their interdependence; concepts of computer system busses, as well as different types of input and output devices; interrupts and DMA (direct memory access) input and output; micro-controller theory; hardware interfacing design techniques. Aspects of real time programming, concurrency and multiple processing, the design of a basic multi-tasking operating system and the solution of a concurrent application. Optional modules toward the end of the subject cover an in-depth study of a selected micro-controller, advanced topics in embedded real time applications, printed circuit board design among others.

48450

Operating Systems

CSE, SE,TE, BEBA, BEBBus
6cp; prerequisites: 48440 Software Engineering; 48441 Introductory Digital Systems
Fields of practice: Computer Systems Engineering Program

The objectives of this subject are that students should: be familiar with the Unix operating system at the POSIX definition level; know how to develop 'C' applications to run on a POSIX standard operating system; know the basic principles of the design and implementation of a centralised POSIX defined operating system (Linux is proposed), know how the centralised operating system functionality can be expanded into a distributed operating system (Windows NT is proposed to be examined in this regard); know the basic principles of Hard Real-time application programming. (Rate monotonic and deadline monotonic to be examined in depth); know how to apply the Hard Real-time principles to existing hard real-time operating system employing the POSIX standard (as a minimum).

Topics include: the use of the Unix operating system and othe POSIX defined operating systems as a tool for developing real-time control applications; advanced control application based 'C' programming; real-time principles and concurrent programming techniques; distributed operating systems employing distributed, memory management, process management, file systems, and I/O; client/server programming, typically using Windows NT. Rate monotonic and deadline monotonic analysis will be examined as a method of providing hard real-time application verification.

48451

Advanced Digital Systems

CSE, BEBA, BEBBus
6cp; prerequisite: 48441 Introductory Digital Systems
Fields of practice: Computer Systems Engineering Program

The objectives of this subject are that students should be able to: analyse, design and implement a programmable digital system based on a user requirement specification, and investigate advanced computing architectures. The subject has two major components (1) analysis/design and (2) implementation, of an advanced computing node. The components are integrated, and are each worth 50 per cent of the course mark.

The subject provides an in depth understanding of the analysis/design and implementation of advanced digital hardware at medium scale computer system building block level. It builds on the basics of Introductory Digital Systems introduced in the earlier 'field of practice' subjects. This subject is common to the Electrical, CSE and Telecommunication degree courses.

Topics include Quantitative Analysis, The Design Process, Functional Design, Implementation Technologies, Computer Architectures, Memory and I/O Systems. It emphasises Computer Aided Design, including the use of the VHDL specification, simulation and integrated VLSI implementation technologies.

48470

Computer Systems Analysis

CSE, BEBA, BEBBus
6cp; prerequisite: 48440 Software Engineering
Fields of practice: Computer Systems Engineering Program

The objectives of this subject are: to learn how to perform a thorough analysis of the various options for implementing a complex computer system; to learn how to write a detailed, unambiguous functional specification; to learn how to acquire new analytical skills; to learn how to apply software engineering principles learnt earlier in the course.

This subject does not have set topics or material to be taught in the usual way. It is up to the students to work out what they need to learn in order to solve the problem. Skills that are likely to be gained include using formal specification languages; computer performance analysis; reliability analysis; risk analysis; architecture development; assessment of ethical and social issues; verification and validation; mathematical techniques for robotics; and user interface analysis.

48475

Software Systems Analysis

6cp; prerequisite: 48440 Software Engineering
SE, BEBA, BEBBus
Fields of practice: Computer Systems Engineering Program

The aim is to draw together information from a range of earlier subjects so the performance and design alternatives of a large technical software system can be analysed. The student should gain an understanding of the interaction of the various hardware and software components in the system and the effects on performance, as well as the functionality, cost, data access, reliability, resilience and social acceptability of various alternative architectures.

The overall method of the course will be problem-based. At the start of semester, students will be given an English language requirement specification for a manufacturing system. They will work in teams to develop a detailed system specification bydeveloping several architectural options and then analysing these options from the viewpoint of performance and functionality. Students will select the best option and then analyse this option further, with the aim of developing a detailed functional specification.

During the course, the students can request lectures on architectural analysis, queuing theory models, discrete event simulation, and other topics.

48480

Computer Systems Design

CSE, BEBA, BEBBus
6cp; prerequisite: 48470 Computer Systems Analysis
FIELDS OF PRACTICE: COMPUTER SYSTEMS ENGINEERING PROGRAM

The objective is to enable students to design and implement complex computer systems as members of a large group (of 12 or more persons). Students should be able to identify several design solutions that meet the system requirements specification as developed in 48470 Computer Systems Analysis, and assess each on the basis of functionality, performance and cost. They will learn to write clear, concise documentation of their decisions and the system implementation, and gain the discipline necessary to be effective team members, through an understanding of the essentials of team organisation, and how to be productive in a group project.

This is a capstone subject that brings together the technical and systems engineering themes of the course. It emphasises the need for management as well as technical skills that are essential in the development of new systems. The subject develops attributes such as system abstraction, goal achievement within time and resource constraints, advanced interpersonal communication skills, and the ability to contribute to effective team documentation.

48485

Software Systems Design

6cp; prerequisite: 48475 Software Systems Analysis

SE, BEBA, BEBBus
FIELDS OF PRACTICE: COMPUTER SYSTEMS ENGINEERING PROGRAM

The aim of this subject is to allow students to take the functional specification developed in Software Systems Design, and use it to design and develop the system. In this way the students will learn to develop a large software system, by actually completing and testing the system. They will learn at first hand the difficulties that can be caused if the design and implementation are carried out with a lack of rigour.

The overall method of the course will be problem-based. At the start of semester the students will be given a functional specification for a complex network based system. They will work in teams to develop a detailed design. The students will then verify the design, implement the various modules, integrate the modules, and test the final system.

During the course, the students can request lectures on aspects of design, coding, testing, and documentation.

48510

Introduction to Electrical Engineering

CSE, EE, ME, SE,TE, BEBA, BEBBus, BScBE
6cp; corequisite: 48210 Engineering for Sustainability
FIELDS OF PRACTICE: ELECTRICAL ENGINEERING PROGRAM

The major objective of Introduction to Electrical Engineering is to give new students some understanding of the scope and methods of Electrical and Computer Systems Engineering. This includes the engineering process, the technologies involved, the approach to problem solving, and the skills and tools used. By the end of the subject, students should be eager to learn more of the analytical techniques used in electrical engineering design and have had their choice of electrical engineering as a rewarding and stimulating future career confirmed.

The subject material is organised around 2 modules. In module 1, basic electrical concepts such as voltage, current, resistance, power, DC and AC are introduced; supply and utilisation of domestic electricity is explored; and the functions of components commonly found in a linear DC power supply are covered. The practical aspects of this module include learning how to use basic equipment such as a multimeter and CRO, learning some simple 'thinking' skills, and building and testing a DC power supply. In module 2, the focus is on a typical application, that of a PC-based Data Acquisition System. The functions of the basic components of this system are presented. Students may then choose a more advanced application area, for example instrumentation, where such a system would be used. Some key concepts related to this advanced application area are covered. The practical aspects of this module include building and testing a PC Data Acquisition kit.

48520

Electronics

Offered jointly by the Faculty of Science and the Faculty of Engineering. Students may choose this subject or 68314 to suit their timetable.
CSE, EE, SE,TE, BEBA, BEBBus, BScBE
6cp; prerequisites: 48510 Introduction to Electrical Engineering; 33130 Mathematical Modelling I or 33132 Mathematical Modelling I (2 semester mode)
Fields of practice: Electrical Engineering Program

The main objective of this subject is to familiarise students with common electronic devices and their applications. By the end of the subject, students should have acquired reasonable proficiency in the analysis of basic electronic circuits and be able to build and test circuits in the laboratory. Particular emphasis will be placed on the practical, hands-on aspect of electronics to provide a solid foundation of working knowledge for all of the basic electronic devices and common electronic circuits. Laboratory work will be a significant proportion of in-class delivery so as to make students proficient in circuit construction, testing, troubleshooting and give them a sound knowledge of the use of test instruments. Another objective is to show that practical electronic applications are relevant to other engineering and technical disciplines and may often be placed within a wider social or commercial context.

Topics covered in the subject include:

Theoretical Material: basic concepts; DC circuits; AC circuits; semiconductors; semiconductor devices; power supply; BJT transistor amplifier; field effect transistor; frequency response of amplifiers; opto-electronics; introduction to digital electronics; and operational amplifiers.

Practical Material: device labelling (resistor colour codes, etc.). Basics of electrical measurements, understanding of instrument accuracy, source loading. CRO, multimeter, function generator and other lab instruments. Power supply fundamentals, floating outputs and earth. Circuit construction and systematic layout from circuit diagrams, and deriving a circuit diagram from a physical circuit. Fault finding.

48530

Circuit Analysis

CSE, EE,TE, BEBA, BEBBus, BScBE
6cp; prerequisite: 48520 Electronics
Fields of practice: Electrical Engineering Program

In previous subjects students have been introduced to the analysis and application of electrical devices and systems. In this subject these skills will be developed to the point of virtuosity, as students acquire proficiency in the rigorous analysis of real-world models. By a process of 1) theoretical investigation, 2) experiment design, 3) experimental testing, and 4) reflection, students will develop a clear conceptual and experiential understanding of the difference between real-world phenomena and the models that are used to represent them. While electrical circuits are a prime focus, the application of analysis techniques to other disciplines and types of system models will be concomitant. The subject will also provide a perspective on the historical development of this area and on present and future trends.

In most weeks students will partake in a 3 hour small group teaching session with up to an additional 3 hours laboratory or in-field activities. Assessment will consist of individual and group work tasks with weekly quizzes and a final exam.

The following topics are covered:

Signals and Systems - Introduction to spectral analysis, Laplace transforms; ideal and real voltage and current sources and loads; Resistors; capacitors, inductors and coupled coils; Kirchoff's voltage and current laws, Thevenin's and Norton's theorems, mesh and nodal analysis, symmetry, circuit transformation, superposition, solution of ODEs using Laplace; Power in AC circuits, electrical distribution networks and devices, multiphase systems; One and two ports systems, transfer and immittance functions, two port parameters and behaviour; Poles and zeros, s-plane analysis, Bode plots; First Order Systems – Response to periodic and non-periodic inputs, time domain solution, frequency domain solution; Arbitrary Systems Analysis – Linear versus Non-linear, response to an arbitrary input using convolution, dominant pole approximation, practical system identification techniques.

48531

Electromechanical Systems

CSE, EE, ME, BEBA BE BBus
6cp; prerequisites: 48510 Introduction to Electrical Engineering; 33230 Mathematical Modelling 2
FIELDS OF PRACTICE: ELECTRICAL ENGINEERING PROGRAM

The objectives of this subject are to familiarise students with the fundamental laws of electromagnetism, magnetic and electrostatic field concepts, basic ac circuit analysis, and the interchange of electric and magnetic energy. By the end of the subject students will be able to model a selection of electromechanical systems and understand their applications.

Technical and theoretical content is expected to be acquired by students to the levels of 'know' (essential), 'familiar' (can solve problems if required) and 'aware' (have read/seen), and the laboratory skills to be acquired, are:

Know:

- Laws – Faraday, Ampere, Gauss, Coulomb, Lorentz.
- Magnetic fields – B, H, M, permeability, flux, energy.
- Magnetic circuits – permeance, reluctance, mmf, flux, inductance, energy, field plots, calculation of permeance from flux lines.
- Electrostatic fields – E, D, P, permittivity, flux, energy.
- Electrostatic circuits – capacitance, potential, flux, energy, field plots, calculation of capacitance from flux lines, calculation of E in series circuit.
- ac circuits – phasor notation, 3-phase system, S, P, Q, pf, rms value.
- Force/torque – rate of change of energy (co-energy).
- Moving circuit models – voltage equations, emf.
- Mechanical models – mass, inertia, Newton 2.
- Solution of coupled equations – state equations, numerical method.
- Conservation of energy – input/output/losses.

Familiar:

- Soft magnetic materials – domains, non-linear, hysteresis, saturation, co-energy, eddy currents.
- Hard magnetic materials – coercivity, ferrite and rare earth magnets, Br, Hc, model.
- Dielectric materials – polarisation, dissipation factor, partial discharge, breakdown voltage.
- Transformer – construction, applications, ideal model, non-ideal T model, capacitance.
- Capacitor – construction, applications, lumped and distributed models, inductance and losses.
- Inductor – construction, lumped and distributed models, capacitance and losses.
- Singly excited electromechanical systems – solenoid, relay, moving iron meter, variable reluctance stepping motor, brushless dc switched reluctance motor, electrostatic motor.
- Doubly excited electromechanical systems – voice coil motor (loudspeaker, disc drive), permanent magnet moving coil meter, two coil meter (wattmeter), permanent magnet stepping motor, brushless dc permanent magnet motor.
- Power electronics – unipolar and bipolar circuits, 3-phase inverter.
- Motor characteristics – models, emf vs speed, force/torque vs speed, current vs torque, efficiency (losses).

Aware (exposure technologies):

- Other electromagnetic machines – homopolar dc motor, synchronous motor, AC generator, induction motor, brushed dc motor, linear motor, watthour meter.
- Electrostatic machines – Van der Graaf, Whimshurst, water drop.
- Control – motor speed and position control requirements.
- Electromechanical energy conversion applications – e.g. disc drive, printer, CD player, washing machine, robot, CNC machine, servo motor, electric car, electric train, rolling mill, power station, air conditioning fan, sewerage pump, water pump, wind generator, speedometer.

Laboratory skills:

- Electrical safety.
- Experiment design – experiments to learn new things, experiments to check theories, experiments to validate designs.
- Measurement of voltage, current, power and frequency.
- Measurement of resistance, inductance and capacitance.

- Measurement of mass and inertia.
- Measurement of magnetic field (B, H, flux)
- Measurement of electric field (E).
- Measurement of torque.
- Flux plots.
- Development of models and calculated parameters and performance.
- Transformer open and short circuit tests.
- Variable reluctance stepping motor torque/current/angle and step response.
- Permanent magnet stepping motor torque/current/angle, step response.
- Brushless dc permanent magnet motor speed/current/efficiency vs torque
- Electronic control of stepping and brushless dc motors
- Three phase ac generator performance.
- Model and design verification by comparison of calculated and measured parameters and performance.

48540

Signals and Systems

CSE, EE, TE, BEBA, BE BBus, BScBE
6cp; prerequisites: 48220 Informatics; 33230 Mathematical Modelling 2
Fields of practice: Electrical Engineering Program

This subject presents the theoretical basis for system analysis and gives students skills in using the techniques to design components of real control/communication systems. The derivation of models from real world devices through measurement, and the comparison of model predictions with experimental results is emphasised in the laboratory component of the course. A group project that requires the design and implementation of part of a control/communication system allows students to apply their knowledge to a real-life problem.

Topics include: signal types and signal representation in the time and frequency domains; system modeling; signal operations in the time and frequency domains; discrete signals and systems; the effects of feedback; time and frequency domain performance and correlation; system stability.

Through learning activities students will also gain study skills including academic literacy skills, and an appreciation of the different fields of practice of engineering and the interdisciplinary nature of engineering.

Class time will be used for lecture-type resource sessions, tutorials, laboratories and project work. There will be a number of formal laboratory sessions that apply system theory to different engineering disciplines, which also familiarise students with the laboratory equipment. Several simple control systems will then be used as case studies in signals and system behaviour. The laboratory component culminates in a substantial group project that will require a formal written and oral presentation.

48550

Power Systems

EE, BEBA, BEBBus, BScBE
6cp; prerequisites: 48531 Electromechanical Systems; 48530 Circuit Analysis; 68038 Advanced Mathematics and Physics
Fields of practice: Electrical Engineering Program

The objective of this subject is to reinforce and extend knowledge of electromechanical systems and circuit analysis into the components and philosophy of typical power systems (generators, transformers, transmission lines, induction and synchronous motors, protection) by a deeper study of 3-phase systems, ac machines, and power system design principles.

Technical and theoretical content is expected to be acquired by students to the levels of 'know' (essential), 'familiar' (can solve problems if required) and 'aware' (have read/seen), and the laboratory skills to be acquired, are shown below. The topics are linked by application to a small power system, on which assignments and laboratory work are based.

Know:

- 3-phase circuit theory – balanced network, star/delta, p.u. system.
- Component non-ideal models and performance – transmission line, 1-phase and 3-phase transformer, dc and ac machines (dc, induction, synchronous as motor and generator).
- System control and design principles – energy storage, cogeneration, renewable generation, remote and grid-connected systems, and pollution control.

Familiar:

- 3-phase circuit theory – symmetrical components, unbalanced network, fault calculations, motor starting, generator short circuit.

- Component models and performance – CT, VT, circuit breaker, cables.
- System control and design principles – voltage selection, ac vs dc, system losses and efficiency.

Aware (exposure technologies):

- Component models and performance – d,q transformation.
- System control and design principles – P,Q, tie lines, state estimation, tap setting, economic load despatch, load flow, FACTS, SVC, harmonics.
- Principles of protection – overcurrent, unit, distance, earth.
- Power system applications – electric train, rolling mill, power station, air conditioning fan, sewerage or water pump, wind generator, sub-station, switchyard, hv and lv reticulation.

Laboratory skills

- 1-phase transformer tests and performance.
- 3-phase transformer tests and performance.
- dc machine performance.
- Induction machine parameters and performance.
- 3-phase dc generator parameters and performance.
- Power system performance.

48551

Advanced Electronics

EE, BEBA, BEBBus, BScBE
6cp; prerequisite: 48530 Circuit Analysis
Fields of practice: Electrical Engineering Program

This subject draws on, and brings together, the knowledge and skills developed in earlier subjects such as Electronics and Circuit Analysis, and teaches students to analyse, understand and design complex electronic circuits and systems. Particular emphasis is placed on developing the ability to model real life devices, to understand their imperfections and limitations. The principal goal of this subject is to give all students – whether destined to become circuit designers, or engineers who simply use electronics – the tools necessary to make intelligent choices in the design of modern electronic circuits and systems. By completing this subject students should be able to: understand the operation and characteristics of BJTs, JFETs and MOSFETs in both discrete and integrated circuits; understand the internal structure of typical IC op amps and the operation of its basic building blocks; understand the character and sources of non-idealities in IC op amps; select an appropriate device type for specific application; understand the frequency-domain behaviour of circuits and systems; understand the feedback principle and use it to advantage in circuit and system design; be familiar with other analogue circuits like oscillators, converters, multipliers, etc.; use computer simulation to analyse and design circuits and systems; be familiar with basic techniques used in CAD of electronic circuits and systems.

Topics include: review of basic BJT, FET/MOSFET and Op Amp circuits; computer-aided design (tools and principles); differential and multistage amplifiers; non-ideal characteristics of op amps; output stages and power amplifiers; review of different op amp types; frequency response of linear circuits and systems; feedback principles and applications; signal generation and waveform shaping; other analogue circuits (data converters, multipliers, etc.); noise in integrated circuits; and grounding, coupling and decoupling techniques.

48560

Analogue and Digital Control

EE, BEBA, BEBBus, BScBE
6cp; prerequisite: 48540 Signals and Systems
Fields of practice: Electrical Engineering Program

The objective of this subject is to enable students to model with validation control systems, to analyse, design, and implement both analogue and digital controllers so that the controlled systems conform with given specifications. Emphasis is placed on laboratory work, the theoretical content of the subject being only that required to produce successful designs. Students are required to work on reduced scale models of actual industrial processes. The equipment is based upon experience gained with authentic control applications and is suitably modified for student use. Students follow the usual sequence adopted in industry, i.e. they start with the calibration of transducers and actuators leading on to dynamic response testing, physical modelling, model verification and finally to controller design, implementation, and testing.

Topics include: linear and nonlinear modelling of control systems using Newton's rules, analogous networks or Lagragian techniques;

linearisation and development of linear, time-invariant transfer functions; development of lead-lad compensators or PID controllers using classical control design techniques such as root locus, Bode gain and phase diagrams, Nyquist plots and Nichols chart; development of state-variable equations from differential equations; development of state-variable feedback controllers and state observers.; open-loop pulse transfer functions and discrete-time state models; discretisation using backward difference, bilinear, step-invariance or pole-zero mapping; development of digital PID controllers, deadbeat controllers, and discrete-time state-variable feedback controllers; describing functions and limit cycles for nonlinear control systems; and the development of linear controllers for nonlinear systems using describing function techniques.

48561

Power Electronics

EE, BEBA BEBBus
6cp; prerequisite: 48530 Circuit Analysis
Fields of practice: Electrical Engineering Program

The objectives of this subject are to enable students to: acquire reasonable proficiency in power electronics and its applications; gain confidence and expertise in the use of power semiconductor devices; have some understanding of rigorous analysis using computer simulation of real power electronic systems; be aware of the electromagnetic interference problems associated with power electronic systems and how these problems can be overcome; be aware of the inter-disciplinary nature of power electronics; be aware of the enormous potential this area has for development and exploitation; learn how to evaluate whether one has the skills to undertake a specific design or analysis task and, if not, how to build up the required skill level; be aware of good and bad practice in problem solving and learn the art of improving on practice whenever a weakness is revealed; develop validation strategies that enable one to have sufficient confidence to analyse one's own readiness to accept professional responsibility for conclusions reached; be aware of the importance of continually seeking improved analytical methods and computational tools that will give results more expeditiously and with reduced chance of errors; have a clear conceptual understanding of the difference between real practical systems and the models that are used to represent them.

Topics include: external characteristics, operation and gate drive circuit design of modern power semiconductor devices; protection circuits and thermal design for power devices; power conversion circuits including rectifiers, choppers, inverters, and cycloconverters; pulse-width modulation techniques; harmonic and voltage control of inverters; applications such as switch-mode power supplies, dc drives, ac drives, UPS systems, HVDC; recent advances in device technology; using microcontroller for power electronic applications; EMC and electromagnetic interference in power electronics; use of linear electronics for control of power electronic systems.

48570

Data Acquisition and Distribution

CSE, EE, BE (CSE, EE), BA
6cp; prerequisites: 48540 Signals and Systems (EE); 48441 Introductory Digital Systems (CSE)
Fields of practice: Electrical Engineering Program

Objectives

By the end of this subject students should be able to:

- Analyse, design, build and test: Data Acquisition and Distribution Systems (DADS); Measurement Systems; Intelligent Instrumentation Systems.
- Characterise, specify and select to satisfy the requirements of a DADS: Sensors/transducers and associated circuits; Transducer analog interfacing and signal conditioning circuits; Data conversion devices and systems.
- Interface DADS to computers, plant and installations.
- Write, test and embed Control and Programming Software for DADS interfacing.

Material to be taught and learnt:

- Applications, requirement specifications and typical architectures of DADS;
- General performance characteristics of DADS components and subsystems;
- Physical principles and design fundamentals of sensors and transducers;
- Mechanical, temperature, pressure, flow-rate, level transducers and applications;
- Optoelectronic transducers and applications;
- Transducer analogue interfacing;

- Precision Amplifiers and Low-level signal conditioning;
- Noise, Guarding and Shielding in Instrumentation Systems;
- Data conversion devices and systems;
- DADS design; Time and error budget of DADS.
- Computer structures for DADS;
- DADS interfacing to computers and control software;
- Intelligent Instrumentation Systems; Data integrity.

48610

Introduction to Mechanical Engineering

CSE, EE, ME, BEBA BEBBus
6cp
Fields of practice: Mechanical Engineering Program

The objectives of this subject are to give students a clear idea of where mechanical engineering fits in the profession and in society; and of the career options open to mechanical engineers and the sorts of problems that mechanical engineering addresses. Students learn how mechanical engineering is conducted in the 'real world'; become aware of the engineering method and systematic approaches to the design process; learn to perform and explain simple mechanics problems and to perform the required calculations. They also learn to graphically represent objects by sketching, using drawing instruments and/or computer methods using standard representation techniques such as orthographic projection; gain an understanding of different materials, making selections based on fundamental material properties and required uses; and become aware of issues associated with moving and rotation machinery – such as lubrication/vibration/noise.

Topics include: introduction to the mechanical engineering profession; design and the engineering method; system oriented approaches to design and problem solving; introductory mechanics; sketching, drawing, and representation techniques; introduction to and awareness of various aspects of mechanical engineering, for example, materials; manufacturing; thermodynamics and heat transfer; electro-mechanical devices; rotating machinery; lubrication and wear.

48620

Fundamentals of Mechanical Engineering

ME, BEBA BEBBus
6cp; prerequisites: 48610 Introduction to Mechanical Engineering; 68039 Physical Modelling (2 semester mode) or 68037 Physical Modelling; 33130 Mathematical Modelling I or 33132 Mathematical Modelling I (2 semester mode)
Fields of practice: Mechanical Engineering Program

The objectives of this subject are to build on the engineering science fundamentals that were introduced in Introduction to Mechanical Engineering and which are required for later subjects, and to sharpen the focus on the university experience emphasised in early stage subjects. Students should gain an understanding of the approach to learning required of university study; Newtonian mechanics, which is one of the fundamental sciences underlying engineering practice; the modelling concept, as applied to Newtonian mechanics; the idea of particle mechanics and its limitations; basic engineering concepts such as equilibrium, force and acceleration, work, energy and power, impulse and momentum, and the relationships between them; and the idea that acceleration may result from a change in direction as well as change in magnitude of velocity.

Topics include: drawing and understanding the use and purpose of free body diagrams, frames and machines; stress resultants; kinematics and dynamics of plane motion; work, energy and power; linear impulse and momentum; conservation of momentum, impact; centroids and centres of mass; and area moments of inertia.

48621

Manufacturing Engineering

ME, BEBA BEBBus
6cp; prerequisite: 48610 Introduction to Mechanical Engineering
Fields of practice: Mechanical Engineering Program

The objectives of this subject are to: explain and provide examples of manufacturing processes listed in the material to be taught; identify and describe the manufacturing process by which different metal, wood, plastic and ceramic objects are made; demonstrate improved technical writing skills by completion of specified laboratory reports and site visit reports; demonstrate basic problem solving skills relating to manufacturing and production.

Students will learn the processes and materials available, as well as a competent and practical approach to evaluating, selecting and recognising the connections between the materials/processes and engineering design.

48640

Machine Dynamics

ME, BEBA BEBBus
6cp; prerequisite: 48620 Fundamentals of Mechanical Engineering
Fields of practice: Mechanical Engineering Program

The objectives of this subject are to give students an understanding of kinematics and dynamics of rigid bodies in general planar motion which are typically encountered in design and analysis of mechanical systems, and an elementary understanding of the vibration of mechanical systems, in particular, the dynamic behaviour of single degree of freedom mechanical systems with various damping and applied forces. Students should be able to: present rigid body planar and spatial kinematics; present rigid body planar dynamics; understand energy methods in contrast to direct applications of Newton's second Laws of Motion for setting up a model; understand the physics of a problem formulated from a real mechanical system and obtain multiple solutions to each problem; appreciate the role of vibration in machines and structures in the engineering world; understand the procedures required to evaluate a vibration problem; and analyse the dynamic response of single degree of freedom mechanical systems.

The subject also covers: the concept of a 'rigid' body, full nomenclature used in kinematics, two-body velocity equations, velocity pole and velocity diagrams of planar motion; two-body acceleration equations and acceleration diagram; three-body velocity equations and acceleration equations including Coriolis acceleration term; angular velocity acceleration equations including 3-dimensional problems; F=ma applied to a rigid-body-dynamics, significance of 'centre of mass', the 'moment' relationship ($M=I\alpha$ etc); angular momentum, conservation of angular momentum (general case, centre of mass moving, no 'fixed' point); linear and angular impulse problems; energy methods for general planar motion; elementary principles of vibration theory, free vibration of undamped single degree of freedom system; free decay vibration of damped single degree of freedom system; and the forced vibration of single degree of freedom system.

48641

Fluid Mechanics

CE, CEE, ME, BEBA BEBBus
6cp; corequisites: 33230 Mathematical Modelling 2; 48331 Mechanics of Solids
Fields of practice: Mechanical Engineering Program

The objectives of this subject are to enable students to: understand key concepts and fundamental principles, together with the assumptions made in their development, pertaining to fluid behaviour, both in static and flowing conditions; deal effectively with practical engineering situations, including the analysis and design of engineering systems and devices involving fluid flow; and engage in further specialised study or research.

Topics include: fluid properties and statics; conservation laws: of mass, momentum and energy; dimensional analysis and similitude; flow in pipes; external flow – lift and drag; potential flow; boundary layers; flow measurements; environmental hydraulics.

48642

Strength of Engineering Materials

ME, BEBA BEBBus
6cp, prerequisites: 60101 Chemistry and Materials Science; 48331 Mechanics of Solids
Fields of practice: Mechanical Engineering Program

This subject draws on, and brings together, the knowledge and skills developed in earlier subjects such as Fundamentals of Mechanical Engineering, Engineering Chemistry and Materials, and Solid Mechanics. It also prepares students for the more dedicated design subjects to come and exposes them to practical aspects of mechanical engineering design. The objectives are that students should be able to: understand, describe and use the methodology of modelling material properties and behaviour; understand and describe the fundamental differences in the behaviour of different types of materials; understand and describe how and why things fail; realise the importance of material selection in engineering design; predict, or design to avoid, failure given the material, environment and loading conditions; use analytical skills in stress analysis and knowledge of material properties in mechanical design.

Topics include: the use of stress analysis and material properties in materials selection and mechanical design; stress analysis – revise concept of normal and shear stress; combined stress; structures and m/c components;

impact; material behaviour – time dependent material properties; strength; failure modes – theories, criteria for static failure (e.g. Tresca, von Mises, Mohr, etc.), plastic collapse (axial, bending and limit analysis), buckling and warping, fracture, creep, fatigue, and fracture-mechanism maps.

48650

Mechanical and Manufacturing Design

ME, BEBA BEBBus
6cp; prerequisites: 48640 Machine Dynamics; 48621 Manufacturing Engineering; 48210 Engineering for Sustainability; 48642 Strength of Engineering Materials; 48510 Introduction to Electrical Engineering
Fields of practice: Mechanical Engineering Program

Engineering design is the activity in which the engineering sciences are put to practical purposes. This subject traces the engineering design process from identification of need, through methodology and analysis, documentation and information, to discussion of common machine elements and engineering materials. Students should gain an understanding of: the linkages between engineering science and engineering practice; some methodologies and techniques of engineering design; the documentation and communication of design; the use of standards in engineering and engineering design; and the use, properties and purpose of commonly used machine elements and materials.

Topics include: design methodology; modelling, optimisation and simulation; machine elements; computer aided design; materials and processes in design; and using standards, codes and handbooks.

48651

Thermodynamics

ME, BEBA BEBBus
6cp, prerequisites: 48641 Fluid Mechanics; 68039 Physical Modelling (2 semester mode) or 68037 Physical Modelling; 48620 Fundamentals of Mechanical Engineering
Fields of practice: Mechanical Engineering Program

The objectives of this subject are to: develop a fundamental understanding of applied thermodynamics in an engineering perspective; use thermodynamics effectively in the practice of engineering; lay the groundwork for subsequent studies in the fields related to energy systems; and increase an awareness and emphasis on energy resources and environmental issues.

Topics include: thermodynamic properties of pure substances; compressible flow; work and heat; the first law of thermodynamics; applications to closed systems; applications to open systems; the second law of thermodynamics; irreversibility; entropy; vapor power cycles; Rankine cycle and steam engines; refrigeration cycle; air standard power cycles; Brayton cycle and gas turbine engines; Otto cycle and spark ignition engines; diesel cycle and compression ignition engines.

48660

Dynamics and Control

ME, BEBA BEBBus
6cp; prerequisite: 48640 Machine Dynamics
Fields of practice: Mechanical Engineering Program

The objectives of this subject are to: have an understanding of the behaviour of linear (or approximately linear) dynamic systems that are typically encountered in the practice of mechanical engineering and process engineering; and gain an understanding of how such systems can be controlled, or have their dynamics altered, so as to achieve desired outcomes.

Topics include: modelling of dynamic systems governed by linear ordinary differential equations of arbitrary order; transient response, frequency response, damped oscillations, neutral stability, instability; investigation of commonly occurring non-linearities and the simulation of them; application of above concepts to analysis of multi-degree of freedom vibrating systems; application of above concepts to the control of dynamic systems by negative feedback; the design of controllers using integral, proportional and derivative actions; data sampling and computer-based control.

48661

Energy Applications

ME, BE BA BEBBus
6cp; prerequisite: 48651 Thermodynamics
Fields of practice: Mechanical Engineering Program

The objectives of this subject are to: understand key concepts and fundamental principles, together with the assumptions made in their development, underlying the operation of various energy-transfer machines, particularly turbomachines; deal effectively with practical engineering situations involving such machines, including their selection, application, performance prediction and design; follow the technical literature and engage in further in-depth study or research.

Topics include: fundamentals of heat transfer; fundamental principles of turbomachines; similitude in turbomachines; flow in cascades; cavitation in pumps; centrifugal pumps, fans and compressors; axial-flow pumps, fans and compressors; radial-flow turbines; and axial-flow turbines.

48662

Mechanical Applications

ME, BEBA BEBBus
6cp; prerequisites: 48642 Strength of Engineering Materials; 48640 Machine Dynamics
Fields of practice: Mechanical Engineering Program

The objectives of this subject is to teach students to: apply some of the basic concepts of rigid and deformable body mechanics learnt in previous subjects, and the more advanced concepts developed in this subject, to various mechanical applications; understand the interdependence of motion, forces, vibration and stress in mechanical applications; see how computer methods can complement a good understanding of the underlying theory when solving problems related to the previous point; and develop an aptitude in multiple approach problem solving.

Specific subject content varies from semester to semester as it reflects student needs and interests and style of teacher, but is likely to include: elementary spatial kinematics and the design of unconstrained mechanisms such as constant velocity joints and guidance linkages; systems of shafts and gears geometry together with associated lubrication, vibration and stress characteristics; the application of spatial dynamics to machine component motion where appropriate; problems associated with vehicle dynamics; stress analysis and methods of solid mechanics applied to various mechanical engineering applications; and modelling and computer methods including Finite Element Analysis.

48663

Advanced Manufacturing

ME, BEBA BEBBus
6cp; prerequisites: 48621 Manufacturing Engineering; 48650 Mechanical and Manufacturing Design
Fields of practice: Mechanical Engineering Program

The objectives of this subject are to: understand the design and manufacturing processing of sheet metal products using a CAD/CAM system (flatpattern, nesting and punchpress/laser); utilise CAD/CAM software to generate and evaluate numerical control (NC) programs for the production of tooling and moulds/dies; utilise coordinate measuring machines and CAD system to evaluate how well manufactured parts meet design criteria; demonstrate good technical writing skills by completion of specified laboratory reports; and demonstrate advanced problem solving skills relating to manufacturing and production.

There are three CAD/CAM modules. Module 1: Sheet metal operations which include flatpattern, nesting and punchpress/laser. Module 2: CAD/CAM tool path generation for milling machine operations including point-to-point machining, planar milling, surface milling, and cavity milling. Machining parameters such spindle speeds, feed rates depth of cut and power requirements will be determined. Module 3: Understanding GD&T and CMM operations to evaluate manufactured part for quality.

48670

Engineering Design

ME, BEBA BEBBus
6cp; prerequisites: All of Stage 5
Fields of practice: Mechanical Engineering Program

Engineering design is the activity in which the engineering sciences are put to practical purposes. Engineering Design is the second of two design subjects in the mechanical engineering field of practice. This subject extends the previous subject in two directions: The identification of need is broadened to encompass engineering ethics, risk, health and safety, sustainability and the environmental impact of engineering design. A second complementary strand extends the design activity addressed in the earlier subject to systems, processes and machines.

The objectives of this subject are to give students an understanding of: the linkages between engineering science and engineering practice; the methodology of engineering design; the documentation and communication of design; the use of standards in engineering and engineering design; the use and purpose of commonly used machine elements and materials; engineering systems design; and the wider context of design, including ethics in design and design for sustainability.

Topics include: design methodology; materials and processes in design; engineering ethics; safety in design; and designing for sustainability.

48720

Introduction to Telecommunications Engineering

TE, BEBA BEBBus
6cp
Fields of practice: Telecommunications Engineering

The objectives of this subject are: to introduce students to the basic concepts and terminology used in telecommunications engineering; to give them basic, up-to-date, 'hands-on', technical skills to assist in finding employment in the field as part of the degree program; to familiarise them with the telecommunications degree program and the rationale behind its structure; and to introduce them to staff involved in telecommunications engineering so that they are aware of current research activities in the field.

Topics include the following: Telephony – the public switched telephone network; mobile telephone networks. Computer communications – modems; host computers* (PCs, and workstations); networks*; the Internet*; mobile communications. Broadcast systems – radio and television; satellite and cable TV; integrated networks – ISDN and ATM.

* These topics are covered in more depth.

48730

Authentication and System Security

TE, BEBA BEBBus
6cp; prerequisites: 48720 Introduction to Telecommunications; 33230 Mathematical Modelling 2; 48220 Informatics; corequisites: 48430 Software Development
Fields of practice: Telecommunications Engineering

By completing this subject, students should be able to formulate their own answers to the following questions: How can data security on networks be achieved? What is the role of firewalls? What is the role of cryptographic codes? What file protection techniques exist? How can passwords be used effectively? What hardware security techniques exist? What software security techniques exist?

Topics include: file protection; password protection; controlling computer access; controlling file access; encryption algorithms; firewalls; virus threats and security measures; channel control; and channel verification.

48740

Communication Networks

CSE, SE,TE, BEBA, BEBBus
6cp; prerequisite: 48430 Software Development
Fields of practice: Telecommunications Engineering

Students will be able to appreciate the principles, design approaches, standards and new digital networks in the field of telecommunications networks. The first half of this subject will concentrate on number of basic principles that appear in this field and examine and evaluate alternative approaches to meeting specific requirements. Students will acquire a reasonable understanding of current standards and their role in relation to future developments. Telecommunication networks are increasingly using broadband technologies to expand their functionality. As a result, telecommunication engineers are required to design and maintain these networks. The latter part of this subject will concentrate on both narrowband and broadband switching technologies, network design concepts and performance measures associated with integrated services networks.

Topics include: data communications; data transmission, transmission media, data encoding, line coding; data communication interface; data link control, multiplexing; Wide Area Networks; circuit switching, packet switching, frame relay, ATM; Local Area Networks; LAN systems, bridges; communications architecture and protocols; protocols and architecture, Internetworking, Internet Protocol, Transport protocols; network security, distributed applications, ISDN and Broadband ISDN.

48750

Network Planning and Management

TE, BEBA, BEBBus
6cp; prerequisites: 33230 Mathematical Modelling 2; 48740 Communication Networks
Fields of practice: Telecommunications Engineering

The objectives of this subject are for students to develop competencies needed for the planning and management of networks, particularly in the areas of traffic source modelling, performance analysis, dimensioning, simulation, and management.

Students will acquire a solid foundation in: modelling of traffic, including bursty sources; dimensioning of fixed networks (primary, alternate, and final route trunking and switching facilities); mobile networks (GSM and CDMA); frame relay networks;

performance analysis of networks based on queuing theory; circuit switching networks; packet switching networks; ATM networks; Local Area Networks (LANs); computer networks; design of common transmission, switching, and service facilities based on a performance/cost analysis aimed at optimising the usage of network resources; simulation tools, particularly Sigma, to model and analyse the performance of networks; network management based on the interplay principle between commercial and technical aspects of designing the network, utilising the technical tools learned above while meeting budget and resource constraints.

Topics include: Part 1: Traffic Source Modelling (CBR, bursty VBR) – Point processes with applications to source traffic modelling; Markov chain theory; other stochastic processes: autoregressive; autoregressive moving average; fluid traffic. Part 2: Network design, planning, and dimensioning – introduction to teletraffic engineering; basics of traffic system design; traffic models for loss and delay systems; designing alternate routing networks; additional applications: traffic analysis in digital telephony; dimensioning of incoming and outgoing lines to/from PABX; dimensioning principles of mobile networks; GSM dimensioning; CDMA dimensioning; dimensioning principles of frame relay networks. Part 3: Performance analysis and management of networks – continuous time queuing theory; network of queues. Additional applications include: performance analysis of medium access control protocols; computer communications networks; statistical multiplexing. Advanced applications include: traffic management in ATM; teletraffic considerations in PCs; and network Management principles. Part 4: Network simulation and modelling validation – overview of discrete event system modelling; tutorial on SIGMA. Selected topics include: single queue, single server model; single queue, multi server model; multi queue, multi server model; single queue with different arrival patterns; server with service breaks; events with priorities; cancellation of events; entering of new events to the system; system performance evaluations; and individual service utilisation.

48770

Signal Processing

TE, BEBA, BEBBus, BScBE
6cp; prerequisite: 48540 Signals and Systems
Fields of practice: Telecommunications Engineering

The objectives of this subject are to enable students to: develop insight into the discrete implementation of signal theory; develop engineering judgement in analysing signal processing problems; become familiar with practical techniques of implementing signal processing algorithms.

Topics include: A/D and D/A conversion; processing with discrete signals and systems; system implementation and convolution; Fourier transforms and discrete Fourier transforms of discrete time signals and systems; Z-transforms; implementation of FIR filters; implementation of IIR filters; finite precision effects; introductory spectral analysis; and decimation and interpolation.

48771

Communication Theory

TE, BEBA BEBBus
6cp; prerequisite: 48540 Signals and Systems
Fields of practice: Telecommunications Engineering

By completing this subject, students should be able to formulate their own answers to the following questions: What are the bandwidth and channel resources required for a digital communications system? What are the system elements and the performance of analogue communication systems? How is the digital modulation type chosen in system design? How is a channel code type chosen in system design? What is the bit error rate performance of various digital modulation types? How is a link budget used in system design? How are carrier, clock, and frame synchronisation achieved? How can systems be designed for multiple access communications?

Topics include: random processes and power spectral density; introduction to digital transmission; review of applicable mathematical concepts; the MAP detector; the maximum likelihood detector; digital modulation techniques; bit error rate performance; link design and the link budget; channel bandwidth requirements; multiple access techniques; synchronisation techniques; channel coding.

48780

Mobile Communications

TE, BEBA BEBBus
6cp; prerequisites: 48540 Signals and Systems; 48720 Introduction to Telecommunications Engineering
FIELDS OF PRACTICE: TELECOMMUNICATIONS ENGINEERING

The objectives of this subject are to develop students' awareness of: the basic conceptual foundations in the science of electrical communications and its implications and uses for telecommunication and wireless applications; the origin of the various tools and formulae applied to circuit analysis, electrical, electronic and telecommunications design; the conceptual difference between lumped-element and distributed circuit behaviour; the role of electromagnetic wave propagation in explaining 'action at a distance' concepts involved in many real life telecommunication engineering applications; the mathematical tools applied in the spatial modelling of electromagnetic waves; the inter-relationships between different fundamental quantities and concepts, and the application of these concepts to solve practical problems; and the mathematical concepts required for modelling, analysis and design of telecommunication systems.

Topics include: models for action-at-a-distance-after-a-time-delay – the consequent development of a formalism placing results of familiar (restricted) models of electric and magnetic effects into an overarching framework. In this module, spatial vector operators will be introduced and their physical meanings explained. Maxwell's equations will be developed within the framework, and general electrodynamic and power/signal transport conceptions placed within a realistic model that is relatively robust in the face of new technologies and applications not yet envisaged.

Application to unbounded waves – unbounded medium as a communication channel; wave equations and wave functions, (briefly exposed in the subject Physical Modelling), behaviour in conducting and dielectric media, power flow/power loss and its material origin.

Application to bounded devices – boundary conditions, behaviour as a combination of discrete modes, standing and travelling waves. Static fields are introduced as special cases of dynamic fields. The subject introduces polarization, wave propagation through multiple conducting and dielectric regions, reflection, refraction, Snell's laws, critical angle, brewster angle and diffraction, discusses TEM, TE and TM waves, phase and group velocities and dispersion, propagation characteristics of microwaves with reference to mobile communications.

Application to guided waves – introduces the concepts of guided-wave propagation using field model, metallic and dielectric guiding structures, hybrid modes and optical fibres. Students look at the fundamental dispersion and attenuation limits applicable to an optical communication channel; make a comparison with analogous but different mechanisms applying to copper signal lines, transmission lines, microwave and radio systems of communication. The subject includes the study of system budgeting in optical links, and some overview of future trends of application of the optical spectrum in telecommunications and computing and signal transduction.

Application to transmission lines (particular to communications applications) – introduces the transmission line as the major example of distributed network pertinent to electrical communication engineers, analyses the behaviour of the transmission line in the time-domain and frequency domain, inter-relates circuit and field concepts, discusses impedance, reflection, transmission and standing wave concepts, introduces impedance matching and Smith chart, discusses the use of transmission line sections for realising distributed reactive circuit elements and resonators. Introduces transmission line as a communication channel. Students undertake laboratory experiments on microstripline and co-axial line passive devices.

Application to antennas and radiation – introduces electromagnetic interference, discusses antenna as a transducer, and antenna characteristics, analysese monopole, dipole, slot and loop antennas, discusses design issues of printed antennas, introduces array antennas – binomial and chebyshev array synthesis and discusses the design of base station antennas. Derive link equation and discuss fixed and mobile communication link design fundamentals.

48820

Introduction to Environmental Engineering

CEE, ESE, BEBA

6cp

Fields of practice: Environmental Engineering Program

The objectives of this subject are: to introduce students to key concepts of environmental science and engineering, and to the social, legislative and political context of the work of environmental engineers; to develop their understanding of the consequences of humans interacting with their environment; to enable them to answer questions such as What is 'pollution'? and What skills are needed for the responsible practice of environmental engineering? The following material is examined and integrated:

The work of environmental engineers – local and global environmental problems and their implications for engineers; the emergence of environmental engineering as a separate discipline; issues addressed by engineers who regard themselves as environmental engineers in Australia; career paths; interactions between environmental engineers and other professions, occupations and groups; community attitudes towards engineers and the social and professional implications of these attitudes for their work; the IEAust Code of Ethics and policies on the environment, heritage and sustainability; journals and other sources of information on environmental engineering; an introduction to environmental management systems and auditing.

The social environment – the social construction of 'environment'; environmental ethics; an introduction to environmentalism, especially in Australia; aims and strategies of Australian non-governmental environmental organisations and community action groups.

The political and legislative environment – how environmental policy and decisions are made; the nature of environmental disputes, and their resolution; environmental legislation and environmental planning.

The natural environment – the atmosphere, hydrosphere and geosphere; the science of the atmosphere and hydrosphere; the concept of biogeochemical cycles in the context of environmental engineering; an introduction to climate, geomorphology, and soil and vegetation associations; methods used to monitor the environment, and geographical information systems.

Consequences of humans interacting with their environment – the environmental impacts of poorly planned urbanisation, industrialisation, and other forms of development; the sources, causes, and effects of air, noise, water and soil pollution; an introduction to the mitigation and abatement of these impacts.

48835

Environmental Monitoring

ESE, BEBA, BEBBus

6cp; prerequisites: 68037/68039 Physical Modelling

Fields of practice: Electrical Engineering Program

This subject aims to provide students with an understanding of the possibilities and limitations of methods used for environment monitoring; and to develop the ability to select, use and interpret the results of local and remote sensing equipment to monitor the quality of the environment for some specific applications.

Topics include: physical quantities and qualities of the environment monitored using suitable instrumentation, referring particularly to water, air, noise and soil pollution and degradation; methods and equipment for environment measurement and monitoring; local sensing and remote data transmission; remote sensing using satellites and aerial surveys; access to information on the environment.

Other topics include: fundamentals of Data Acquisition Systems; physical principles and characteristics of local sensors for temperature, pressure, flow rate, radiation, chemical composition and pollution of gases, liquids and soil; biosensors for indoor and outdoor pollutants; meteorological monitoring; signal conditioning and processing of sensor signals; analog to digital conversion and microcomputer control of DAS; remote data transmission, telemetry; display, recording, processing and analysis of data; and software for data acquisition, data logging and data analysis.

It also covers: the principles of remote sensing; electromagnetic radiation; multispectral and thermal photographic sensing; image resolution, processing and interpretation; active microwave sensing; remote sensing of terrestrial environment and geophysical parameters; monitoring of agricultural, forest and urban land usage and cover; and global remote sensing.

Assessment: Examinations 70 per cent; Laboratory reports 10 per cent, Assignments 20 per cent

Note: Laboratory experiments refer to local sensing and to using data acquisition systems. Assignments will include: remote sensing image interpretation projects; choosing and specifying methods and equipment for a specific environment monitoring task.

48840

Water Supply and Wastewater Engineering

CEE, BEBA BEBBus
6cp; prerequisites: 60101 Chemistry and Materials Science; 48820 Introduction to Environmental Engineering
Fields of practice: Environmental Engineering Program

This subject provides Civil and Environmental Engineering students with a detailed knowledge of (1) water pollution control objectives; (2) the design of potable water and sewage treatment processes and sewerage and water reticulation systems, and (3) the technologies used in the upgrading of water and wastewater treatment plants and in water reuse.

At the completion of this subject, students will understand: public health and environmental objectives in water supply and wastewater disposal; the design concepts for drinking water and sewage treatment plants; sewerage systems and water reticulation systems; and new technologies developed to meet the new water quality and water re-use objectives.

Topics include: sewerage systems and water supply systems – water quality and quantity; description and design concepts for sewerage systems; design concepts for reticulation systems; sewage treatment – water pollution, statutory requirements; primary treatment; biological/ secondary processes; tertiary treatment; potable water treatment – flocculation, sedimentation, filtration, ion-adsorption, disinfection; new water quality standards for specific pollutants and technologies used for upgrading on water treatment processes; quality requirements for water recycling and water re-use technologies; cases studies on water reclamation projects, small community and large potable water treatment plants; laboratory laboratory sessions to determine flocculation, sedimentation, and filtration performance.

48845

Soil and Landscape Systems

ESE BEBA, BEBBus
6cp; prerequisites: 60102 Environmental Physical Chemistry; 91150 Biology and Ecology; 48820 Introduction to Environmental Engineering
Fields of practice: Environmental Engineering Program

The objective of this subject is to give a broad-based introduction to the geo-sciences. These sciences provide fundamental inputs to the analysis of environmental problems associated with soil and rock. The subject is broken into three components – geology, solid engineering and soil science. Each is taught by a different lecturer in order to familiarise students with the subject matter and terminology of the three disciplines. At the completion of the course students should be familiar with the natural processes occurring on the surface of the earth; be able to communicate with geologists, earth scientists and others involved in studying the ground and be aware of the importance of inter-disciplinary involvement; understand those aspects of soil and rock behaviour which have an important bearing on environmental impact; be able consider the broad range of inputs necessary in understanding the interaction between soil and human activities in the field of environmental engineering; and have a solid basis for further study in the field.

Topics include: geological fundamentals – soil/ rock cycle, rock classification and composition, structure of rock, weathering, properties of rock, hydrogeology; an introduction to soil engineering – nature of soil, classification, soil mechanics, state of stress in soil, groundwater and seepage, permeability; soil sciences – geomorphology, soil formation and landforms, soil chemistry, soil surveying and soil inputs in environmental impact studies.

48850

Environmental Planning and Law

CEE, BEBA BEBBus
6cp; prerequisite: 48820 Introduction to Environmental Engineering
Fields of practice: Environmental Engineering Program

The objectives of this subject are: to introduce key environmental law relating to water, waste, energy and land use issues; to give a sound understanding of the history of planning with particular emphasis being placed on the NSW experience; to develop awareness of planning legislation in NSW and

the need to engineer within the constraints of that legislation; to provide knowledge of the planning process and constraints on land use planning; to develop skills to identify and deal with legal problems confronting engineers in industry; to develop the capacity to communicate in both written and verbal form when dealing with legal matters relating to the environment and land use planning; and to equip students with the skills necessary to deal with legal issues in the absence of detailed lecture material. This will help students to know when to ask questions or seek professional legal advice and to introduce them to the operation of the Land and Environment Court of NSW.

Students will cover the following topics: Environmental Law – the operation of the Environment Protection Authority of NSW, water and waste legislation (*Clean Waters Act* and *Waste Minimisation Act*), air and noise legislation (*Clean Air Act* and *Noise Control Act*), miscellaneous environmental legislation addressing pollution issues, *Independent Pricing and Regulatory Tribunal Act, Sydney Water Corporatisation Act,* selected court decisions relating to pollution and land use issues, *Environmental Offences and Penalties Act.*

Environmental Planning – evolution of human settlement, NSW environmental planning legislation, urban planning and sustainability, planning the neighbourhood, environmental studies, environmental impact assessment in NSW, traffic noise in the urban environment, project control and the environment, and the operation of the Land and Environment Court of NSW.

Tutorial sessions will be scheduled twice a week to discuss environmental law and planning issues using case studies.

Students have to present a 10 minute discussion paper on an environmental issue of an engineering nature, which will assist in developing verbal communication skills and audio-visual equipment usage skills, as well as developing inter-disciplinary teamwork skills.

48855

Air and Noise Pollution

ESE, BEBA BEBBus

6cp; prerequisites: 33230 Mathematical Modelling 2 (CE, CEE); 68037 Physical Modelling; 60102 Environmental Physical Chemistry; 48651 Thermodynamics

The objective of this subject is to enable students to understand the key concepts and fundamental principles involved in the assessment of air and noise pollution and in dealing with the associated problems.

The air pollution component of this subject draws on material in preceding subjects on chemistry and physical and mathematical modelling, to deal with the origins and extent of air pollution problems.

The noise pollution component introduces the student to the two main areas of noise pollution, namely: occupational noise and environmental noise. The legislation and policing bodies pertaining to these are also discussed. The noise component is presented in an applied manner with an emphasis on the measurement of noise pollution in its varied forms with a field experiment. Several case studies on noise pollution and assessment will be reviewed.

48856

Environmental Biotechnology and Ecotoxicology

ESE, BEBA, BEBBus

6cp; prerequisites: 68037 Physical Modelling; 60102 Environmental Physical Chemistry; 91150 Biology and Ecology

Fields of practice: Environmental Engineering Program

The role of biotechnology and ecotoxicology in environmental systems and management has long been recognized. This subject includes the following topics:

Introduction to biotechnology and ecotoxicology in environmental management; biological systems and their applications in domestic and trade waste management with an emphasis on energy production; principles of environmental bioremediation and bioaugmentation using natural and genetically modified organics and their application in oil spills and chemically contaminated sites; genetically engineered micro-organisms in hazardous and toxic waste management; role of environmental biotechnology in the air

quality improvement and the prevention of green house effect and ozone depletion; engineered and natural microorganisms in cleaner production with case studies on paper, mining and dairy industries, biosensors in environmental monitoring.

Students will explore toxic substances in aquatic, atmospheric and terrestrial environments, and the prediction of species response to pollution stress. Studies will include a look at organisms as indicators of environmental conditions and ecosystem approaches to pollution effects.

48857

Environmental Geotechnics

ESE, BEBA, BEBBus
6cp; prerequisite: 48845 Soil and Landscape Systems
Fields of practice: Environmental Engineering Program

The environmental status of soil for engineering purposes has become a major issue with the increasing urbanisation of city hinterlands and coastal plains which were formerly rural areas. The object of this subject is to introduce students to the identification, assessment and management of the development of such areas that in many instances are underlain by soils with specific physical and chemical properties. These soils include acid sulfate soil, contaminated soil and sodic soil. The subject will also address problems such as urban soil salinity. The students will be made aware of the appropriate legislation and planning controls which provide guidelines for development and management of such areas. Other topics that are an integral part of this subject include groundwater contamination and transport and sediment and erosion control.

At the completion of the course students should be able to identify these soils and be able to communicate with ecologists, earth scientists and hydrogeologists so that that best management practice can be achieved.

48860

Pollution Control and Waste Management

CEE, BEBA BEBBus
6cp; prerequisite: 48840 Water Supply and Wastewater Engineering or 48350 Environmental and Sanitation Engineering
Fields of practice: Environmental Engineering Program

The main objective of this subject is to provide an opportunity to understand the principles of pollution control and waste management in a modern society. The subject develops an understanding of air and noise pollution control technologies, as well as better product or process design to mitigate the problems of air and noise pollution both in automobile industry and other manufacturing industries. It also begins to tackle the problems of solid and hazardous waste minimisation, generation, treatment and disposal.

Topics include: solid waste characterisation, generation and composition analysis, development of optimum collection routing network, transfer stations, design, operation and maintenance of sanitary landfills, and related social and environmental issues; hazardous waste generation, regulatory process, process information, toxicology, design of treatment and stabilisation methodologies, methods of disposal and related environmental issues, community perspective and education; soil contamination, chemical, biological and thermal remediation methodologies, site characterisation, planning, monitoring, containment and case studies; air pollutants and their types, sources, generation, measurements and estimations. Other topics include: control of the generation of specific air pollutants from the manufacturing and automobile industries; an overview of the indoor air pollution problem and its control; environmental regulation and air quality standards; noise pollution sources; the effect of noise on people; noise measurements; traffic noise predictions; and noise control and related regulation.

48865

Life Cycle Analysis

ESE, BEBA BEBBus
6cp; prerequisite: 48856 Environmental Biotechnology and Ecotoxicology
FIELDS OF PRACTICE: ENVIRONMENTAL ENGINEERING PROGRAM

Life cycle analysis (also known as life cycle assessment) is a systematic, general method of comparing the environmental, health, social and economic impacts of different products, processes and systems. It represents a sophisticated, holistic, system-oriented approach to reducing environmental impacts. The practical application of life cycle analysis still presents many practical difficulties, but simpler methods and approaches currently under development seem likely to address many of these problems while maintaining its usefulness.

The objectives of this subject are to enable students to understand the key concepts and fundamental principles involved, the assumptions made in their development, and the ways the methodology is applied in practice.

Students will explore the application of Life Cycle Analysis to energy and other systems. For a number of selected cases they will follow the whole process of analysis, from initial decision making about the purpose and conduct of the analysis, through detailed study of the various systems involved, to evaluation, interpretation, reporting and critical review of the results.

48866

Environmental Systems Modelling

ESE, BEBA, BEBus
6cp; prerequisites: 48855 Air and Noise Pollution; 48362 Hydraulics and Hydrology; 48845 Soil and Landscape Systems
FIELDS OF PRACTICE: ENVIRONMENTAL ENGINEERING PROGRAM

Upon completion of this subject, students should be able to demonstrate:

1. a critical understanding of the process and uses of mathematical and computer-based modelling;
2. experience in engaging and evaluating an authentic mathematical modelling process in an environmental systems engineering context;
3. competence in independent and peer-based learning, and application of a new area of mathematics and/or mathematical method, and software;
4. critical awareness of the ethical and political dimensions of modelling;
5. success in documenting, planning and managing a modelling project in a group situation; and
6. continuing critical reflection on the learning and practices of engineers.

The subject will involve critical reading of some of the literature on the socio-political dimensions of modelling, as well as mathematical and technical literature on mathematical methods and models. Students will be introduced to classification of models, for example - physical systems versus socio-economic systems models; top-down versus bottom-up models; and linear versus nonlinear models, statistical versus deterministic models, and so on.

Students will spend the earlier part of the semester engaging in a common modelling project. The environmental systems context of the project may vary from year to year. In the latter part of the semester, students will engage in an individually or team-based negotiated learning contract where they will be formulating their own modelling project in the environmental systems area.

Assessment will consist of three learning contracts consisting of: a learning journal; common modelling project; and a negotiated modelling project.

48875

Environmental Audit

CEE, BEBA BEBBus
6cp; prerequisite: 48865 Life Cycle Analysis
FIELDS OF PRACTICE: ENVIRONMENTAL ENGINEERING PROGRAM

Environmental audit is a systematic, periodic, objective and documented evaluation of available resources, facilities and their management. It not only gauges the environmental status of a system, but also identifies environmental hazards. This subject will deal with environmental issues in a community including industries. Some of the topics in this subject include processes for water, sewage and trade waste treatment that are required to meet the guidelines set by regulatory bodies. This subject will also deal with processes for solid and hazardous waste

management in a community and/or industry. An emphasis will be placed on selecting these processes in an integrated system to obtain sustainable solutions. The treatment processes selected will initially aim to comply with environmental regulations and ultimately to achieve higher environmental performance.

50140

Modernisation and Social Change

BEBA DipEngPrac (all majors)
8cp; 4hpw; coordinated by the Institute for International studies and the Faculty of Humanities and Social Sciences

The importance of the comparative analysis of social change has been emphasised since the late 1980s with the end of the Cold War, as well as rapid social, economic and political change in Eastern Europe, East and South-East Asia. There have been various claims for the inevitable triumph of the homogenising influences of capitalism and democracy; a renewed emphasis on cultural determinism; and a questioning of the Eurocentricity of the social sciences. Through an examination of key elements of modernisation and social change this subject provides an introduction to social change in Western Europe, Latin America, East and South-East Asia, as well as the academic discussions about the processes of social change.

There are no prerequisites for this subject. It is intended primarily for students in the International Studies program, but can be taken by any student interested in the comparative analysis of social change.

60101

Chemistry and Materials Science

CE, CEE, ESE, ME, BEBA BEBBus
6cp
Whilst there are no prerequisites for this subject, it is expected that students preparing to undertake the subject will have passed NSW HSC 2 Unit Chemistry, the UTS Chemistry bridging course or equivalent
FIELDS OF PRACTICE: MECHANICAL ENGINEERING PROGRAM

On completion of the subject students should: understand why engineers require a fundamental understanding of chemistry and materials; have a solid science foundation (theory) for further engineering studies (application); understand the fundamentals of chemistry and materials terminology and nomenclature in order to facilitate the working relationship of engineers, chemists and materials scientists; understand the role of chemistry in engineering processes and enterprises in general; be able to identify and solve chemical problems in engineering projects; relate properties of engineering materials to their structure and bonding; relate properties of engineering chemicals/materials important in the environment to structure/bonding; relate properties of engineering chemicals/materials important in manufacturing to structure/bonding; be aware of economic, environmental and societal factors/impacts of chemistry and materials in engineering; be able to interpret and discuss results or advice obtained from a chemical/materials laboratory/chemist/materials scientist; appreciate the role of a chemist/materials scientist; have a disciplined, scientific approach to problem solving.

Topics include: Chemical bonding of materials – electronic structure of materials, fundamental bonding concepts, chemical reactions; Materials science and engineering – classification of materials, structure property relationship, mechanical properties, ferrous and non-ferrous alloys, engineering ceramics, composites, materials degradation and materials selection; Industrial organic chemistry – hydrocarbons, functional groups, polymers, energy and fuels; Electrochemical processes – reduction-oxidation reactions, spontaneous reactions, electrochemical cells, electrolysis, electroplating, industrial processes, corrosion – theory, applications and protection. In covering these topics specific applications in engineering design, manufacturing, maintenance and operations will be emphasised.

60102

Environmental Physical Chemistry

ESE
6cp; prerequisite: 60101 Chemistry and Materials Science
FIELDS OF PRACTICE: ENVIRONMENTAL ENGINEERING PROGRAM

This subject is designed to provide students with a sound knowledge of the underlying physical chemistry principles of chemical thermodynamics and reaction kinetics, in the study of environmental systems engineering. A sound knowledge of these twin pillars of physical chemistry is extremely important for numerous professional environmental engineering activities that include process design for waste treatment, as well as fate and transport modelling.

The bedrock of environmental engineering is a sound knowledge of chemical thermodynamics and reaction kinetics. Unfortunately, these topics are not formally addressed in most environmental engineering curricula.

During the early stages of the deveopment of environmental engineering, the emphasis was on air and water quality, hence traditional courses in environmental engineering focussed on the basic chemistry of water analysis, and to some extent atmospheric processes. Over the last few decades a change in both the emphasis and content of environmental engineering has occurred, due to its interdisciplinary nature. Increasingly, it is becoming obvious that a student deficient in physical chemistry principles will find himself/herself treading on unfamiliar territory.

65101

Chemistry 1C

6cp; 6hpw; assumed knowledge: core of HSC 2–unit chemistry or equivalent

This subject is an introduction to some fundamental concepts in chemistry. Topics covered are: chemicals and chemical reactions; atomic structure; the periodic table; chemical bonding; enthalpy changes in chemical reactions; and the structures and properties of solids. The subject is designed for students with a strong background in chemistry and accordingly the topics are covered to a greater depth than in 65012 Chemistry 1A. There is a laboratory program which complements the learning experiences of the lectures and tutorials. Other important aims of this subject are to enhance students' thinking skills, to foster their ability to work cooperatively with their peers and to assist in the development of their communication skills.

65201

Chemistry 2C

6cp; 6hpw; prerequisite: 65101 Chemistry 1C or equivalent

This subject builds on the foundation studies in 65101 Chemistry 1C. Topics covered are: chemical equilibrium; acid-base theory; complex ions; electrochemistry; chemical kinetics; structure and bonding in carbon chemistry; chemical reactions of carbon compounds. There is a laboratory program which complements the learning experiences in the lectures and tutorials.

The subject also aims to enhance students' thinking skills, to foster their ability to work cooperatively with their peers, and to assist in the development of their communication skills.

68037

Physical Modelling

CE, CEE, CSE, ESE, EE, ME, SE,TE, BEBA BEBBus 6cp; prerequisites: NSW HSC 2–Unit Mathematics is assumed, and HSC 2 Unit Physics is recommended; corequisite: 33130 Mathematical Modelling 1

CORE

Refer to 69039 Physical Modelling (2 semester mode) for subject description.

68038

Advanced Mathematics and Physics

EE, BEBA, BEBBus
6cp; prerequisites: 68037/68039 Physical Modelling; 33230 Mathematical Modelling 2; 48510 Introduction to Electrical Engineering

FIELDS OF PRACTICE: ELECTRICAL ENGINEERING PROGRAM

The objectives of this subject are: to develop the mathematical skills and foundations required to describe a range of electrical engineering and engineering science systems, especially those to be encountered in senior undergraduate and postgraduate programs; to provide an introductory understanding of key concepts in modern physics which underpin modern electrical engineering technologies; to equip students with a basic understanding of the dielectric and magnetic properties of key electrical engineering materials; to introduce some fundamental insights into select electronic and photonic devices and transducers.

Topics include: advanced Mathematics – one dimensional heat and wave equations; solution by separation of variables; Fourier sine and cosine series; line and surface integrals; divergence and curl; theorems of Gauss and Stokes; application to field and potential problems; functions of a complex variable; Cauchy-Riemann equations; complex integration; Cauchy's integral theorem and integral formula; Taylor and Laurent series; singular points and their use in contour integration; inverse Laplace transforms. Advanced Physics – electrons as quantum entities, basic quantum concepts, simple solutions of the Schroedinger equation; energy levels in atoms, molecules and semiconductors. Selection of two from: laser, optical absorption and emission, optical sensors, or magnetisation and dielectric polarisation fundamentals, or ferroelectrics, piezoelectrics,

dielectric breakdown, or basis of some everyday transducers (e.g. temperature, pressure, force, velocity).

68039

Physical Modelling (2 semester mode)

CE, CEE, CSE, ESE, EE, ME, SE,TE, BEBA BEBBus 6cp; prerequisites: NSW HSC 2 Unit Mathematics is assumed, and HSC 2 Unit Physics is recommended; corequisites: 33132 Mathematical Modelling 1 (2 semester mode)
CORE

The objectives of this subject are to provide students with: a conceptual basis in mechanics, thermal physics, waves and optics, electric and magnetic fields; problem solving skills through practice in selected problems; an appreciation of the role of modelling, and hence mathematics, in understanding and describing the natural world; the basic techniques of physical measurement, data analysis and verification of models; technical communication skills; an understanding of nature through its natural components, with an emphasis on vector methods and modes (including frames of reference, coordinate systems and orthogonality); an appreciation of the nature of physics as a professional discipline of great importance to engineering innovation; an ability to use physical concepts in a mathematical formulation and hence be able to apply those concepts to engineering problems.

Lectures

Mechanics (including fluids) (11 lectures): Introduction (SI system, dimensions etc.), vectors, motion (linear and rotational), Newton's laws, circular motion, friction, energy, momentum, elasticity and fluids at rest and in motion; Heat and Thermodynamics (8 lectures): kinetic theory, temperature, heat capacity, heat transfer, ideal gas, 1st law and Carnot cycle; Waves (4 lectures): Introduction to waves, waves, superposition of waves, light and EM spectrum; Optics (4 lectures): Mirrors, lenses, optical instruments, optical and wave behaviour; Electric and Magnetic Fields (7 lectures): Electrostatics, magnetism and magnetic materials, magnetic fields and optical and wave behaviour, electromagnetism and electromagnetic applications; Special Topics (3 lectures).

Laboratory program

Basis of Experimentation (3 sessions) basic measurements; data, uncertainties, graphs; and modelling data; Oscillations and Vibrations (2 sessions) introduction to oscillations; and damped and forced oscillations.

Thermal Physics (2 sessions); Optics (2 sessions); Fields (3 sessions).

Notes

- Topics covered in the mechanics, and heat and thermodynamics lectures, and the associated laboratory sessions, form a conceptual basis for much of the subject mathematical modelling
- The names in the lecture schedule are topic names. Different topics will be taught at different levels. Problem solving will only occur in select areas; other areas will be qualitative.
- The pivotal role of modelling complex physical systems using vectors, suitable coordinate frames and other decomposition techniques, such as normal modes, will be demonstrated wherever suitable. The reverse process of combining components to show observed behaviour will also be covered. This will be followed up in Mathematical Modelling 2 and various Engineering subjects.
- The Special Topics lectures will cover a wide range of material and will be assessed in the final examination. The topics will include issues such as historical perspectives, current social issues related to Science, and the latest physics research.

68101

Physics 1C

6cp; 6hpw

This is a foundation physics subject primarily for students in the physical sciences. It covers the fundamentals of dynamics and statics, fluid mechanics, thermal physics, electricity and waves. Students are introduced to the basic techniques of measurement.

68201

Physics 2

6cp; 6hpw; prerequisite: 68101 Physics 1C

This subject covers the fundamentals of electrostatics, electromagnetism, optics and atomic and nuclear physics, as well as extending the Physics 1C coverage of mechanics, thermal and fluids.

68311

Physics 3

6cp; 5hpw; prerequisites: 68201 Physics 2; 33290 Computing and Mathematics for Science

This subject builds on the concepts introduced in earlier physics material, employing first year mathematical techniques to extend the understanding and modelling of mechanics and optics and to embrace the exciting developments of modern physics, this then providing the foundation of later core physics subjects. Mechanics topics will include the generalisation of kiematics to 3D motion, orbital mechanics and the dynamics of complex systems. Optics studies will include refraction, lenses, dispersion of light, aberrations, polarisation and scattering phenomena. Modern physics will study the basic properties of the atom, radioactivity and relativity, leading into a foundation study of quantum mechanics. Elective modules of interest to medical science students may be available. The emphasis of the subject is theoretical, but laboratory work will be extended from the explorative first year treatment to optical experimentation, study of radioactivity and computer simulation of dynamic systems.

68312

Applied Physics 1

6cp; 5hpw; prerequisites: 68201 Physics 2; 33290 Computing and Mathematics for Science

This subject covers three main areas of activity: electromagnetism, the practical implementation of physical concepts and the analysis of experimental data. The concepts of electricity, electromagnetism and electrical measurements are developed and used as the context to explore the processes of science and scientific investigation and to emphasise skills such as experimental design, scientific writing and analysis of experimental data. This is a key to providing students with the confidence, skills and flexibility to design, implement and analyse scientific experiments.

68314

Electronics

Offered jointly by the Faculty of Science and the Faculty of Engineering. Students may choose this subject or 48520 to suit their timetable.
6cp; 5hpw; prerequisites: 68201 Physics 2 and either 33190 Mathematical Modelling for Science or 33130 Mathematical Modelling 1

This subject will develop students' understanding of the basic building blocks of electronic circuits. Topics include: a review of circuit theory, semiconductors theory, diodes and bipolar transistors, transistors as switches and linear devices, introduction to digital electronics, logic gates, latches and counters, frequency characteristics and feedback in amplifiers, and operational amplifiers. The subject includes hands-on learning and guided discovery activities in the laboratory context. The subject may be offered jointly with 68411.

68411

Physics 4

6cp; 5hpw; prerequisites: 68311 Physics 3; 33390 Mathematics and Scientific Software

The subject fulfils two important functions, namely, to round off the study of classical and fluid mechanics and to build a solid foundation in quantum mechanics for future subjects. Twentieth century technologies of jet propulsion, energy-absorbing materials, nuclear power and lasers are explored through classical and fluid mechanics and vibration, quantum and nuclear physics, including the solution of the one-dimensional Schroedinger equation. Elective modules of interest to medical science students may be available. Although the emphasis of this subject is mostly theoretical, there will be the opportunity for laboratory work in nuclear physics. The use of computer packages for qualitative and quantitative analysis of mechanics and waves is a central feature.

68412

Applied Physics 2

6cp; 5hpw; prerequisite: 68312 Applied Physics 1

This subject will develop students' organisational skills and provide opportunities to apply the experimental design skills of Applied Physics 1 to larger scale investigations. The broad topic areas covered are vacuum and thin film technology, energy technology and sustainability, and project management. There is a high experimental component, and small group project work will

allow students to develop their project management skills. At this stage of the course there is an expectation that students will take the opportunity to further develop their independent learning skills. Self-access resources and the use of the Physics Resources Centre will be a key component of this subject.

68511

Quantum and Solid State Physics

6cp; 5hpw; prerequisites: 68411 Physics 4; 33490 Computational Mathematics and Physics

This subject will highlight the fundamental nature of quantum mechanics and its application to the understanding of solids. Potential wells, eigenstates and eigenvalues, solutions to SWE in 3 dimensions, LCAO, band theory, electrons and phonons in solids will be explored. Applications of the theory in 1D and 2D devices, the interaction between electromagnetic waves and solids and the quantum mechanical basis for the LASER will also be a key feature. You do not have to be Einstein to understand the quantum mechanical basis of the LASER nor its importance to modern life. A major assignment will be computational and will utilise software skills developed in 33490 Computational Mathematics and Physics.

68512

Applied Physics 3

6cp; 5hpw; prerequisite: 68312 Applied Physics 1 (or equivalent experimental design experience)

The purpose of this 'capstone' applied physics subject is to provide the opportunity for students to experience applied physics research. Students will be able to develop skills in cutting edge research techniques. Exact topics covered will vary, depending on the availability of staff. For example, X-ray diffraction, atomic force microscopy, scanning electron microscopy, solar energy materials, advanced optical characterisation, lighting, energy, medical imaging, and parallel computing could be offered. A few background lectures may take place, though the subject will be predominantly project and laboratory based. The subject would be a suitable elective for students in all branches of the physical sciences.

68611

Electromagnetics and Optics

6cp; 5hpw; prerequisites: 68201 Physics 2; 33490 Computational Mathematics and Physics or equivalent

The subject's purpose is to consolidate the emphasis on optics and its applications in the course. The development of an understanding of electromagnetic theory and some of its key features, and its relevance to modern telecommunications will benefit scientists and engineers. The subject seeks to consolidate students' understanding of the theory of electromagnetism in the modern world. The topics include derivation, and application, of Maxwell's equations, energy transfer by waves, guided waves and optical fibre technology, optical instrumentation, diffraction and spatial filtering techniques. The emphasis of this subject is conceptual. Students will also engage in an extensive laboratory program in experimental optics. Computer simulation and data visualisation techniques will underpin the electromagnetics theory. Students will be encouraged to explore topics of interest through project activities.

79370

Law and Contracts

BT
3cp; prerequisite: 48074 Engineering Communication and Documentation
subject coordinator: Mr M Adams (Faculty of Law)

The objectives of this subject are to familiarise students with the Australian legal framework, the sources of commercial engineering law in Australia and the responsibilities of engineers in an industrial environment; and to prepare students for the procedures and processes of operating and negotiating contractual matters as a client, consultant or contractor.

Topics include: an introduction to Australian Law; elements of engineering contracting including the contract life cycle; contract organisation; application of quality assurance; occupational safety and security; environmental protection; product liability; intellectual property and principles of employment contracts.

Assessment: 2 assignments of 25 per cent; class participation 10 per cent; examinations 40 per cent.

91150

Biology and Ecology

CEE, ESE, BEBA BEBBus
6cp
Fields of practice: Environmental Engineering Program

The principal objective of this subject is to provide a sound background in biology and ecology relevant to students majoring in Environmental Engineering and related fields. It will also provide the foundation for later subjects, such as Introduction to Environmental Engineering and Water Supply and Wastewater Engineering.

Students will have a good understanding of key concepts, including: structure and function of cells, cell division and the role of genetic material in cell function; biodiversity – the classification and distinguishing characteristics of plants, animals and microorganisms and their economic, medical and ecological importance; the physiology of higher plants and mammals and the effects of environmental pollution and disturbance; the principles of population and community ecology; the structure and function of aquatic and terrestrial ecosystems; and the impact and management of humans on natural ecosystems.

Topics include: Introduction: What is biology? What is ecology? Contribution to biology and ecology from other disciplines. Role of engineers and physical scientists in environmental management and pollution control. Living things contrasted with non-living things. Viruses. Origins of life.

Cellular basis of life: Cells as the basic unit of life and their functions. Use of light and electron microscopy as tools for studying cells. Prokaryotic and eukaryotic cells and their ultrastructure. Organelles in eukaryotic cells, their structure and function.

Role of genetic material in cell function: Role of genetic material in cell function and heredity. Structure of DNA and RNA. Process of enzyme synthesis in cells. Enzymes as catalysts in biochemical reactions. One gene one enzyme theory. Causes and consequences of mutation.

Cell Divisions: Biological significance of cell divisions. Cell division in prokaryotes. Cell division in eukaryotes – mitosis. Sexual reproduction in eukaryotes – meiosos and its function in the life cycle of eukaryotes. Significance of sexual and asexual means of reproduction in life history and the long term survival of populations and species. Causes and effects of errors in the mitotic and meiotic processes.

Biodiversity: The ecological significance of biodiversity. The need to classify. Concept of species, bionomial nomenclature. Hierarchy in classification. The distinguishing characteristics, classification, and the medical and economic importance of organisms in the plant and animal kingdoms.

Environmental microbiology: The nature of microorganisms and their contribution to biological relationships and processes in aquatic and terrestrial ecosystems. Stable and unstable microbial communities. The impact of environmental microbiology on economic activities – waste disposal practices, metal corrosion and others.

Plant physiology and the effects of environmental pollution and disturbance: Photosynthesis; soil and water relationships and evapotranspiration; mineral nutrition; reproduction; regulation of plant development; plant hormones. Effects of air and water pollution or salinisation. Soil erosion.

Animal physiology and the effects of environmental pollution: Structures of the organ systems and their functions – respiratory, circulatory, digestive, reproductive, nervous, hormonal, immune, muscular and skeletal systems in the human. Effects of environmental pollution and personal life style on the occurrence of disease.

Ecology: General principles of ecology: its scope, the definition of autecology, synecology, populations, community, ecosystems, biome and biosphere. Structural components of ecosystems – producers, consumers and decomposers. Biotic and abiotic factors, climatic regions. Energy flow in ecosystems: trophic levels, food webs, pyramids of biomass, energy and numbers. Contrast of one-way energy throughput with biogeochemical cycles. Succession to stability. The climax concept, community development, habitat, niche, and spatial diversity. Classification of terrestrial biomes. Detailed examination of the structure, function and vulnerability of a terrestrial ecosystem and an aquatic ecosystem. Human impacts on natural ecosystems – air and water pollution, soil erosion and toxic contamination. Management and control of impacts.

POSTGRADUATE SUBJECTS

Subjects offered to students enrolled in the Graduate School of Engineering are listed in numerical order below. Subjects taught in the Faculty of Engineering are listed first, then those taught in other faculties.

Subjects are listed in alphabetical order in the next section.

Most subjects can be taken as electives, provided prerequisite requirements are satisfied. However, the availability of subjects which are core to specialist (specific award) courses may be affected by policies on class size.

All postgraduate subjects are open to a limited number of senior undergraduates. This ensures the viability of some specialist subjects with limited postgraduate demand. Whenever possible, if subjects are popular with both groups, separate classes will be held for undergraduates. Not all subjects will be offered this year.

Specialist (specific award) courses are identified below as follows:

Master of Engineering Management	MEM
Master of Engineering in Groundwater Management	ME(GWM)
Master of Environmental Engineering Management	MEEM
Graduate Diploma in Engineering in Groundwater Management	GDE(GWM)
Graduate Diploma in Local Government Engineering	GD(LGE)
Graduate Certificate in Environmental Engineering and Management	GC(EEM)
Graduate Certificate in Engineering Management	GC(EM)

Research Degrees

Students undertaking PhD or ME by Thesis must enrol in the appropriate subject number as listed below:

41777 ME Thesis (Electrical – F/T)
41778 ME Thesis (Electrical – P/T)
41987 PhD Thesis (Electrical – P/T)
41988 PhD Thesis (Electrical – F/T)
42777 ME Thesis (Mechanical – F/T)
42778 ME Thesis (Mechanical – P/T)
42987 PhD Thesis (Mechanical – P/T)
42988 PhD Thesis (Mechanical – F/T)
43777 ME Thesis (Civil – F/T)
43778 ME Thesis (Civil – P/T)
43987 PhD Thesis (Civil – P/T)
43988 PhD Thesis (Civil – F/T)
44777 ME Thesis (Groundwater MGT – F/T)
44778 ME Thesis (Groundwater MGT – P/T)
44987 PhD Thesis (Groundwater MGT – P/T)
44988 PhD Thesis (Groundwater MGT – F/T)
49777 ME Thesis (Eng – F/T)
49778 ME Thesis (Eng – P/T)
49987 PhD Thesis (Eng – P/T)
49988 PhD Thesis (Eng – F/T)

Coursework Awards - General and Specialist

Credit point values (cp) and contact hours per week (hpw) are indicated against each subject.

Coordinator and assessment details may vary from semester to semester.

49001

Judgment and Decision Making

Availability: all courses (core for MEM)
6cp; 3hpw/distance mode
subject coordinator: A/Prof J V Parkin

This subject develops understanding of rational decision aids in the light of modern descriptive theories of judgment, choice and decision in organisations. The methods of management science, decision analysis and judgment analysis are presented, and models of individual, group and strategic decision making are critically assessed.

Assessment: two assignments 30 per cent each; one quiz 40 per cent.

49002

Project Management

Availability: all courses (core for MEM)
6cp; 3hpw/distance mode
subject coordinator: Mr D Eager

The emphasis is an interdisciplinary one of relevance to all fields of engineering. The subject considers the management, financial and contractual responsibilities of engineering managers and organisations from the establishment of a project team and the instigation of a contract. The perspective of all parties, including principal contractors and subcontractors is considered.

Assessment: assignments 30 per cent; reading list evaluations 30 per cent; project 40 per cent.

49003

Economic Evaluation

Availability: all courses (core for MEM)
6cp; 3hpw/distance mode
subject coordinator: Dr D Sharma

This subject deals with the application of economic concepts to engineering decision making. Main topics include: Macroeconomic issues and policies; microeconomic market theory; theory of the firm; project evaluation and cost-benefit analysis; intangibles and risk.

Assessment: three assignments 40 per cent; two quizzes 60 per cent.

49004

Systems Engineering for Managers

Availability: all courses (core for MEM)
6cp; 3hpw; prerequisite: 49001 Judgment and Decision Making or equivalent; corequisite: 49002 Project Management
subject coordinator: Prof W R Belcher

The underlying process of problem solving through engineering projects is interpreted as a unifying discipline. Drawing on contemporary scholarship and best practice, the philosophy, concepts, techniques and tools of this systems engineering process are examined in the context of engineering management, and their domain of applicability explored. The subject provides extensive opportunity for individual and group encounter with the challenges of the systems approach, and is illustrated by case studies presented by guest lecturers.

Assessment: mastery test (confirming understanding of concepts) 20 per cent; group assignment (relating to case studies) 30 per cent; individual project (including seminar) 50 per cent.

49005

Technological Change

Availability: all courses
6cp; 3hpw
subject coordinator: Dr R B Ward

In this subject the results of introduction of technological innovations into society are examined, using both historical and contemporary examples. The potential effects of emerging technologies are considered with the possibilities of facilitating planned and desirable technological developments. The subject is also seen as a key element in the development of communication skills at a professional level, orally in small and large groups and in written work.

Assessment: four essays 20 per cent each; student seminar 20 per cent.

49006

Risk Management in Engineering

Availability: all courses
6cp; 3hpw; prerequisite: suitable undergraduate subject
subject coordinator: Mr J Irish

This subject develops capability to identify, assess, ameliorate and limit risk in the management and practice of engineering through the application of the concepts and tools of risk engineering. On completion, students are also able to identify the main hazards in an engineering project and to design an appropriate risk management strategy. Topics supported by case studies include: semantics of risk and hazard; risk as a social construct; principles of risk management; steps in risk engineering; integration with engineering process; risk perception, risk communication, and the acceptability of risks; statutory provisions in NSW relating to some engineering risks; legal principles relating to engineering risks (contract, liability etc); checklists and scoping for risk identification and assessment; design criteria and code provisions for various risks; comparing risks; quantified and qualitative risk assessment methods; risk assessment in emergencies; financial tools in the management of engineering risks.

Assessment: four assignments 25 per cent each.

49009

Engineering in Australian Society

Availability: all courses
6cp; 3hpw
subject coordinator: A/Prof S Johnston

The subject deals with the nature of the engineering profession and its various interactions with society in Australia. Attention is given to the historical development of engineering practice in Australia, current trends, and issues for the future. The philosophical basis of the profession and its relationship with the environment, industry and the community are explored. Engineering policy development processes and their recent outcomes are discussed.

Assessment: introductory exploration 10 per cent; participation in workshops and group discussions 10 per cent; major assignment 40 per cent, minor assignment 20 per cent; seminar or debate 20 per cent.

49010

Engineering Ethics

Availability: all courses
6cp; 3hpw
subject coordinator: A/Prof S Johnston

The subject deals with professionalism, the roles of Codes of Ethics, and the responsibilities of professional engineers. It systematically introduces students to the concepts of Honesty, Truthfulness and Reliability; to ways of thinking about moral issues; and to methods of solving moral problems. It also deals with Risk, Safety and Liability in Engineering, and the promotion and enforcement of ethical standards.

Assessment: introductory exploration 5 per cent; participation in workshops and group discussions 20 per cent; major assignment 40 per cent, minor assignment 15 per cent; seminar or debate 20 per cent.

49011

International Engineering

Availability: all courses
6cp; 3hpw
subject coordinator: A/Prof S Johnston

The subject deals with the international nature of engineering and the ways in which it is changing. Attention is given to both current trends and issues for the future. Processes of accreditation of professional engineers are reviewed, with a view to expanding on the details of Australian practice and locating it in its global context. New models of organisation of engineering activity are reviewed, including 'virtual enterprises'. Practical workshops are included to explore some of the problems associated with working across cultures.

Assessment: introductory exploration 5 per cent; participation in workshops and group discussions 20 per cent; minor assignment 15 per cent; seminar or debate 20 per cent; major assignment 40 per cent.

49012

Project Management Support Systems

Availability: all courses
6cp; block attendance and Internet support; prerequisite: some experience in industry on participating in an engineering project. It is desirable that students either complete or are concurrently studying 49002 Project Management
subject coordinator: Mr R Bagia

The aim of this subject is to develop the skills for planning and controlling projects. Students will also learn how to use computer tools to construct a project plan of a real project and control a simulated project. Students will understand how models for Project Management have been developed and which models are appropriate in different contexts. The model will include the 'waterfall' model, the incremental development model and the spiral model. Models for risk assessment and financial planning aspects of projects will also be covered. Students will understand and apply terms such as Work Breakdown Structure, Network Planning, PERT, GANTT charts, cash flow and Cost/Schedule Control Systems Criteria to their project.

Assessment: developing and presenting a project plan 40 per cent; simulating a project 10 per cent; auditing a project 10 per cent; preparation and participation in workshop 20 per cent, subject portfolio 10 per cent; computer-mediated conference participation 10 per cent.

49013

Managing Information Technology in Engineering

Availability: all courses
6cp; block attendance and Internet support; prerequisite: an introductory course on computing; students should already have some skills such as being able to use a word processor, spreadsheet, email and a WEB browser
subject coordinator: Mr R Bagia

The aim of this subject is to explore the influence of Information Technology (IT) on organisations and management and in particular engineering management. Students will critically examine both past and recent IT innovations. Issues in information technology will extend into groupware, computer-aided logistic support, decisions support systems, tools for systems engineering and communications technology including the Internet. Students will use a computer

mediated conferencing tool on the Internet to participate in group project work either on or off campus. Most of the support material such as lectures will be on the Internet.

Assessment: development of IT policy and selection criteria for the IT Manager 30 per cent; library research group project 30 per cent; participating and reflection on using computer mediating conferencing tools 20 per cent; debate 20 per cent.

49021

Evaluation of Infrastructure Investments

Availability: limited (core in Energy Planning and Policy programs for ME, MTech)
6cp; 3 modules, each 2 days; prerequisite: introductory course in Probability and Statistics, or equivalent
subject coordinator: Dr D Sharma

The subject develops capability to appraise, analyse and evaluate energy investments within a multidisciplinary framework. Topics include: the context and rationale of project evaluation; characteristics of energy project investments; concepts and methods of financial and economic evaluation of energy investments; issues in cost-benefit evaluation; treatment of risk, intangibles, and externalities; environmental considerations in project evaluation; multi-attribute evaluation frameworks; case studies. Emphasis is place on achieving depth and balance in all aspects of the evaluation process, with topical case studies providing an application focus.

Assessment: assignments 40 per cent; quizzes 50 per cent; contribution to class discussions 10 per cent.

49022

Energy Resources and Technology

Availability: limited (core in Energy Planning and Policy programs for ME, MTech)
6cp; block attendance
subject coordinator: Dr D Sharma

Topics covered in this subject include: energy resources and reserves; concepts and principles of resource assessment; regional, national and international resource requirements and availability; resource technology evaluation; and the economic and environmental impacts of resource use.

Assessment: assignments 40 per cent; quizzes 60 per cent.

49023

Energy and Environmental Economics

Availability: limited (core in Energy Planning Policy programs for ME, MTech)
6cp; 3 modules, each 2 days; prerequisite: introductory course in Microeconomics, or equivalent; corequisite: 49021 Evaluation of Infrastructure Investments
subject coordinator: Dr D Sharma

Topics include: energy-economy-environment interactions; the micro model (demand, supply and markets); short-run and long-run energy pricing; shadow pricing of energy; the economics of non-renewable and renewable energy resources; intemporal allocation of resources; the economics of the environment; economic and non-economic principles for environmental valuation. Emphasis is placed on achieving depth and balance in all aspects of the valuation principles, with topical case studies providing an application focus.

Assessment: assignments 40 per cent; quizzes 50 per cent; participation 10 per cent.

49024

Energy Modelling

Availability: limited (core in energy Planning and Policy programs for ME, MTech)
6cp; 3 modules, each 2 days; prerequisites: 49023 Energy and Environmental Economics; 49021 Evaluation of Infrastructure Investments (recommended)
subject coordinator: Dr D Sharma

This subject covers: models and modelling; macroeconomic settings of energy-economy modelling; energy balances; energy input-output analysis; energy aggregating; energy system modelling, energy demand modelling; modelling of energy economy interactions.

Assessment: assignments 40 per cent; quizzes 50 per cent; contribution to class discussions 10 per cent.

49025

Methods for Energy Analysis

Availability: limited
3cp; 3hpw
subject coordinator: Dr D Sharma

This subject covers: probability concepts; sampling and estimation; regression analysis; statistical tests; analysis of variance; simultaneous equations; time series methods; econometric models and applications; introduction to statistical packages.

Assessment: assignments 60 per cent; examinations 40 per cent.

49026

Electricity Sector Planning

Availability: limited (see prerequisites)
6cp; 3 modules, each 2 days; prerequisites: 49021 Evaluation of Infrastructure Investments, 49023 Energy and Environmental Economics (recommended)
subject coordinator: Dr D Sharma

Topics covered in this subject include: nature of electricity planning; planning perspective; economic and technological dimensions of power system operation, reliability and integrity; generation planning and production costing; demand-side management planning; integrated resource planning; selected topics on issues relating to the environment, institutional structures, renewable resources, regulation, etc. Emphasis is placed on all aspects of electricity sector planning and policy, with topical case studies providing an application focus.

Assessment: assignments 40 per cent; quizzes 50 per cent; contribution to class discussions 10 per cent.

49027

Energy Demand Analysis and Forecasting

Availability: limited (see prerequisites)
6cp; block attendance; prerequisites: 49023 Energy and Environmental Economics; 49024 Energy Modelling, or equivalents
subject coordinator: Dr D Sharma

This subject looks at the theoretical and analytical concepts and tools used for the understanding of energy demand generation and evolution in relation to socio-economic development. Students will learn methods and models of energy demand projections and explore the various considerations which must be made in the design, implementation and monitoring of an energy demand management policy.

Assessment: assignments 40 per cent; quizzes 60 per cent.

49028

Policy and Planning of Energy Conservation

Availability: limited (see prerequisite)
6cp; block attendance; prerequisite: 49021 Evaluation of Infrastructure Investments, 49023 Energy and Environmental Economics, or equivalents
subject coordinator: Dr D Sharma

This subject introduces students to the rationale and context for energy conservation planning and policy; historical perspective of energy conservation; public and private sector interventions and mechanisms for rationalising the design of energy conservation policies; examples and case studies of energy conservation programs at national, sectoral and enterprise levels in developing and industrialised countries; decision methods for program design.

Assessment: assignments 40 per cent; quizzes 60 per cent.

49029

Environmental Policy for Energy Systems

Availability: limited (see prerequisites)
6cp; block attendance; prerequisite: 49021 Evaluation of Infrastructure Investments; corequisites: 49023 Energy and Environmental Economics; 49024 Energy Modelling (recommended)
subject coordinator: Dr D Sharma

This subject introduces students to the following: policy context; energy resource system analysis; approaches to environmental impact assessment; analysis of pollution effects and control technologies; risk analysis of energy systems; costs and benefits of environmental management; and institutional and regulatory issues.

Assessment: assignments 40 per cent; quizzes 60 per cent.

49031

Information Structures, Perception and User Interface Design

Availability: all courses
6cp; 3hpw or block attendance
subject coordinator: Dr D Lowe

This subject will look at how authors create information and how users access it. It introduces students to methodologies used to structure information, to facilitate creation and access. Existing information classification and

indexing schemes will be studied and extended to meet demands imposed by hypermedia systems. User interface design issues based on how we perceive and access information, and how different media can be used to effectively communicate a message, will also be studied in this subject.

Assessment: assignments and project 100 per cent.

49032

Sustainable Technological Development

Availability: all courses
6cp; 3hpw or block attendance
subject coordinator: A/Prof P Bryce

This subject examines the application of sustainable development objectives to project definition and design requirements, in the context of renewable energy projects in the developing world. The context provides a practical format to explore the more general issues of client and community participation in engineering decision-making. The emerging energy technologies, particularly renewable, are discussed and compared with an application context.

Assessment: major project design study 50 per cent; minor assignment 25 per cent; presentations and contribution to class discussions 25 per cent.

49040

Graduate Seminar

Availability: all coursework award courses
3cp; 3 hour sessions at intervals over two or more semesters
subject coordinators: Prof W R Belcher, A/Prof B Samali

The subject enhances professional communication skills, in written and oral English, through the preparation, presentation and defence of a topic being studied at advanced level in two or more public seminars. It also develops understanding of professional expectations and communication possibilities through attendance at other nominated seminars. It provides opportunities to present research or project work to an audience of peers, academic staff and professional practitioners, making use of modern technologies for presentation and audience participation within and beyond UTS. (Seminars are normally presented in rooms permitting full audio/video interaction.) Guidance in preparation is offered, and structured feedback from advisers and audience, on content and presentation.

Assessment is criterion-referenced and ungraded, and requires the submission of written materials, seminars relating to the candidate's concurrent research, or project work.

49041

Engineering Research Methodology

Availability: all coursework
6cp; 3hpw; prerequisites: enrolment in a UTS research or coursework program at Master's or Doctoral level
subject coordinators: Prof W R Belcher, A/Prof B Samali

The subject familiarises students with a range of approaches used in engineering research, with an emphasis on approaches used in professional practice. Topics include the advantages and limitations of different research approaches and their applicability in different engineering contexts, the recognition and protection of intellectual property, and the boundaries and interdependencies between research, development, design and innovation. Research ethics in engineering are also reviewed.

Students learn how to design research programs and to analyse and interpret data and reports. Participants solve problems creatively, access and utilise information resources, and critically evaluate research work.

Assessment is criterion-referenced and ungraded, and based on assignments requiring preparing of a research critique, a research plan, a discussion group assignment and a seminar presentation.

49044

Engineering Communication and Documentation

Availability: all courses
6cp; 3hpw or block attendance
subject coordinator: Mrs H McGregor

High level communication skills are essential for professional engineers. This subject explores communication theories which support effective practice. It investigates the role of information as an engineering resource. The increasing importance of engineering documentation is analysed and strategies for producing and managing documentation are developed.

Assessment: continuous assessment of a variety of assignments. First assignment 10 per cent; research project and class presentation 50 per cent (oral presentation 25 per cent, written presentation 25 per cent); team project (40 per cent).

49045

Engineering for Lawyers

Availability: Graduate Certificate in Law for Court Referees only
6cp; 3hpw; prerequisites: Postgraduate enrolment in a Faculty of Law research or coursework program
subject coordinator: Prof W R Belcher

Many disputes require that referees have an overview of issues and concepts which relate to engineering. This subject will enable referees to develop an understanding of engineering practice.

Assessment: participation 10 per cent; preliminary assignment 30 per cent; final assignment 60 per cent.

49047

Finite Element Applications in Structural Mechanics

Availability: all courses
6cp; 3hpw or block attendance; prerequisites: suitable undergraduate subjects
subject coordinator: Dr A Saleh

This subject extends understanding of Finite Element Analysis (FEA) techniques and their application to problems in engineering, particularly in solid and structural mechanics, and develops problem formulation and modelling skills in FEA. Topics include a review of matrix analysis methods; the derivation of element stiffness, force and field matrices; an introduction to geometrical and material non-linearity; and dynamic analysis and stability. Each is illustrated by engineering applications. The subject requires the use of general purpose FEA programs in assignments and project work.

Assessment: assignments 60 per cent; project 20 per cent; quiz 20 per cent.

49050–76

Graduate Project

Availability: ME, MTech only
Normally 18-24cp, individual supervision over 1, 2 or 3 semesters; prerequisites: completion of all other subject requirements of the course in which the student in enrolled; apart from those taken as corequisites. Corequisites: any outstanding subject requirements for the course in which the student is enrolled; 49040 Graduate Seminar may be one of them
subject coordinator: Dr Hung Chung

The project is a capstone requirement taken over one or two semesters or in exceptional circumstances, three. It is undertaken on an individual basis, except in special circumstances approved in advance by the Faculty Board in Engineering, and provides opportunity for the integration and application of advanced skills and knowledge gained in part through other subjects taken during the course. The depth and extent of the project varies with credit point requirements. These are set on the basis of an agreed project plan submitted by the student to the supervisor, and approved by the Head of the Graduate School of Engineering. The project may involve the development of new technology (hardware and/or software), the application of technology, research addressing a significant technical or engineering management issue or, in special circumstances, a critical review in the area of the student's concentration, describing key contributions in the field covered by the project work undertaken, results achieved and a discussion of their significance and implications.

Assessment is based on the preparation of a written report, usually, and a seminar presentation.

49050 Graduate Project (12cp in 1 sem)
49051 Graduate Project (12cp in 2 sem)
49052 Graduate Project (18cp in 1 sem)
49053 Graduate Project (19cp in 1 sem)
49054 Graduate Project (20cp in 1 sem)
49055 Graduate Project (21cp in 1 sem)
49056 Graduate Project (22cp in 1 sem)
49057 Graduate Project (23cp in 1 sem)
49058 Graduate Project (24cp in 1 sem)
49060 Graduate Project (18cp in 2 sem)
49061 Graduate Project (19cp in 2 sem)
49062 Graduate Project (20cp in 2 sem)
49063 Graduate Project (21cp in 2 sem)
49064 Graduate Project (22cp in 2 sem)
49065 Graduate Project (23cp in 2 sem)

49066 Graduate Project (24cp in 2 sem)
49070 Graduate Project (18cp in 3 sem)
49071 Graduate Project (19cp in 3 sem)
49072 Graduate Project (20cp in 3 sem)
49073 Graduate Project (21cp in 3 sem)
49074 Graduate Project (22cp in 3 sem)
49075 Graduate Project (23cp in 3 sem)
49076 Graduate Project (24cp in 3 sem)

49082, 49083, 49084, 49086

Special Course A

49092, 49093, 49094, 49096

Special Course B

Availability: all courses
2, 3, 4 or 6cp; normally block attendance;
prerequisites: appropriate to the agreed learning contract
subject coordinator: A/Prof J V Parkin

This subject offers students maximum educational opportunity to benefit from short courses and other learning experiences available through the Faculty of Engineering. Enrolment for credit is approved by the Head of the Graduate School, on the coursework recommendation of the relevant Coursework Director, for a program of study to be undertaken and assessed within a prescribed period. Approval requires demonstration by the candidate to the Director of a special learning need or development opportunity consistent with the other requirements of the candidate's program.

Assessment: individual assessment requirements are agreed in a learning contract according to each individual program of study being undertaken. Normally assessment includes written and oral components and the demonstration of enhanced engineering capability in the application of principles.

49082	Special Course A	2cp
49083	Special Course A	3cp
49084	Special Course A	4cp
49086	Special Course A	6cp
49092	Special Course B	2cp
49093	Special Course B	3cp
49094	Special Course B	4cp
49096	Special Course B	6cp

Groundwater Projects

44152

Groundwater Engineering Project (FT)

44156

Groundwater Engineering Project (PT)

Availability: ME(GWM) only 24cp

44153

Groundwater Engineering Project (FT)

44157

Groundwater Engineering Project (PT)

Availability: GDE(GWM) only 12cp
subject coordinator: Prof M J Knight, National Centre for Groundwater Management

49102

Traffic and Transportation

Availability: all courses
6cp; block attendance
subject coordinator: Mr P Kenny

The objective of this subject is to provide the student with the knowledge to implement traffic engineering principles in the local government area in accordance with current practice in NSW. The student will be introduced to standards adopted by the Roads and Traffic Authority NSW and AUSTROADS. The subject provides the basic principles of transportation planning and traffic engineering, including the technical aspects and the influence of environmental and political factors.

Assessment: project 40 per cent; examination 60 per cent.

49103

Management and Industrial Relations

Availability: all courses (core for GD(LGE))
6cp; block attendance
subject coordinator: A/Prof T Anderson

The objective of this subject is to examine the concept of management; its principles, functions, structures, processes, systems and their application; and how management systems can be operated in a cohesive fashion to achieve effectiveness, efficiency and economy in 'real-world' situations.

Its subjects include management concepts, principles and systems, management process, organisational behaviour, functional management, and managing effectiveness.

Assessment: major assignment 50 per cent of class mark; examination 40 per cent; class work 10 per cent.

49104

Asset Maintenance Management

Availability: all courses (core for GD(LGE))
6cp; block attendance
subject coordinator: Mr K Halstead

This subject aims to enhance the skills and capacity of the local government engineer to: develop an awareness of the real cost of owning, operating and maintaining assets and services; gain an understanding of the planning, design, maintenance, and monitoring concepts and methods, with a view to optimising life cycle cost/benefits; develop knowledge of the methods for assessing and controlling potential losses and risks; and understand how these aims interact with and support the requirements of the management, logistics, reporting and accounting guidelines.

Subjects include legislative and other requirements, basic maintenance strategies, maintenance support strategies, risk assessment and control, maintenance management systems.

Assessment: project 40 per cent; examination 60 per cent.

49105

Water Supply and Wastewater Management

Availability: all courses (core for GD(LGE))
6cp; block attendance
subject coordinator: Prof S Vigneswaran

The objective of this subject is to concentrate on the design, operation and maintenance of municipal wastewater treatment plants, sewage systems and water supply systems. At the completion of this subject the student will understand drinking water and sewage treatment plants, sewerage systems and water reticulation systems in terms of purpose, basic design concepts, operation and maintenance, identifying and quantifying major problems, operating these systems to avoid or overcome problems.

Subject content includes statutory requirements, constituents and quality of wastewaters, description, operation and control of treatment process, performance monitoring, sewerage and water reticulation systems, trouble-shooting and problem solving.

Assessment: two assignments 30 per cent; mid-semester examination 25 per cent, formal final examination 45 per cent.

49106

Road Engineering Practice

Availability: all courses (core for GD(LGE))
6cp; block attendance
subject coordinator: Mr P Kenny

The aim of this subject is to equip students with the ability to design, construct and maintain roads in accordance with current practice in NSW. This includes pavement design, as well as the geometric design of roads. The subject embraces the standards adopted by the Roads and Traffic Authority NSW, AUSTROADS and the Australian Road Research Board. Particular attention will be paid to the requirements of the residential street network. Students will also develop an understanding of current issues in road engineering, particularly quality assurance contracts, road safety needs of pedestrians and cyclists, and the use of innovative techniques in road construction and maintenance.

Assessment: assignments 40 per cent; examination 60 per cent.

49107

Storm Runoff Regulation

Availability: all courses
6cp; block attendance
subject coordinator: A/Prof G O'Loughlin

This subject aims to: refresh students in basic principles and methods of hydraulics and hydrology; familiarise them with methods of urban drainage set out in recent manuals, with an emphasis on flood protection and integration with stormwater quality enhancement; and provide an overview of rural design flood estimation, erosion protection, flood mitigation and coastal engineering.

Assessment: five assignments 50 per cent; final examination 50 per cent.

49108

Local Government Law

Availability: all courses (core for GD(LGE))
6cp; block attendance
subject coordinator: Mr K Halstead

This subject aims to provide the Local Government Engineer with the necessary skills to operate within the legal framework of legislative requirements and procedures governing Local Government in NSW; appropriate knowledge of the law, to operate effectively within environmental, economic, social and physical constraints; and the knowledge and expertise to manage the environment in a practical and effective manner. It covers the history of Local Government in NSW, the local government engineer as a senior officer, *Local Government Act* and *Companion Legislation 1993*, Local Government Regulations, and the *Roads Act 1993*.

Assessment: project 40 per cent; examination 60 per cent.

49111

Coastal Engineering

Availability: all courses
6cp; 3hpw; prerequisite: Sound knowledge of Mathematics and Fluid Mechanics as part of a first or higher degree in Engineering or a cognate discipline
subject coordinator: A/Prof G O'Loughlin

This subject deals with engineering design and coastal structures, with particular reference to the natural behaviour of water waves and their interactions with the coastline. Topics covered include: wave generation processes and wave forecasting methods; linear and non-linear wave theories and their limits of validity; wave characteristics in deep, intermediate and shallow water depths; wave shoaling and breaking; wave refraction and diffraction; wave scattering and radiation; full and partial standing waves; field measurements and statistical analysis of random waves, estimation of extreme waves; tides and other long period water level fluctuations; estuarine hydraulics; coastal sedimentation; coastline management; and physical and computer models.

Assessment: assignments/reports 60 per cent; examinations 40 per cent.

49112

Urban Stormwater Flood Management

Availability: all courses
6cp; 3 blocks of 1.5 days each; prerequisite: suitable undergraduate subject
subject coordinator: A/Prof G O'Loughlin

The subject provides a strong grounding in the design and analysis of urban stormwater drainage systems for protection against flooding and safe removal of water likely to cause inconvenience. Students consider flood protection systems in terms of social, economic and environmental requirements, and the rationale for their design and operation. They are required to understand the integration between flood protection and the pollution prevention measures covered in a companion subject 49113 Urban Stormwater Pollution Management. By performing exercises (mostly using software packages) students become familiar with standard design procedures and aware of problems encountered in practice.

Assessment: continuous assessment involving eight assignments.

49113

Urban Stormwater Pollution Management

Availability: all courses
6cp; 3 blocks of 1 day sessions with optional tutorials; prerequisites: suitable undergraduate subjects
subject coordinator: A/Prof G O'Loughlin

The subject develops understanding of the nature of pollution processes and levels in urban situations, and of engineering systems for the reduction of pollution, particularly in receiving waters. Students consider pollution management systems in terms of social and environmental requirements, and the rationale for design and implementation of remedial measures. They are also to understand the integration between pollution prevention and the flood protection measures covered in the companion subject 49112 Urban Stormwater Flood Management. Through a series of assignments, students become familiar with commonly-used procedures and aware of problems encountered in practice.

Assessment: continuous assessment involving six assignments.

49114

Statistical Hydrology

Availability: all courses
6cp; block attendance totalling 30 hours; prerequisites: completion of at least one undergraduate subject in statistics. Some prior knowledge of hydrology is assumed, but may have been gained through either employment or formal education
subject coordinator: Mr J Irish

This subject provides students with experience in a field of hydrology with the confidence to use a range of statistical tools and with knowledge of statistical methods which can be usefully employed in hydrological practice. Such methods are presently employed in Australia in only a limited way for design flood estimation. Examples will be drawn from surface water hydrology, including problems relating to reservoir yield, design flood estimation and continuous modelling of water resources systems.

Assessment: three assignments 20 per cent each and end-of-semester examination 40 per cent.

49121

Environmental Assessment and Planning

Availability: all courses (core for GC(EEM))
6cp; 3hpw
subject coordinator: Mr K Halstead

This subject analyses the principles of sustainable development and the expectations which they place on various aspects of human interaction with the environment. Existing and proposed measures by governments are examined in the areas of environmental legislation, environmental economics and land use planning in relation to sustainable development.

Assessment: project 40 per cent; formal examination 60 per cent.

49122

Ecology and Sustainability

Availability: all courses (core for GC(EEM))
6cp; 3hpw
subject coordinator: Prof S Vigneswaran

This subject covers the following stopics: ecological systems and processes; basic ecological principles, bio-geochemical cycles, development of ecosystems, interaction between physical ecosystems, global environmental issues such as greenhouse effect, ozone depletion, acid rain etc; human impact on ecosystems: population growth, terrestrial ecosystems (forest and agriculture land), aquatic ecosystems (lake, river and ocean), bio-diversity; importance of sustainable development; overview of major environmental problems, their effect and remedies; air pollution, noise pollution, water pollution, soil pollution, solid and hazardous wastes; and case studies.

Assessment: assignments 30 per cent; examinations 70 per cent.

49123

Waste and Pollution Management

Availability: all courses (core for GC(EEM))
6cp; 3 hwp
subject coordinator: Prof S Vigneswaran

Waste minimisation and pollution control are treated in an integrated and comprehensive manner, permitting evaluation of the benefits of waste minimisation to industry and of pollution reduction in the environment. Topics include: environmental auditing of the product life cycle; leading-edge technologies of waste minimisation and pollution control; raw materials extraction and refinement: product development, design and manufacture, product use, product reuse/recycling, solid/hazardous wastes, liquid wastes; effective management of the product life cycle; institutional barriers to improving the technologies of waste technology and management practices adopted in domestic waste paper industry, metal plating industry, food and dairy industry, household waste, and waste recycling in buildings.

Assessment: assignments and class presentations 50 per cent; examinations 50 per cent.

49124

Water Quality Management

Availability: all courses (core for GC(EEM))
6cp; 3hpw
subject coordinator: A/Prof G O'Loughlin

This subject examines urban water systems including natural water bodies (streams, estuaries, groundwater), and related human infrastructure (water supply, sewerage, stormwater drainage systems) and provides an assessment of the impacts and methods of monitoring pollution in these environments in relation to water quality, natural flora and fauna, aesthetic quality and public health. It

will enable students to gain a general knowledge of these systems, their vulnerability to pollution and degradation, and remedial measures.

Assessment: two essays 20 per cent; class exercises 30 per cent; quiz and final examination 50 per cent.

49125

Environmental Risk Assessment

Availability: all courses
6cp; 3 blocks, each of 2 days
subject coordinator: Mr J Irish

This subject provides an introduction to methods of risk assessment for graduates working in environmental engineering, environmental auditing or environmental impact assessment. An understanding of the concepts of risk perception, risk communication, risk acceptability and the modification of risks and their application to environmental engineering, impact assessment and auditing, together with capabilities essential to environmental risk assessment, is developed.

Topics include: semantics of risk and hazard; risk as a social construct; principles of risk management; steps in risk engineering; risk perception, risk communication, and acceptability of risks; statutory provisions in NSW relating to environmental risks; legal principles relating to environmental risks (liability, etc); checklists and scoping for impact assessment and auditing; risks to health and to ecosystems; comparing risks; quantified and qualitative risk assessment methods; discussion of some specific environmental hazards in the context of risk amelioration; risk assessment in emergencies; financial tools in the management of environmental risks; environmental auditing procedures.

Assessment: three assignments 20 per cent each; examination 40 per cent.

49126

Environmental Management of Land

Availability: all courses
6cp; 3hpw or block attendance; prerequisite: suitable undergraduate subject
subject coordinator: Dr P Hazelton

This subject introduces students to basic concepts and principles of land resource compilation, planning and environmental management. On completion the student should be able to interpret and evaluate physical limitations and their effects on urban and semi-rural planning and development. The various stages of management of land with special needs, such as coastal areas, effluent and biosolid disposal sites and recreational and open space should be clearly understood.

Assessment: one major assignment task 50 per cent; one quiz 50 per cent.

49131

Medium Span Bridges

Availability: all courses
6cp; 3hpw; prerequisite: strong background in the design of civil engineering structures
subject coordinator: Prof S Bakoss

This subject develops competence in the area of bridge design and analysis. It includes assignments requiring the design of major components of a typical bridge structure in accordance with the Australian Code for Bridge Design. Each student is also required to undertake an investigation project involving analysis and design of a selected modern bridge structure and to submit supporting documentation including calculations at the end of the investigation.

Assessment: three major design assignments 35 per cent; investigation, report and/or design of a modern bridge structure 30 per cent; 2 quizzes 35 per cent.

49132

Stability of Structures

Availability: all courses
6cp; 3hpw
subject coordinator: Dr A Saleh

The behaviour of slender members subjected to compression and/or flexure is examined in this subject. Factors which contribute to the onset of buckling in single members and slender frames are analysed to develop an understanding of structural loads and their effects. In addition, students learn how to assess the stability of practical frames using computer-based methods of analysis.

Assessment: continuous assessment 60 per cent; informal final examination 40 per cent.

49133

Steel and Composite Design

Availability: all courses
6cp; prerequisite: suitable undergraduate subject
subject coordinator: Dr S Parsanejad

This subject provides an understanding of web buckling and post-buckling behaviour of composite beams, columns and connections

and of plastically deformed steel frames. The course will develop familiarity with both Australian and overseas code provisions and their underlying concepts. The teaching strategy will consist of formal and informal lectures, with student participation.

Assessment: composite beam project 30 per cent; plastic design projects 20 per cent; two quizzes, 25 per cent each.

49134

Structural Dynamics

Availability: all courses
6cp; 3hpw or block attendance; prerequisites: suitable undergraduate subjects
subject coordinator: A/Prof B Samali

This subject introduces students to the concepts and techniques of structural dynamics and their application to the design and analysis of dynamically sensitive structures, such as tall buildings, towers, chimney stacks and foot bridges. Students develop an understanding of the nature of dynamic (time varying) loads, produced by wind, earthquake, rotating machinery, trains, human beings and other sources; ability to assess the response of civil engineering structures to such loads, taking into account load-structure interaction; and structural design approaches satisfying both strength and serviceability requirements.

Assessment: assignments 40 per cent; three quizzes 60 per cent.

49135

Wind Engineering

Availability: all courses
6cp; 3hpw or block attendance; prerequisites: suitable undergraduate subjects
subject coordinator: A/Prof B Samali

Introduces basic concepts and fundamental principles in wind engineering and their application to structural design and analysis of structures, such as buildings, towers, chimney stacks and bridges in accordance with strength, stability and serviceability limit states design criteria. On completion the student should understand the nature of wind loads acting on buildings due to along and cross-wind actions, and be able to prevent aerodynamic instabilities, such as flutter, galloping, torsional divergence and others by proper design. Wind tunnel testing techniques for determining wind-induced dynamic response of structures and cladding pressures are introduced, and the environmental effects of severe winds around buildings and other structures are studied in terms of human safety and comfort.

Assessment: assignments 50 per cent; two quizzes 25 per cent each.

49136

Application of Timber in Engineered Structures

Availability: all courses
6cp; 3hpw; prerequisites: suitable undergraduate subjects
subject coordinator: Prof S Bakoss

This subject will present recent advances that have enhanced the role of timber as a versatile renewable resource with a wide range of applications in engineered structures. It will familiarise students with the structural behaviour of timber and timber-based manufactured products to facilitate the choice of materials, design, construction and maintenance procedures to produce cost-effective, durable and aesthetically pleasing structures. Quality control and reliability issues will form an important focus. Particular requirements of large span industrial structures (including connection design), multi-storey buildings and bridges and the use of the limit states version of AS1720 will be addressed.

Assessment: assignments 30 per cent; quizzes 30 per cent; seminar 10 per cent; major project 30 per cent.

49137

Railway Engineering

Availability: all courses
6cp; 3hpw
subject coordinator: Mr A Brady

This subject introduces students to the design, construction and maintenance concepts of railway tracks and bridges. On completion of the lecture program, the students should be able to design, independently, a branch line or a siding complex according to standards applicable to NSW. An understanding of track-train inter-relationships and their effect on track structure will also be developed.

Assessment: assignments 50 per cent; bridge design project 20 per cent; quiz 30 per cent.

49141

Advanced Geomechanics

Availability: all courses
6cp; 3hpw
subject coordinator: Dr G Ring

This course consists of two separate components. The first deals with the study of rock mechanics, including the description of rock and the quantification of rock properties, sampling and testing techniques and the three-dimensional analysis of rock discontinuity. The course considers how these properties can be incorporated into the analysis and design of various structures such as underground openings, slopes and foundations. Methods of reinforcing rock masses using anchors and bolts are also treated.

The second component deals with computer applications in geomechanics. After a theoretical overview, it concentrates on the finite element and boundary element methods and provides considerable hands-on experience using PC-based software. Students are expected to solve problems of seepage, deformation associated with the non-linear analysis of structural interaction, and stress around underground openings.

Assessment: assignments 50 per cent; projects 50 per cent.

49151

Advanced Concrete Technology

Availability: all courses
6cp; prerequisite: suitable undergraduate subject
subject coordinator: Dr R Sri Ravindrarajah

This subject develops advanced engineering knowledge and capabilities pertaining to the specification, production, testing and application of concrete as a construction material. It also provides opportunity to gain research experience through a mini-project focusing on recent advances in concrete construction technology and practice.

Topics include: supplementary cementing materials; rheology of concrete; design of normal and special concrete mixes; concrete production and quality control; control and in-situ testing of concrete; cracking and failure of concrete; high-performance concrete; fibre-reinforced concrete; polymer concrete, and lightweight concrete.

Assessment: assignments 30 per cent; quizzes 30 per cent; major report 40 per cent.

49152

Damage and Repair of Concrete Structures

Availability: all courses
6cp; prerequisite: suitable undergraduate subject
subject coordinators: Dr R S Ravindrarajah and Dr H W Chung

This subject provides understanding of the mechanisms of damage in concrete structures and of the methods for in-situ assessment and repair. An individual project is an essential part of the subject. Main topics include: causes of damage; corrosion of steel in concrete; in-situ strength of concrete; non-destructive testing; repair materials selection; repair procedures and techniques; prevention, protection and maintenance of concrete structures.

Assessment: assignments 30 per cent; quizzes 30 per cent; seminar 10 per cent; major report 30 per cent.

49201

Integrated Services Networks

Availability: all courses (core for ME(TE))
6cp; 3hpw; prerequisite: suitable undergraduate subject
subject coordinator: A/Prof A Seneviratne

This subject covers the following topics: switching methods, CCITT recommendations, SDH, ISDN technology, ISDN signalling, broadband ISDN, ATM standards, resource sharing and multiple access (ALOHA, CS/CD. CSMA/CD, Token Bus, Token Ring, QPSX, FDDI).

Assessment: assignments 25 per cent; laboratory project 25 per cent; final examination 50 per cent.

49202

Communication Protocols

Availability: all courses (core for ME(TE))
6cp; 3hpw; prerequisites: suitable undergraduate subjects
subject coordinator: A/Prof A Seneviratne

In this subject students will study, at an advanced level, the concepts and protocols associated with each of the seven layers in the ISO Reference model for Open Systems Interconnection (OSI) with applications examples from a wide range of network types.

Assessment: practical work 40 per cent; examination 60 per cent.

49203

Telecommunications Signal Processing

Availability: all courses (core for ME(TE))
6cp; 3hpw; prerequisite: suitable undergraduate subject
subject coordinator: Dr M P Eckert

This course will focus on one aspect of telecommunications signal processing: source coding of images and audio. Incorporated in this main topic will be: characterisation of random signals using autocorrelation function and power spectral density, optimal linear prediction of signals (including Wiener filtering), quantisation of signals using pulse coding modulation, and differential pulse code modulation, linear transforms (Discrete Fourier Transform, Discrete Cosine Transform, Karhunen-Loeve Transform), subband coding transforms, and lossless compression. These topics will be brought together with an in-depth examination of JPEG coding of images. Finally, we will discuss the implementation of various other compression methods, including MPEG-2, MPEG-4, MPEG-audio, and various techniques of speech coding.

Assessment: design assignment 20 per cent; written examination 80 per cent.

49204

Advanced Teletraffic Engineering

Availability: all courses (core for ME(TE))
6cp; 3hpw; prerequisites: suitable undergraduate subjects; corequisite: 49201 Integrated Services Networks
subject coordinator: tba

The subject exposes students to theoretical and practical aspects of modern communication network design, including teletraffic engineering and network performance modelling. The course covers an overview of relevant statistics and probability theory; traffic characterisation; traffic intensity measures; traffic data collection measurement and forecasting techniques; queuing theory; mathematical models for loss and delay in systems; modelling and analysis of circuit, packet and fast-packet switched networks. Students analyse practical examples of network dimensioning for capacity, and network performance evaluation using simulation software package (BoNES or OPNET).

On completion of the course students are able to apply an appropriate mathematical model to any communication network, to dimension the primary route and alternate route trunking and switching facilities, and to evaluate the network performance either using a mathematical approach and/or by using simulation. Case studies included in the course provide the student with capabilities to make a choice in networking solutions based on the performance/cost analysis to meet user expectations.

Assessment: four assignments 60 per cent; final examination 40 per cent.

49205

Transmission Systems

Availability: all courses (core for ME(TE))
6cp; 3hpw; prerequisites: 49203 Telecommunications Signal Processing or equivalent
subject coordinator: A/Prof S Reisenfeld

The subject covers major aspects of digital transmission systems at an advanced level, including modulation, coding, synchronisation, and multiple access. Case studies of optical and satellite links demonstrate how the effects of performance degradations are incorporated into the link budget. Subject involves lectures supported by assignments and project work using laboratory facilities.

Assessment: design assignment 20 per cent; written examination 80 per cent.

49206

Advanced Studies in Electromagnetic Compatibility

Availability: all courses
6cp; 3hpw; prerequisite: suitable undergraduate subject
subject coordinator: Dr A Sanagavarapu

Compliance with Electromagnetic Compatibility regulation is becoming mandatory for engineering products. This course provides an understanding of the underlying concepts for the analysis, modelling and design necessary for achieving electromagnetic compatibility.

Assessment: continuous assessment of a variety of assignments negotiated by the student with the coordinator.

49207

Wave Propagation for Microwave and Mobile Communications

Availability: all courses
6cp; 3hpw; prerequisite: suitable undergraduate subject
subject coordinator: Dr A Sanagavarapu

Information transmission using radio propagation is becoming significant with the introduction of mobile communication services. This course explores the fundamental issues of microwave propagation in typical communication environments and introduces channel modelling and design methodologies.

Assessment: continuous assessment of a variety of assignments negotiated by the student with the coordinator.

49208

Telecommunications Management

Availability: all courses
6cp; 3hpw or full day block modes; prerequisite: suitable undergraduate subject
subject coordinator: A/Prof S Reisenfeld

The subject provides an integrated technology management perspective on communications infrastructure and services and the changing telecommunications and information technology environment. It focuses on techniques and tools for strategic telecommunications planning, and covers the evaluation of systems and selection procedures. Software packages are used for network modelling, dimensioning and performance evaluation.

On completion, students are able to assess corporate telecommunications requirements, to collect statistical data required for corporate telecommunications planning, to prepare a strategic telecommunications plan capitalising on technology and market trends, and to evaluate the performance and cost of the planned system.

Assessment: Assignments 60 per cent; mid-semester quiz 10 per cent; final examination 30 per cent.

49211

Software Engineering Principles

Availability: all courses (core for SEP Graduate Certificate)
6cp; 3hpw; prerequisite: Some programming experience, ideally in industry
subject coordinator: Mr J Leaney

The aim of this subject is to introduce the issues and basic principles of software engineering. The objectives are to develop a framework into which more detailed material regarding specific aspects of the software engineering process, techniques, and issues can fit, including software systems, software quality, the software development process, process models, development paradigms, development methodologies, and software project management. Within the subject the principles are applied to a small realtime project (a device driver written in C). The subject assumes significant programming experience in a first degree.

Assessment: classwork, assignments, essay, examinations 50 per cent, major project (industry involvement where possible) 50 per cent.

49212

Object-Oriented Languages

Availability: all courses (core for SEP Graduate Certificate)
6cp; 3hpw; prerequisites: 49211 Software Engineering Principles or equivalent
subject coordinator: Mr J Leaney

This subject introduces students to object-oriented principles in design, and helps them to gain competence in programming techniques using object-oriented languages. It covers object-oriented software development using the Ada language, and thence the C++ language. It includes coverage of OO concepts, design and implementation. The subject has a strong emphasis on the practical application of these concepts to the development of industrial software systems.

Assessment: 50 per cent major development project; 50 per cent learning contract.

49213

Human Machine Interfaces and Software Implementation

Availability: all courses (core for SEP Graduate Certificate)
6cp; 3hpw; prerequisites: 49211 Software Engineering Principles, 49212 Object-Oriented Languages; 49214 Unix and C
subject coordinator: Mr J Leaney

The subject has a strong emphasis on the practical application of software engineering concepts to the development of industrial software systems. The subject actively encourages participants to develop their understanding of practical issues in software development. This is a competency-based subject, designed to develop basic skills in software engineering via a software development project. It also presents principles, guidelines and practice in human machine interfaces.

Assessment: 30 per cent HMI software design project; 70 per cent software development learning contract.

49214

UNIX and C

Availability: all courses (core for SEP Graduate Certificate)
6cp; 3hpw; prerequisite: 48430 Software Development or equivalent programming experience
subject coordinator: Dr C Scott

A subject to develop understanding and competence in the use of UNIX as a development tool for a software engineer, and C programming in a UNIX environment. The subject encourages good programming practices through programming style and development approaches such as Abstract Data Types. UNIX is examined as an environment supporting the software development process. Technical aspects of UNIX such as shell programming, the UNIX file system, the UNIX process model, and system level programming are also covered. The subject assumes that students have had significant undergraduate programming in C or a similar language and that students are familiar with UNIX at a user level.

Assessment: three negotiated learning contracts, individual and team based, worth 33.3 per cent each.

49217

Software Verification and Validation

Availability: all courses (core for SEP Master's degree)
6cp; 3hpw/block attendance; prerequisite: 49211 Software Engineering Principles or equivalent
subject coordinator: Mr J Leaney

This subject helps students to develop an understanding of verification and validation in the context of differing international processes and lifecycles, and differing methodologies (structured, object oriented etc). Test planning is considered in relation to development planning and quality planning, assisting the appropriate choice of validation and verification techniques. Verification and validation are considered throughout the lifecycle, involving the client wherever possible. Particular techniques include requirements validation; walkthroughs and inspections (throughout the lifecycle); unit testing techniques (including algebraic proofs); target machine and host machine tests; integration and acceptance testing; and tools which can be used to support unit testing, integration testing and quality (Attol, Logiscope).

Assessment: classwork, assignments, and examinations 50 per cent; major project (industry involvement where possible) 50 per cent.

49225

Software Project Management

Availability: all courses (core for SEP Master's degree)
6cp; 3hpw/block attendance or part-time; prerequisite: 49211 Software Engineering Principles or equivalent
subject coordinator: Mr J Leaney

This subject aims to present and develop the confidence and software project management skills required to become effective project team leaders and potential project managers. The course covers such concepts as team constitution, business aspects, technical organisations charts and cost estimates, scheduling and monitoring, and maintenance. The course proposes an analysis of existing Software Project Management tools and groupware technologies. Apart from the theoretical presentations, much time is given to participants reviewing their past experience and doing illustrative exercises.

Assessment: classwork, a learning contract, a major project (80 per cent) and an examination (20 per cent).

49233

Software Requirements Specification

Availability: all courses (core for SEP Master's degree)
9cp; block attendance
subject coordinator: Mr J Leaney

This subject establishes, first, the need for software engineering, the current state of the field, and the role that the software engineering program can play in this context.

Second, it is a subject to develop competency in the capture of system requirements and their representation. The requirements' capture focuses on the use of realtime structured analysis and English for representation and documentation. The subject aims to have a strong practical focus, covering tools and methodologies and developing skills which will be immediately relevant to the applicants and their companies. The subject contains a significant component of practical project work which is aimed at reinforcing the material covered in the subject.

Assessment: analytical written assignment 10 per cent; software design project 30 per cent; software specification learning contract 30 per cent; software verification learning contract 30 per cent.

49234

Real Time Object-Oriented Software Development

Availability: all courses (core for SEP Master's degree)
9cp; block attendance
subject coordinator: Mr J Leaney

This subject establishes students' competency in the design and implementation of realtime object based systems. The subject covers object-oriented software development using the Ada language, including a coverage of OO methodology, tools, processes and implementation issues, focusing on those aspects specific to developing realtime software. Aspects of C++ will also be covered, especially aspects related to realtime systems.

Assessment: student presentations 20 per cent; software design projects 20 per cent; four minor projects to be used during the second academic project 4 x 15 per cent.

49235

Real Time Operating Systems

Availability: all courses (core for SEP Master's degree)
3cp; block attendance
subject coordinator: Mr J Leaney

Designed to establish an understanding of the issues in realtime operating systems and competency in the use of them in a project, this subject covers realtime kernels and realtime Unix systems, using POSIX to illustrate various concepts. Topics include management of signals, communication, shared memory and flags.

Assessment: C++ development learning contract 25 per cent, realtime Ada learning contract 25 per cent, realtime Unix learning contract 25 per cent, application learning contract 25 per cent.

49236

Software Development Project

Availability: Software Engineering Program only
6cp; block attendance
subject coordinator: Mr J Leaney

The major goal of this subject is to promote the development of the participants' ability to apply the knowledge and skills developed throughout the course to handling real-world software development problems. The project covers issues such as the need for an appropriate approach to developing software, applying the development process to practical problems, documentation, quality assurance, and the use of software tools. In particular the project aims to act as a capstone module and tie the academic content of the course into a cohesive whole, as well as to enable students to experience aspects of teamwork and its implications. The project involves working together in groups of four (in varying roles) during the complete development of a software system. The project is defined in such as way that cost is not critical but deadlines are, thus encouraging effective teamwork.

Assessment: the assessment focuses on the ability to apply the material presented throughout the course to the development of practical software systems.

49237

Software Quality and Configuration

Availability: all courses (core for SEP Master's degree)
3cp; block attendance
subject coordinator: Mr J Leaney

This subject is designed to develop students' understanding of software quality issues, and develop their skills in configuration management. The quality module includes developing an ability to read a quality plan and a development plan, and to understand the role of a QA engineer and the role of the developer in contributing to quality during the development process. Also covered are issues such as QA activities and organisation. The configuration module aims to develop an understanding of, and the ability to use, the basic mechanisms of configuration management. Aspects covered include clients, activities, objects, standards, the modification process and planning methods. The module also covers the use of a typical configuration management tool.

Assessment: learning contract 30 per cent; report 30 per cent; projects 40 per cent.

49241

Hypermedia Technologies

Availability: all courses
6cp; 3hpw or block attendance
subject coordinator: Dr D Lowe

This subject provides an introduction to Hypermedia. It introduces basic components and the structure of hypermedia systems, underlying technologies for capturing, compressing, structuring and authoring of different media (text, images, video and sound). Issues related to storage and transmission of large volumes of data are discussed, including temporal media and synchronisation. The Internet and the World Wide Web are studied in detail.

Assessment: assignments 30 per cent; mini project 40 per cent; quiz 30 per cent.

49242

Mono Media Technologies

Availability: all courses
6cp; 3hpw or block attendance; prerequisites: Students are assumed to have appropriate background knowledge in the following areas: mathematics; software; information and systems
subject coordinator: Dr D Lowe

This subject introduces engineering issues and state-of-the-art solutions related to capturing, representation, storage, compression and presenting digital media. Special emphasis is placed on images, video and audio. Topics such as colour space, image video and audio compression techniques and standards (JPEG, MPEG), processing of visual information for applications such as image and video databases will be studied.

Assessment: major development project 50 per cent; learning contract 50 per cent.

49243

Development of Hypermedia Information Systems

Availability: all courses
6cp; 3hpw or block attendance; prerequisite: suitable undergraduate subject;
corequisites: 49242 Mono Media Technologies, 49031 Information Structures, Perception and User-interface design, or equivalents
subject coordinator: Dr R Meegoda

In this subject, students will learn how to develop large complex hypermedia information systems that need to be maintained and updated over a period of time. Students will learn how to extract the structure of information and develop a document using SGML. Students will then develop programmes to convert the marked-up documents into formats suitable for different browsers (such as HTML) and applications.

The topics will also include life-cycle considerations, project management in Hypermedia Systems Development, and new technical issues such as copyright and social impact.

In this subject industry standard application development tools will be used for practical work

Assessment: project 75 per cent; quiz 25 per cent.

49244

Hypermedia Programming

Availability: all courses
6cp; 3hpw; corequisite: 49241 Hypermedia Technologies
subject coordinator: Dr D Lowe

This subject aims to develop specific skills in using software technologies which are relevant to the implementation of hypermedia information systems. The students should develop specific skills, but more importantly, develop an understanding of what technologies are available, what are their limitations and strengths, and how these technologies can be most effectively utilised.

Assessment: assignments 80 per cent; quiz 20 per cent.

49245

Hypermedia Systems Architecture

Availability: all courses
6cp; 3hpw; corequisite: 49241 Hypermedia Technologies
subject coordinator: Dr D Lowe

This subject aims to develop an understanding of, and ability to develop, the hardware systems and architectures which are needed to support hypermedia information systems. The students should develop an understanding of what technologies are available, what their limitations and strengths are, and how these technologies can be most effectively utilised.

Assessment: assignments 80 per cent; quiz 20 per cent.

49261

Biomedical Instrumentation

Availability: all courses
6cp; 3hpw; prerequisite: suitable undergraduate subject
subject coordinator: A/Prof H Nguyen

This subject covers general concepts applicable to the design of all medical instrumentation systems, the measurement of biopotentials and critical-care analyses for diagnostic purposes, and the design of biomedical devices for therapeutic purposes. The subject includes three modules covering sensors and amplifiers, vital sign monitoring for diagnostic purposes, and physiological intervention/closed-loop control.

Assessment: assignments 25 per cent; project work and seminar 50 per cent (includes 20 per cent for seminar); final examination 25 per cent.

49271

Computer Architecture

Availability: all courses
6cp; 3hpw; prerequisite: suitable undergraduate subject
subject coordinator: Mr N J Carmody

The subject explores at an advanced level issues that impact upon the hardware design of modern computers. This experience will enable the student with a quantitative definition of an application requirement to evaluate a proprietary system, to develop a hardware system using standard sub-assemblies, and to design system components, such as specialised processor elements, which meet the application requirement.

Assessment: final examination 50 per cent; laboratory assignment 30 per cent; other assignments 20 per cent.

49272

Adaptive and Multivariable Control

Availability: all courses
6cp; 3hpw; prerequisite: suitable undergraduate subject
subject coordinator: Dr J G Nicol

This subject covers advanced techniques for modelling, analysis and design of systems suited to multi-variable, adaptive or optimal control. Laboratory projects are conducted on a continuous basis throughout the semester. Topics include: direct and inverse Nyquist arrays, characteristic locus, robust control, pole shifting techniques, identification algorithms, minimum variance control, self-tuning adaptive regulator, linear quadratic regulator design, state estimation and the Kalman filter.

Assessment: laboratory work including 2 seminar presentations 50 per cent; 3 out of 4 assignments 50 per cent.

49273

Random Signal Theory

Availability: all courses
6cp; 3hpw; prerequisite: suitable undergraduate subject
subject coordinator: tba

This subject provides fundamental background in probability theory, random variables, random processes, random sequences and the characteristics of special classes of random processes. It establishes the mathematical modelling prerequisites for practice and research in signal detection, estimation and stochastic control.

Assessment: assignments 50 per cent; final examinations 50 per cent.

49274

Advanced Robotics

Availability: all courses
6cp; 3hpw or block attendance; prerequisite: suitable undergraduate subject
subject coordinator: Dr R Meegoda

This subject covers advanced topics in robotics and robot programming, including mechanical manipulation using robots, actuation, sensing and vision systems, and robotic applications. Upon completion of the course, the student is expected to be competent to program and control robots with up to six degrees of freedom. In addition, the student is expected to have sufficient understanding to build robots with 2-dimensional (terrestrial) and 3-dimensional (aquatic) motions using advanced techniques such as subsumption architecture and artificial intelligence.

Assessment: assignments 30 per cent; laboratories and quizzes 10 per cent; final examination 60 per cent.

49275

Neural Networks and Fuzzy Logic

Availability: all courses
6cp; 3hpw; prerequisite: suitable undergraduate subject
subject coordinator: A/Prof H Nguyen

The principal objective of this subject is to introduce students to neural networks and fuzzy theory from an engineering perspective. In the identification and control of dynamic systems, neural networks and fuzzy systems can be implemented as model-free estimators and/or controllers. As trainable dynamic systems, these intelligent control systems can learn from experience with numerical and linguistic sample data.

Assessment: three assignments totalling 25 per cent; project 50 per cent and final examination 25 per cent.

49276

Sliding Mode Control

Availability: all courses
6cp; 3hpw or block attendance; prerequisite: suitable undergraduate subject
subject coordinator: A/Prof H T Nguyen

This subject covers the salient aspects of deterministic control of uncertain systems from an engineering perspective. It deals specifically with sliding mode techniques for achieving effective control of systems with uncertain dynamics or bounded unknown disturbances. Students develop ability to identify bounded disturbances and model variations, to analyse and design appropriate sliding mode controllers, and to implement control solutions in a specified application. The project is presented through lectures, tutorials and a semester-length practical project.

Assessment: assignment 25 per cent; examination 25 per cent; project 50 per cent.

49306

Quality Systems – Implementation and Accreditation

Availability: all courses
6cp; 3hpw or block mode
subject coordinator: A/Prof R M Spencer

More and more organisations recognise that quality is a core strategy for survival in the market. An effective Quality System with its appropriate procedures will ensure that customer requirements are met continuously.

This subject helps to understand how to design, develop and implement a Quality System and how to achieve certification of the Quality System according to the International Standards ISO 9000 series. It develops understanding of the means of defining the structure of the Quality System in manufacturing and service organisations, determining what resources are needed to complete the documentation and the evaluation of the Quality System.

This subject also highlights the use of an effective Quality System for Continuous Quality Improvements.

Assessment: assignments 30 per cent; projects 30 per cent; written examination 40 per cent.

49307

Internal Combustion Engines and Environmental Issues

Availability: all courses
6cp; 3hpw or block attendance
subject coordinator: Dr G Hong

This subject emphasises solutions to environmental and energy resource problems related to internal combustion (IC) engine design, development and utilisation. It introduces a pragmatic engineering field of internal combustion engines and provides opportunities to students to develop an understanding of the applications of IC engines in environmental protection, transportation, electricity generation and other areas.

Assessment: laboratory reports 35 per cent; projects 35 per cent; examination 30 per cent.

49308

Rapid Response Manufacturing

Availability: all courses
6cp; 3hpw or block mode; prerequisites: 48621 Manufacturing Engineering or equivalent
subject coordinator: A/Prof R M Spencer

World best-practice in rapid response manufacturing is an essential consideration for an enterprise that wants to remain competitive and adaptable. Against a background of economic and quality considerations, rapid response manufacturing seeks to minimise the time from market demand to product delivery in the context of life cycle assessment. This subject studies the operational strategies and team work strategies that are available and effective in achieving this objective. Topics for consideration are: market constraints, quality function deployment, plant de-bottlenecking and the theory of constraints, lead time and set-up time reduction, JIT, kanban and concurrent engineering. The coursework material is practised in a team learning environment.

Assessment: three group and individual formative projects totalling 100 per cent. A pass is required in each project with a summative mastery quiz in borderline cases.

49309

Quality Planning and Analysis

Availability: all courses
6cp; 3hpw/distance mode; prerequisite: suitable undergraduate subject
subject coordinator: A/Prof R M Spencer

This subject develops understanding of the imperatives, culture, philosophy, scope, strategies and practice of total quality management and covers problem identification, process design, continuous improvement, vendor supplies, customer service, quality auditing and the development of a quality assurance practices manual and compliance with relevant Australian Standards and supplier assessment schemes.

Assessment: concept mastery tests 20 per cent; assignments 40 per cent; project including seminar 40 per cent.

49311

Advanced Heat Transfer

Availability: all courses
6cp; 3hpw
subject coordinator: Dr J Madadnia

This subject develops concepts and methods for dealing with some advanced topics in heat transfer. These include boiling, natural convention and radiation. Numerical simulation and practical laboratory experiments are important components of the course.

Assessment: assignments, projects and/or an examination.

49312

Advanced Flow Modelling

Availability: all courses
6cp; 4hpw; prerequisite: suitable undergraduate subject, plus some programming experience
subject coordinator: Dr A Mack

Computational Fluid Dynamics (CFD) is a cornerstone of modern engineering and a technology which is regarded as crucial to the success of the major economies. Along with more traditional modelling techniques, this subject provides exposure to the numerical methods in CFD computer codes and experience in the practical application of commercial CFD packages. Importantly, it develops skill in the evaluation of the solution integrity. The subject culminates in a major project of the students' own choosing. On completion, students should have proficiency to undertake leadership roles in this exciting new field across the entire engineering

spectrum and, in particular, in the mechanical, aeronautical, civil and environmental context. The subject has particular relevance to the design of vehicles, buildings, structures, engines, turbomachinery, manufacturing processes, heat transfer, combustion behaviour, pollutant dispersal, weather patterns, ocean currents and biomedical phenomena.

Assessment: projects 50 per cent; assignments 35 per cent; laboratories 15 per cent.

49318

Manufacturing Systems Management

Availability: all courses
6cp; 3hpw/distance; prerequisite: 48621 Manufacturing Engineering or equivalent
subject coordinator: A/Prof R M Spencer

Systems thinking is a vital strategy in the international competitiveness of modern manufacturing industry. In this subject, a manufacturing system is analysed by partitioning, to model its flow of materials and information, and to identify waste and value adding activities. Manufacturing system paradigms are reviewed in the context of their application to different businesses, professional disciplines and functional areas. Simple linear control systems are contrasted with non-linear, long time lag learning systems with multi-input strategies to achieve corporate objectives interacting with multiple performance indices; assumptions for the simplification of complexity for scaling, modelling and simulation. Case studies relevant to the student's learning needs or employment may incorporate issues of marketing, forecasting, maintenance, modularity, group technology, flexible manufacturing, time to market, clean production, life cycling, bench marking and the control of inventory, production or finance. The design and synthesis of new systems built on interlinked sub-systems with manageable modules are considered through incremental development and step change innovation.

Assessment: formative projects 35 per cent; formative assignments 35 per cent; examination 30 per cent.

49319

Product Modelling and Analysis

Availability: all courses
6cp; 3hpw or block attendance; prerequisite: suitable undergraduate subject
subject coordinator: Prof F Swinkels

Emphasis is on surface and solid modelling of parts and assemblies, parametric/associate design, mass and surface properties analysis, and interfacing to manufacturing and analysis programs. This subject enables students to understand and use advanced computer modelling methods, design tools, and analysis techniques and their application to other areas of design and manufacturing. Models of mechanical parts are developed using advanced surfacing and solid modelling tools including associativity and parametrics.

Assessment: four assignments dealing with specific aspects of the applications with an integrative project.

49320

Industrial Tool Design and Manufacture

Availability: all courses
6cp; 3hpw or block attendance; prerequisite: suitable undergraduate subject
subject coordinator: Prof F Swinkels

This subject will examine off-line Numerical control (NC) programming for production tooling (such as jigs and fixtures) and mould and die manufacture. The subject would also develop an in-depth understanding of sheet metal operations such as flat pattern, nesting, and punch press/laser cutting programming. The concepts and principles of electrical discharge machining (EDM) would be developed for mould and die manufacture.

Assessment: four assignments dealing with specific aspects of the applications with an integrative project.

49321

Energy Conversion

Availability: all courses
6cp; 3hpw
subject coordinator: Dr J Madadnia

The subject develops the capability to appraise, analyse and evaluate sustainability in design, selection and application of energy conversion systems. Topics for the subject include three kinds of conversion systems: renewable (direct and indirect, solar, wind, hydro, biomass and tidal), alternative (hydrogen and methanol)

and non-renewable (coal, petroleum and natural gas) systems. Aspects to be covered include technological (design concepts), economic (cost and efficiency) and environmental (greenhouse effects including life cycle analysis and pollution) analysis of energy conversion system. From an Australian perspective, the subject will consider the future developments for energy supply, using solar energy, wind turbines, water turbines, steam turbines, gas turbines, internal combustion engines, and fuel cells relevant to social and environmental criteria. Case studies and relevant laboratory-based projects will be directed towards improving understanding of the fundamentals of the energy conversion.

Assessment: assignments 15 per cent; laboratories and case studies 60 per cent; examination 25 per cent.

49322

Airconditioning

Availability: all courses
6cp; 3hpw; prerequisite: 4865 I Thermodynamics or equivalent
subject coordinator: Dr G Hong

Air conditioning systems are required by modern society and promoted by high technology to be functional, well-controlled, energy-efficient and environmentally friendly, to maintain human comfort and health as well as industrial productivity. The objectives of this subject are: to advance student understanding of refrigeration and air conditioning systems; to develop basic skills for carrying out the design and construction of air conditioning for buildings; to enhance knowledge of energy conservation and management as applicable to air conditioning systems.

Topics include: principles of thermodynamics and heat transfer, air conditioning systems and components, design criteria and standards, psychometry and air conditioning processing, refrigeration, load estimation, computer software for load estimation, duct and pipe design, control system, noise and pollution.

Assessment: Laboratory report 20 per cent; project 30 per cent; examination 50 per cent.

49323

Vibration Analysis: Theory and Applications

Availability: all courses
6cp; 3hpw or block attendance; prerequisite: 48662 Mechanical Applications or equivalent
subject coordinator: Dr N Zhang

This subject extends students' understanding of vibration theory and its application to problems encountered in mechanical and structural engineering. It focuses on learning and practising the techniques and skills most frequently used in engineering practice. After a brief revision of basic vibration theory for single-degree-of freedom systems, the subject moves on to multiple-degree-of-freedom systems, modal analysis, torsional vibration, approximation and numerical methods for transverse vibration including influence coefficient methods, transfer matrix method and finite element methods. Applications include vibration reduction by passive and active means, design of vehicle suspension systems, experimental modal analysis, rotor dynamics and spin stability and analysis.

Assessment: assignments and laboratory reports 70 per cent; final examination 30 per cent.

49324

Instrumentation and Condition Monitoring

Availability: all courses
6cp; 3hpw or block attendance; prerequisite: 48660 Dynamics and Control
subject coordinator: Dr F C O Sticher

This subject introduces students to the fundamentals of strain-stress, sound and vibration measurement commonly used in condition monitoring and maintenance programs of major equipment in modern industries. It covers topics of strain gauging, data acquisition, frequency response analysis, signal processing, characterisation of signatures and infra-red techniques. Experiments include taking various physical measurements by using strain gauges, sound meters, accelerometers, temperature measuring devices etc., together with their associated data acquisition/analysis systems. Students apply these skills to detection and diagnosis of faults in the bearings and gear transmission systems of rotating machines.

Assessment: laboratory reports 70 per cent; final examination 30 per cent.

49325

Computer Aided Mechanical Design

Availability: all courses
6cp; 3hpw or block attendance; prerequisite: 48650 Mechanical and Manufacturing Design
subject coordinator: Mr T Brown

This subject extends the development of students' design skills. Students will use computer aided methods to complement and enhance the analytical and theoretical skills and knowledge obtained in undergraduate subjects and in practice. Mechanical system simulation software will be used for designing mechanical systems and controls, and to introduce virtual prototyping. A finite element analysis program will be used for analysing stresses in mechanical components. Although commercially available software will be used, students will not simply be trained in the use of that particular program. Rather, the objective of the subject is that students understand the general approach to computer aided engineering and the importance of having a sound knowledge of the fundamental mechanics.

Assessment: assignments and projects 70 per cent; quiz 30 per cent.

49326

Heat Transfer and Equipment Design

Availability: all courses
6cp; 3hpw
subject coordinators: Dr J Madadnia and Prof V Ramsden

This subject is a combination of heat transfer and equipment design and is for electrical, electronic and mechanical engineers wishing to learn creative design skills and the practical implementation of their ideas. The equipment studied requires cooling, heating or heat exchange for its operation.

The first part of the subject covers the principles and practical results of heat transfer, namely conduction, convection and radiation, to a level appropriate for engineering design. Thermal-network models are developed for the analysis of steady-state and transient heating and cooling. It also discusses thermal degradation, thermal properties of materials, Australian Standards relating to thermal requirements, and the selection of electrical and mechanical materials. Laboratory work is used to develop skills in thermal measurements and a deeper understanding of cooling techniques and heat exchangers.

The second part covers the design of electrical, electronic and mechanical equipment. There is close integration of the two parts because good thermal design is required for reliable performance and high efficiency and/or low cost of equipment. This part will be taught through team solution of problem-based design projects and case-studies selected according to the students' interest. The focus is on overall design optimisation to achieve a specified objective, subject to constraints of Australian Standards, available materials, total energy consumption, and customer requirements. Typical topics include power resistors, power transistor circuits, inductors, transformers, rotating machines, heat engines, cooling coils, and heat exchangers.

Assessment: assignments 10 per cent; laboratory reports 10 per cent; design projects 50 per cent; examination 30 per cent.

49377

Process Control Studies

Availability: all courses
6cp; 3hpw or block attendance; prerequisite: suitable undergraduate subject
subject coordinator: Mr K Stillman

This subject examines the instrumentation and control of modern process systems, focusing on advanced design practice and its industrial application. The subject covers constraint control, statistical process control, override control, on-line optimisation and adaptation. It includes visits to automated industrial plants to study their design and performance.

Assessment: assignments 25 per cent; reports 35 per cent; final examination 40 per cent.

49381

Applications of Optimisation in Engineering

Availability: all courses
6cp; 3hpw or block attendance; prerequisite: suitable undergraduate subject
subject coordinator: Mr K Stillman

Following a review of the theoretical background of a selection of standard optimisation procedures, this subject applies the procedures to engineering problems. Software packages are used for generating and testing the solutions. On completion, students should be able to formulate the objective function and constraints for a problem, make an informed choice of an appropriate algorithm and validate the solution in terms of sensitivity and local optimums. Contents

include: linear programming and its extensions, unconstrained and constrained continuous problems, discontinuous problems and 'genetic' algorithms.

Assessment: assignments 70 per cent; final examination 30 per cent.

49453

Infrastructure Management

Availability: all courses
6cp; block attendance; prerequisite: 21731 Resource Management or equivalent
subject coordinator: Mr K Halstead

This subject examines current and likely future roles of local government in the provision of urban and regional infrastructure. Future infrastructure technologies are examined (such as information transfer), as are methods of public and private provision.

Assessment: essay on infrastructure 25 per cent; project 35 per cent; major assignment 40 per cent.

49550

Computing for Groundwater Specialists

Availability: ME(GWM), GDE(GWM) only
(no cp); block attendance totalling 24 hours
subject coordinator: Prof M J Knight, National Centre for Groundwater Management

This subject provides the computing background needed for students with varying degrees of computer literacy. Topics covered include DOS and WINDOWS operating systems, databases, spreadsheets, word processing, statistical and graphical packages with applications relating to groundwater processes.

Assessment: continuous assessment involving assignments and problems.

49551

Surface Hydrology and Groundwater

Availability: all courses (core for ME(GWM) and GDE(GWM))
6cp; block attendance totalling 36 hours
subject coordinator: Prof M J Knight, National Centre for Groundwater Management

This subject provides the interface process link between Surface Hydrology and Groundwater. Topics include hydrological cycle, water and energy balances and circulation, precipitation, interception, infiltration, storm runoff, hydrograph analysis, evaporation and transpiration, surface and groundwater interactions, land-use effects, artificial recharge.

Assessment: continuous assessment involving assignments and problems and short examinations.

49554

Groundwater Computing

Availability: all courses (core for ME(GWM) and GDE(GWM))
6cp; block attendance
subject coordinator: Prof M J Knight, National Centre for Groundwater Management

This subject provides a strong computing basis for groundwater management especially in the area of statistics and graphics as applied to groundwater problems involving computing. Introduction to DOS and WINDOWS operating systems, databases, spreadsheets, word processing, elements of geostatistics and graphical packages with applications related to groundwater processes, groundwater computing project.

Assessment: continuous assessment involving assignments and problems. Assignments and problems assessed at a more advanced level than 49550 Computing for Groundwater Specialists.

49555

Groundwater Modelling

Availability: all courses (core for ME(GWM) and GDE(GWM))
6cp; block attendance totalling 36 hours; corequisite: 49550 Computing for Groundwater Specialists
subject coordinator: Prof M J Knight, National Centre for Groundwater Management

The subject provides the computer modelling tools required for particular groundwater resource management underpinned by an adequate appreciation of the underlying theory and computer algorithms. Topics include conceptual modelling, analytical modelling, numerical modelling and solution algorithms applied to the governing differential equations. Emphasis is placed on finite difference and finite element methods. Applications to groundwater resource studies, borefield management, optimisation problems.

Assessment: continuous assessment involving assignments, problems and short examinations.

49701

Gas Sector Planning

Availability: limited (see prerequisites)
6cp; block attendance; prerequisites: 49021 Evaluation of Infrastructure Investments; 49023 Energy and Environmental Economics
subject coordinator: Dr D Sharma

This subject aims to develop an understanding of the nature, characteristics and methods of gas sector planning. Topics include: nature of gas sector planning; planning perspectives; planning concepts and methods; economic and technological dimensions of gas sector planning and operation; integrated resource planning; institutional structures and ownership of gas industry; regulatory issues; gas pricing; social, environmental and political dimensions of gas planning; other selected topics. Emphasis is placed on achieving depth and balance in all major aspects of gas sector planning and policy, with topical case studies providing an application focus.

Assessment: 40 per cent assignments; 50 per cent quizzes; 10 per cent contribution to class discussion.

49702

Gas Distribution Technology and Management

Availability: all courses
6cp; block attendance
subject coordinator: Dr D Sharma

This subject aims to introduce the principles, concepts and methods of designing, operating and managing gas distribution systems with due regard for their security, safety and other related aspects. Topics include: general overview of gas distribution; typical features of gas distribution systems; gas distribution technologies; gas distribution network design; construction of gas distribution systems; network operational practices and procedures; maintenance and safety issues; management of gas distribution networks; marketing issues and technological trends. Emphasis is placed on achieving depth and balance in all aspects of the design and development of gas distribution networks, with topical case studies providing an application focus.

Assessment: 40 per cent assignments; 50 per cent quizzes; 10 per cent contribution to class discussion.

49703

Selected Topics (Energy Pricing)

Availability: limited (see prerequisite)
3cp; block attendance; prerequisite: 49023 Energy and Environmental Economics
subject coordinator: Dr D Sharma

This subject aims to develop understanding of the micro economic principles and methods of energy pricing. Topics include: micro economic foundations of energy pricing; demand, supply and demand-supply interactions under various market conditions; pricing as a planning tool; pricing and efficiency; methods of pricing; case studies on the pricing of electricity, gas, oil and other energy resources.

Assessment: 40 per cent assignments; 50 per cent quizzes; 10 per cent contribution to class discussion.

49706

Regulatory Economics

Availability: limited (see prerequisites)
6cp; block attendance; prerequisites: 49021 Evaluation of Infrastructure Investments; 49023 Energy and Environmental Economics; 49026 Electricity Sector Planning
subject coordinator: Dr D Sharma

This subject focuses on developing an understanding of the economics of regulation, and methods and principles of regulation design for the energy sector and other sector of the economy. Topics include: historical overview of regulation; drivers for regulation; costs and benefits of regulation; impacts of regulation; institutional structure, ownership and regulation; regulatory frameworks; regulation design; policy issues and politics of regulation; case studies on regulatory aspects will be provided from the energy section and other sectors of the economy.

Assessment: 40 per cent assignments; 50 per cent quizzes; 10 per cent contribution to class discussion.

Postgraduate subjects taught in the Faculty of Business

21813

Managing People

Availability: MEM core subject
6cp; 3hpw/distance
subject coordinator: Mr R Connor

Theory and research from the social sciences are used to explore human behaviour at work. Students are introduced to the basics of individual psychology which is then critically applied to the fields of motivation and job design. The work of social psychology on group dynamics is presented and applied to the management of work groups and committees. Various theories of leadership are examined and critically assessed. The question of intergroup behaviour and conflict is discussed, as are power and politics in organisations. The question of change in organisations draws upon much of the foregoing. The subject takes a critical approach to management theory and practice.

Assessment: case study 30 per cent; seminar paper and presentation 30 per cent; examination 40 per cent.

22747

Accounting for Managerial Decisions

Availability: MEM core subject
6cp; 3hpw/distance
subject coordinator: Mr L Moysa

This subject introduces accounting to those who are not preparing for a career in accounting, but are going to use accounting information in their roles. Topics include both financial and management discounting; financial statements, balance sheet and income statement, financial statement analysis and understanding financial statements, the nature of management accounting, cost behaviour, differential accounting, capital budgeting, responsibility accounting and budgeting.

Assessment: class tests 40 per cent; assignment 20 per cent; final examination 40 per cent.

Postgraduate subjects taught in the Faculty of Science

66014

Hydrogeology

Availability: ME(GWM) and GDE(GWM) core subject
6cp; block attendance
subject coordinator: Prof M J Knight, National Centre for Groundwater Management

This subject provides a knowledge of geological occurrence and hydraulics of groundwater flow, exploration techniques, extraction engineering and resource management.

66015

Hydrogeochemistry

Availability: ME(GWM) and GDE(GWM) core subject
6cp; block attendance
subject coordinator: Prof M J Knight, National Centre for Groundwater Management

The subject covers the chemicals basis for understanding how the chemistry of groundwater evolves both naturally and in the case of contamination. Both practical field measurement and computer modelling will be covered.

66016

Geophysics and Remote Sensing of Groundwater Resources

Availability: ME(GWM) and GDE(GWM) elective subject
6cp; block attendance
subject coordinator: Prof M J Knight, National Centre for Groundwater Management

This subject examines both theoretically and practically the geophysical and remote sensing techniques applicable to groundwater resources evaluation and other environmental problems.

66017

Geopollution Management

Availability: ME(GWM) and GDE(GWM) elective subject
6cp; block attendance
subject coordinator: Prof M J Knight, National Centre for Groundwater Management

This subject studies the relationship between groundwater contamination and water quality together with appropriate waste management

and disposal methods for minimal environmental impact. Contaminated land issues are also addressed.

66018

Groundwater Geophysics

Availability: ME(GWM) and GDE(GWM) elective subject
6cp; block attendance
subject coordinator: Prof M J Knight, National Centre for Groundwater Management

This subject presents an advanced application of geophysical techniques for groundwater research and resource management and includes contamination assessment and monitoring. The focus is on seismic, electrical and electromagnetic methods.

66025

Contaminated Site Management

Availability: ME(GWM) and GDE(GWM) elective subject
6cp; flexible
subject coordinator: Dr Robert McLaughlan, National Centre for Groundwater Management

The course content includes: site assessment methodology, physical, chemical and biological properties and behaviour of contaminants, health issues, risk assessment, site assessment technology. See website: http://groundwater.ncgm.uts.edu.au./ncgm and contact supervisor on (02) 9514 2614.

AGSEI subjects

Availability: all courses
subject coordinator: A/Prof J V Parkin
Credit Points: 6
Mode: distance

49602

Marketing Engineering Services

The most focused activity of the marketing process in project-oriented enterprises occurs in tendering or bidding. The tendering process is in fact a rehearsal of the project, which requires all team members to specify how they would perform their part to the satisfaction of the customer's requirements and to return a profit to the enterprise.

The key decisions relating to product and pricing strategy, promotion, and delivery, are treated as part of the multi-disciplinary team task. From this perspective the customer's needs and wants become integral parts of the design process, and communication with both customers and suppliers becomes paramount.

49604

Information Technology in Management

Information technology represents a vital tool in achieving competitive advantage through breakthrough gains in efficiency and the ability to fashion radically new processes and services. Despite the promise of IT, the history of its deployment has been generally disappointing. This subject demonstrates how IT can be aligned with business processes to achieve the promised benefits. Methods of analysing the business case for IT investments are an important element. The subject also addresses issues of IT strategy including the benefits of open systems, and demonstrates the application of IT to the engineering process from design through manufacturing, service and support.

Alphabetical list of subjects

Boards and committees

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(as at 31 August 1998)

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(as at 31 August 1998)

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Examination Review Committees

Graduate Courses Committee

Prizes Committee

Research Degrees Committee

Student Assessment Appeals Committee

(Composition, terms of reference and membership details are available from the Faculty Administrator.)

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(as at 31 August 1998)

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Index

D

E

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http://www.uts.edu.au

City campus

Broadway

- Building 1 (Tower Building)
  1 Broadway, Ultimo
- Building 2
  1 Broadway, Ultimo
- Building 3 (Bon Marche Building)
  Cnr Harris Sreet and Broadway, Ultimo
- Building 4
  Cnr Thomas and Harris Streets, Ultimo
- Building 6
  702–730 Harris Street, Ultimo
- Broadway Terraces
  9, 11 and 13 Broadway, Ultimo
- Magic Pudding Childcare Centre,
  Thomas Street, Ultimo

Haymarket

- Building 5
  Cnr Quay Street and Ultimo Rd, Ultimo

Blackfriars

- Cnr Blackfriars and Buckland Streets,
  Chippendale
- Blackfriars Childrens Centre
  Buckland Street, Chippendale

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- 3 Small Street, Ultimo

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- Cnr Quay and Thomas Streets

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- Geegal
  82–84 Ivy Street, Ultimo

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Kuring-gai campus

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- Dunbar Building
  Cnr Pacific Highway and
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- Gore Hill Research Laboratories
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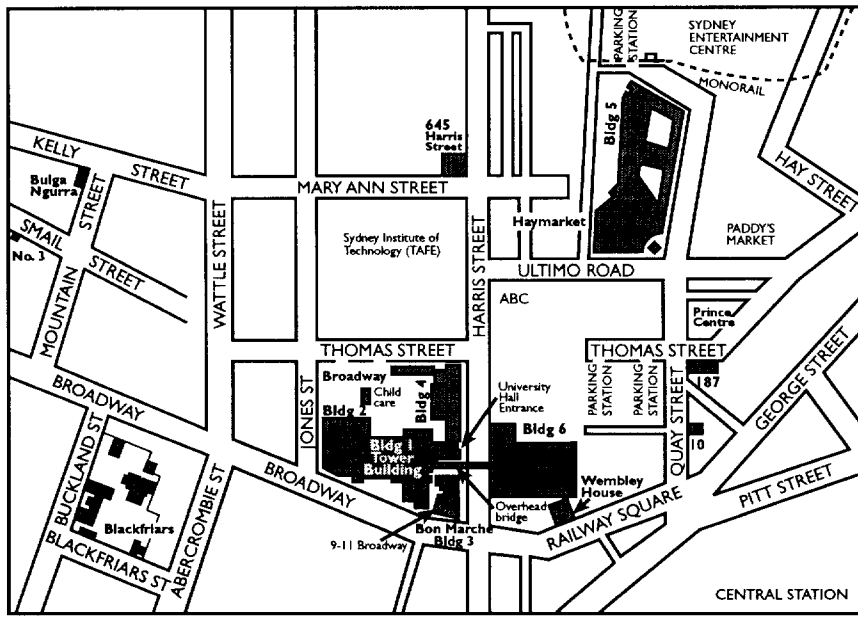
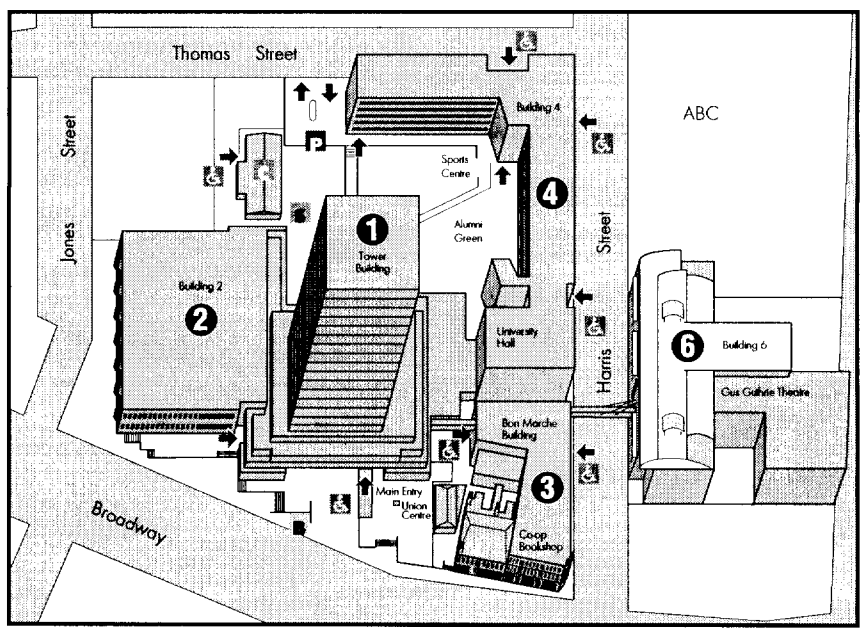


Broadway



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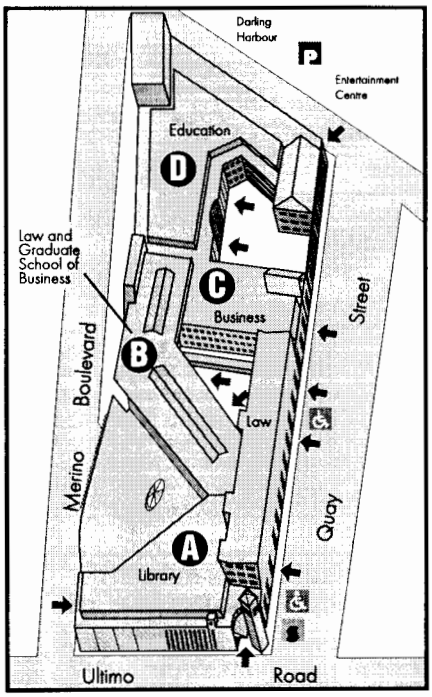

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- Entry/Exit
- Disabled access
- Main bus stop
- UTS shuttle bus
- Parking
- Building numbers
- Child care

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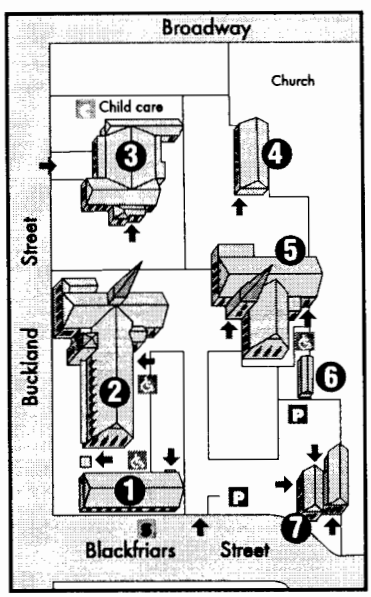
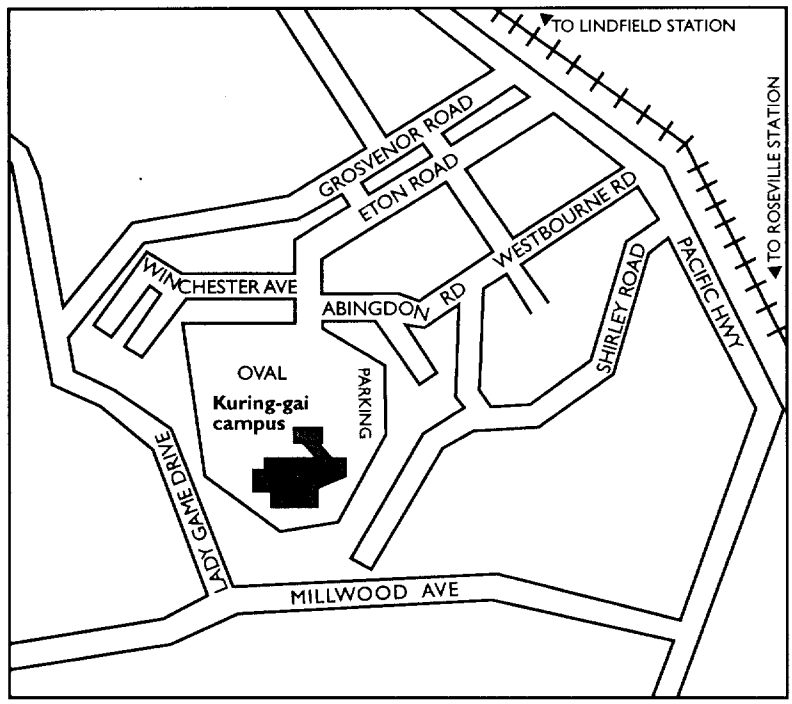
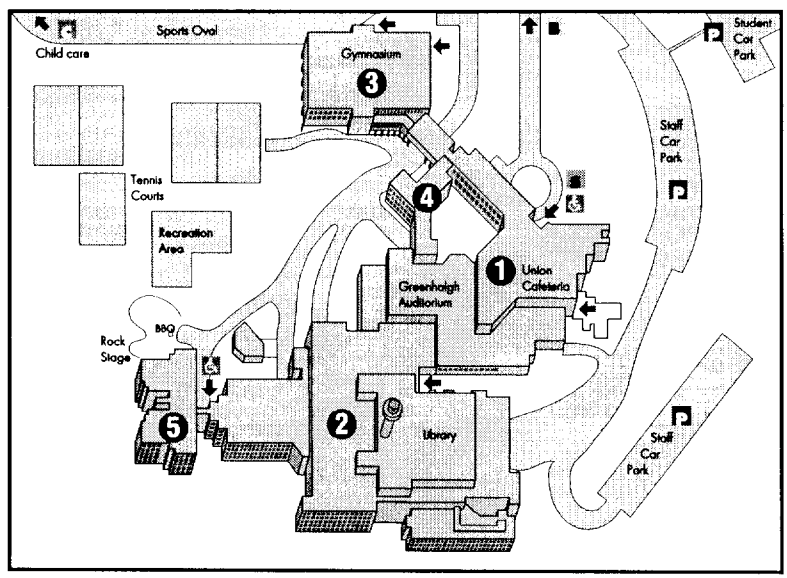


Kuring-gai campus





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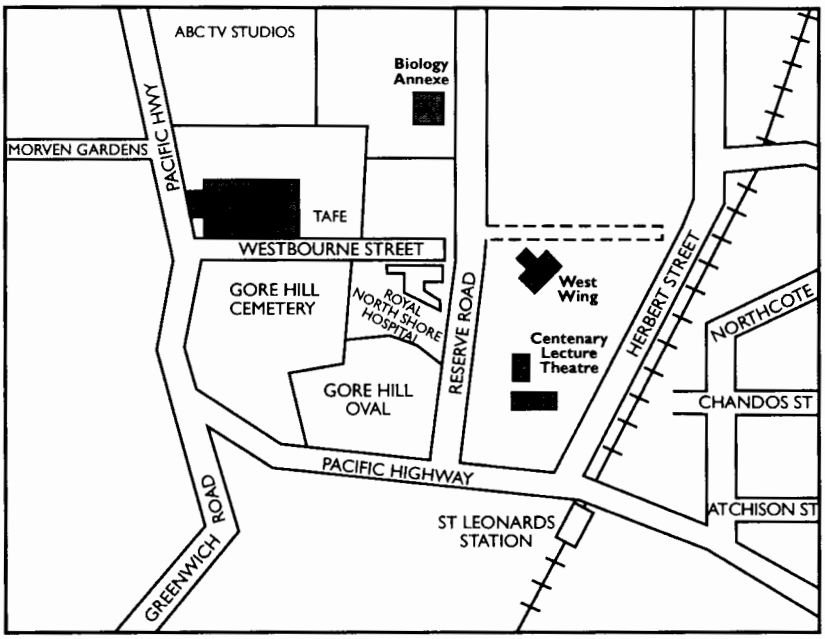

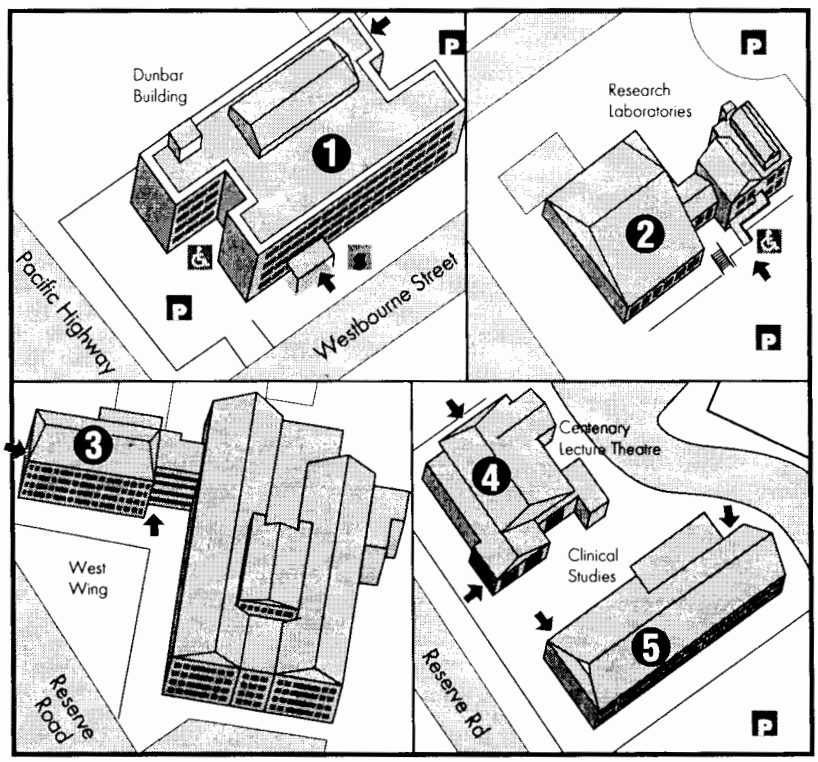

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