The University of New South Wales

Engineering

1992
Faculty Handbook

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

Information in this Handbook has been brought up to date as at 4 November 1991, but may be amended without notice by the University Council.

Contents

Calendar of Dates

The academic year is divided into two sessions, each containing 67 days for teaching. There is a recess of approximately six weeks between the two sessions and there are short recesses of one week within each of the sessions

Session 1 commences on the Monday nearest 1 March.

	1992	1993	Faculties other than Medicine
Session 1 (67 teaching days)	2 March to 16 March	1 March to 8 April	
Recess:	17 April to 26 April	9 April to 18 April	
	27 April to 12 June	19 April to 11 June	
Study Recess:	13 June to 18 June	12 June to 17 June	
Examinations	19 June to 7 July	18 June to 6 July	
Midyear Recess:	8 July to 26 July	7 July to 25 July	
Session 2 (67 teaching days)	27 July to 25 September	26 July to 24 September	
Recess:	26 September to 5 October	25 September to 4 October	
	6 October to 6 November	5 October to 5 November	
Study Recess:	7 November to 12 November	6 November to 11 November	
Examinations	13 November to 1 December	12 November to 30 November	

Important Dates for 1992

January

W	1	New Year's Day – Public Holiday
F	10	Last day for acceptance of applications by office of the Admissions Section for transfer to another undergraduate course within the University
M	13	Term 1 begins – Medicine IV
M	20	Term 1 begins– Medicine V
M	27	Australia Day – Public Holiday

February

T	4	Enrolment period begins for new undergraduate students and undergraduate students repeating first year
M	10	Re-enrolment period begins for second and later year undergraduate and graduate students enrolledin formal courses
F	28	Last day for acceptance of enrolment by new and re-enrolling students (Late fee payable thereafter if enrolment approved)

March

M	2	Session 1 begins – all courses except Medicine IV and V
Su	8	Term 1 ends – Medicine IV
M	9	Term 2 begins – Medicine IV
F	13	Last day applications are accepted from students to enrol in Session 1 or whole year subjects
Su	22	Term 1 ends – Medicine V
M	30	Term 2 begins – Medicine V
T	31	HECS Census Date for Session 1

April

F	17	Good Friday – Public Holiday Mid-session Recess begins
M	20	Easter Monday – Public Holiday
S	25	Anzac Day – Public Holiday
Su	26	Term 2 ends – Medicine IV Mid-session Recess ends

May

S	2	May Recess begins – University College, ADFA
M	4	Term 3 begins – Medicine IV
F	8	Term 1 ends – AGSM
T	12	Publication of Provisional Timetable for June examinations
Su	17	May Recess ends – University College, ADFA
W	20	Last day for students to advise of examination clashes
Su	31	Term 2 ends – Medicine V

June

M	1	Term 2 begins – AGSM
T	2	Publication of Timetable for June examination
M	8	Queen's Birthday – Public Holiday
T	9	Term 3 begins – Medicine V
F	12	Session 1 ends
S	13	Study Recess begins College of Fine Arts Assessment Week begins
Su	14	Term 3 ends – Medicine IV
M	15	Term 4 begins – Medicine IV
Th	18	Study Recess ends
F	19	Examinations begin Session 1 ends – University College, ADFA
S	20	Midyear Recess begins – University College, ADFA College of Fine Arts Assessment Week ends
M	22	Examinations begin – University College, ADFA

July

T	7	Examinations end
W	8	Midyear Recess begins
S	11	Examinations end – University College, ADFA
Su	19	Midyear Recess ends – University College, ADFA
M	20	Session 2 begins – University College, ADFA
Su	26	Midyear Recess ends
M	27	Session 2 begins

August

F	7	Last day applications are accepted from students to enrol in Session 2 subjects. Term 2 ends – AGSM
Su	9	Term 3 and 4 ends – Medicine IV and V
M	17	Term 4 and 5 begins – Medicine IV and V
M	31	HECS Census Day for Session 2. Term 3 begins – AGSM

September

F	25	Closing date for applications to the Universities Admission Centre
S	26	Mid-session Recess begins September Recess begins – University College, ADFA

October

Su	4	September Recess ends – University College, ADFA
M	5	Labour Day – Public Holiday Mid-session Recess ends
T	6	Publication of provisional timetable for November examinations
W	14	Last day for students to advise of examination clashes
Su	18	Term 4 ends – Medicine V
F	23	Session 2 ends – University College, ADFA
M	26	Examinations begin – University College, ADFA

November

F	6	Session 2 ends Term 3 ends – AGSM
S	7	Study Recess begins College of Fine Arts Assessment Week begins
Su	8	Term 6 ends – Medicine IV
Th	12	Study Recess ends
F	13	Examinations begin Examinations end – University College, ADFA College of Fine Arts Assessment Week ends

December

T	1	Examinations end
F	25	Christmas Day – Public Holiday
S	26	Boxing Day – Public Holiday
M	28	Public Holiday

Staff

Comprises Schools of Civil Engineering, Computer Science and Engineering, Electrical Engineering, Mechanical and Manufacturing Engineering (incorporating Aerospace Engineering and Naval Architecture), and Surveying; and Centres for Biomedical Engineering, Photovoltaic Devices and Systems, and Wastewater Treatment. The Faculty is also associated with the Centres for Groundwater Management and Hydrogeology and with the Co-operative Research Centres for Waste Management, and Pollution Control and Aerospace Structures.

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Peter Louis Brennan Oxley, BSc PhD Leeds, CEng, CPEng, FTS, FIProdE, FIEAAust, FIMechE

Visiting Professors
George Bennett, BA *Syd.*, PhD *N.S.W.*, ASTC, CEng, FIProdE
Henry Ehikpehale Enahoro, BSc MScTech *Manc.*, PhD *Sheff.*, CEng, FIMechE, MIProdE, FAS
Zdenek Josef Holy, DiplIng *Prague*, MSc *Birm.*, MEngSc PhD *N.S.W.*, CPEng, MIEAust

Visiting Fellows
Frances Herbert Carr, BE ME *W.A.*, PhD *N.S.W.*, CPEng, MIEAust, FAIE, MANA
Leslie George Kemeny, BE *Syd.*, CPEng, FAIE, FIEAust, MACS
Gerhart Claus Lowenthal, BA BSc DipPubAdm *Melb., MSc PhD N.S.W.*, FAIP, MInstP

School of Surveying

Professor and Head of School
John Charles Trinder, BSurv PhD *N.S.W.*, MSc *I.T.C. Delft*, RegSurvNSW, FISAust

Professor of Surveying
Friedrich Karl Brunner, DiplIng Drtech *T.U. Vienna*

Associate Professors
Bruce Crosby Forster, MSurv *Melb.*, MSc *R'dg.*, PhD *N.S.W.*, MISAust, LSVic, MIEEE
Arthur Harry William Kearsley, MSurvSc PhD *N.S.W.*, MISAust
Jean Marc Rueger, DiplIng *E.T.H. Zurich*, PhD *N.S.W.*, SIA, ACSM, LSSwitz, MISAust
Artur Stolz, BSurv PhD *N.S.W., RegSurvNSW*

Senior Lecturers
Bruce Raymond Harvey, BSurv PhD *N.S.W.*, RegSurvNSW
Christopher Rizos, BSurv PhD *N.S.W.*
Anthony John Robinson, BSurv MBA PhD *N.S.W.*, RegSurvNSW, MISAust, MAIC

Lecturers
Pratap Shivabhai Amin, BSc *I.T.C. Delft*, MSc *Lond.*, MISK, CLSEA, ARICS
Sabapathy Ganeshan, BSc *Ceyl.*
Ewan Gerald Masters, BSurv PhD *N.S.W.*, MISAust
John Richard Pollard, BSc *Qld., BTech S.A.I.T.*

Administrative Assistant
Leon Daras, BA *N.S.W.*

Professional Officers
Brian Edward Donnelly, BSurv *N.S.W.*, MSurv *N'cle.(N.S.W.)*, GradDipCompStud *C.C.A.E.*, RegSurvNSW
Karl David Sippel, BSurv *N.S.W.*
William Zhong, BSc *Shanghai*

Computer Systems Officer
Bernd Hirsch, BApplSc *Mitchell C.A.E.*

Centre for Biomedical Engineering

Associate Professor and Director
Klaus Schindhelm, BE PhD *N.S.W.*, MIEAust, MASAIO

Associate Professor
Christopher David Bertram, MA DPhil *Oxf.*

Visiting Professor
Peter Craig Farrell, BE *Syd.*, SM *M.I.T.*, PhD *Wash.*, DSc *N.S.W.*, MASAIO, MISAO

Senior Lecturers
Alberto Pompeo Avolio, BE PhD *N.S.W.*
Bruce Kenneth Milthorpe, BA *Macq.*, PhD *A.N.U.*

Lecturer
Ross Alexander Odell, BSE *Prin.*, PhD *M.I.T.*

Professional Officer
Laura Anne Poole-Warren, BSc PhD *N.S.W.*

Administrative Assistant
Rhonwen Cuningham, BA DipSocWk *Syd.*

Centre for Groundwater Management and Hydrogeology

In association with the Faculty of Applied Science.

Director
Associate Professor M. J. Knight

Deputy Director
Associate Professor C. R. Dudgeon

Senior Lecturers
William Alexander Milne-Home, BSc *Leic.*, MSc *Lond.*, PhD *Alta.*, FGS
Richard Ian Acworth, BSc *Leeds*, MSc PhD *Birm.*, FGS

Senior Research Fellow
Jerzy Jankowski, MSc PhD *Wroclaw*

Project Scientist
David Ronald Cohen, BSc *Syd.*, MSc *Qu.* PhD *N.S.W.*

Professional Officers
Robert Gregor McLaughlan, BSc *Melb.*, MAppSc GradDip *N.S.W.*

Administrative Assistant
Areerom Romy Peters

Centre for Remote Sensing

In association with the Faculty of Applied Science.

Director
Associate Professor B. C. Forster

Deputy Director
Associate Professor A. K. Milne

Professional Officer
Arthur Mark Hall, BSc *N.E.*

Laboratory Manager
John Charles Klingberg, BSc *Darling Downs I.A.E.*, GradDip *N.S.W.*

Research Assistant
John Lambert Steer, BAppSc *N.S.W.I.T.*

Introduction

This handbook provides information on courses of study offered by the Faculty of Engineering, at both undergraduate and graduate levels, together with descriptions of subjects available and areas in which research may be undertaken.

The Faculty consists of the Schools of Civil Engineering, Computer Science and Engineering, Electrical Engineering, Mechanical and Manufacturing Engineering, Surveying and the Centres for Biomedical Engineering, Photovoltaic Devices and Systems and Wastewater Treatment. The Faculty is also closely associated with the Centres for Groundwater Management and Hydrogeology, and Remote Sensing which are multidisciplinary in nature.

The Faculty is also actively involved with two of the 15 Cooperative Research Centres (CRCs) established under the Commonwealth Government's program of CRCs announced in 1991. These are the CRC for Waste Management and Pollution Control and the CRC for Aerospace Structures.

The Faculty is dedicated to the achievement of excellence in scholarship, teaching and research in technology and its application for the benefit of the community. The goals of the Faculty are to:

1. provide undergraduate, graduate and continuing education programs, and to undertake research, in the professional fields of engineering and surveying;
2. provide formal and continuing education programs, and to undertake research, in interdisciplinary fields in which engineering science and practice play a prominent role;
3. aid the advancement, development and practical application of science and technology to satisfy the needs of industry, commerce, the infrastructure of society and the efficient management of resources.

Achievement of these goals will develop the attitudes and skills required of professional engineers operating into the twenty-first century.

Schools within the Faculty offer undergraduate courses leading to the award of the degree of Bachelor of Engineering (BE) in Aerospace Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Environmental Engineering, Manufacturing Management, Mechanical Engineering and Naval Architecture and Bachelor of Surveying (BSurv). Combined degree courses are also available which lead to the award of two degrees: Bachelor of Engineering and Bachelor of Science (BE BSc), Bachelor of Engineering and Bachelor of Arts (BE BA), Bachelor of Engineering (Civil Engineering) and Bachelor of Laws (BE LLB) and Bachelor of Surveying and Bachelor of Science in Computer Science (BSurvBSc).

Through its schools and centres, the Faculty offers an active graduate program. Formal graduate courses are available which lead to the award of the degrees of Master of Biomedical Engineering, Master of Computer Science, Master of Engineering Science, Master of Environmental Engineering Science, Master of Information Science, Master of Surveying Science and to the award of Graduate Diplomas. Supervision is also available for candidates undertaking research degrees leading to the awards of Master of Engineering, Master of Science and Doctor of Philosophy.

The Faculty's engineering and surveying courses seek to develop in students:

1. The technical, scientific and creative skills required to solve all aspects of engineering problems.
2. An understanding of human interaction with the environment so that the impact of engineering activity can be assessed.
3. The ability to direct and manage engineering activities.
4. The ability to communicate with other members of the profession, with industrial personnel, administrators and with members of the public.
5. The desire and ability for continuing self-education and reappraisal of current practice including the ability to innovate.
6. The ability to evaluate independently and to criticise constructively their own work and the work of other engineers.

As part of their training for the profession, students are required to write reports and make verbal presentations. Therefore a high level of competence in written and spoken English expression is expected.

It is also important for students to join in the development of themselves as professional engineers. Engineering is a cooperative profession where teamwork is very important. Whilst at university, students should take as many opportunities as possible to join in the activities which help to develop the whole person. Student clubs and professional institutions provide many opportunities for gaining knowledge and experience which will be valuable in later years.

Dean
Faculty of Engineering

Faculty Information

Some People Who Can Help You

If you require advice about enrolment, degree requirements, progression within courses, subject content and requirements, contact the appropriate school/centre representative listed below:

School of Civil Engineering: Mr G. J. Harris, Room 406, Civil Engineering Building.

School of Computer Science and Engineering: Dr G.R. Whale or Ms V. Joubert, School Office, Room 313, Electrical Engineering Building.

School of Electrical Engineering: Dr C. J. E. Phillips, Room G6, or Ms A. G. M. Johnson, School Office, Electrical Engineering Building.

School of Mechanical and Manufacturing Engineering: Dr E.M. Kopalinsky, Room 105B, or Mr A.D. Bauman, Room 112, Mechanical and Manufacturing Engineering Building.

School of Surveying: Mr L. Daras, School Office, Room 529, Geography and Surveying Building.

Centre for Biomedical Engineering: Associate Professor K. Schindhelm, 5th Floor, New Research Building.

Centre for Groundwater Management and Hydrogeology: Dr M. J. Knight, Room 810, Applied Science Building.

Centre for Remote Sensing: Associate Professor B.C. Forster Room 247, Geography and Surveying Building.

Important: As changes may be made to information provided in this handbook, students should frequently consult the noticeboards of the schools and the official noticeboards of the University.

Entrance Requirements

Students are selected for courses offered by the Faculty according to the Tertiary Entrance Rank obtained in the New South Wales Higher School Certificate (NSW HSC). Other students are admitted on the basis of their previous academic mark. In addition, students are expected to have reached the following standards (or equivalent) in the NSW HSC subjects:

Course	NSW HSC Prerequisites For First-Year Subjects	NSW HSC Score Range Required
Engineering:	2U Mathematics or	60-100
Aerospace	3U Mathematics or	1-50
Civil	4U Mathematics	1-100
Computer		
Electrical	2U Science (Physics) or	53-100
Environmental	3U Science or	90-150
Mechanical	4U Science	1-50
Manufacturing		
Management		
Naval Architecture	2U English (General) or	53-100
Surveying	2U English or	49-100
	3U English or	1-50
	2U Contemporary English	60-100

Students are advised that the lack of specified subject prerequisite/s do not preclude their selection to any course but the required standard must be achieved before enrolment in the University subject is permitted.

The University conducts Bridging Courses to assist in remedying deficiencies in subject levels. Further details are available from the Students' Information Guide published annually by the Universities Admissions Centre (UAC).

Introductory subjects are also available to students who do not have the New South Wales Higher School Certificate prerequisite/s in Mathematics or Physics. It should be noted that inclusion of these subjects in first-year programs could extend the duration of a course.

Faculty of Engineering Enrolment Procedures

All students re-enrolling in 1992 or enrolling in graduate courses should obtain a copy of the free leaflet *Re-Enrolling 1992* available from School offices and the Admissions Office. This leaflet provides detailed information on enrolment procedures and fees, enrolment timetables, enrolment in miscellaneous subjects, locations and hours of Cashiers and late enrolments.

Equal Opportunity in Education (EOE)

The Faculty of Engineering is committed to the principles that course design, curriculum content, classroom environment, assessment procedures and other aspects of engineering education provide equality of educational opportunity to all students enrolled in subjects offered within the Faculty.

It is nevertheless expected of students that they possess prerequisite knowledge and manipulative skills and obtain the relevant practical experience necessary to satisfactorily complete a degree course in Engineering or Surveying. The University provides bridging and remedial courses to overcome prerequisite deficiencies, counselling services to help with problems of a personal or a psychological nature and support services to assist with obtaining mandatory industrial experience during the undergraduate course.

It is Faculty and University policy to promote equal opportunity in Education: refer to EOE Policy Statement, *University of New South Wales Calendar*, and the *Guide for Students*.

Faculty of Engineering Library Facilities

Although any of the university libraries may meet specific needs, the staff and students of the Faculty of Engineering are served mainly by the Physical Sciences Library and the Undergraduate Services.

The Physical Sciences Library

The library, located on Levels 6 and 7 of the Library tower, caters for the information needs of staff, graduate students and undergraduates in the pure and applied sciences, engineering and architecture.

Physical Sciences Library materials are listed in the Library's online catalogue, microfiche book finding list or microfiche serials catalogue.

This Library provides reference, reader assistance and reader education services including interlibrary loan, online search and CD-ROM facilities. Photocopying facilities are also available.

Trained Library staff are always available on Level 7 to assist readers with their enquiries.

Physical Sciences Librarian — Rhonda Langford

Undergraduate Services

- The **Open Reserve Section** houses books and other materials which are required reading. Level 2.
- The **Audio Visual Section** contains multi media videos and cassette tapes of lectures. The section has wired study carrels and cassette players for student use. The map collection is also located here. Level 3.
- The **Reader Education** program provides orientation tours and introductory library research method lectures to students.

Student Clubs and Societies

Students have the opportunity of joining a wide range of clubs and societies. Many of these are affiliated with the Students' Union. There are numerous religious, social and cultural clubs and also many sporting clubs which are affiliated with the Sports Association.

Clubs and societies seeking to use the name of the University in their title, or seeking University recognition, must submit their constitutions either to the Students' Union or the Sports Association if they wish to be affiliated with either of these bodies, or to the Academic Registrar for approval by the University Council.

The following societies serve the interests of students in the various courses in the Faculty of Engineering: Biomedical Engineering Society (BioEngSoc); Civil Engineering Society (CIVSOC); Computing Science Association (CSA); Electrical Engineering Society (ELSOC); Mechanical Engineering Society (MECHSOC); Naval Architecture Students' Association (NASA); Surveying Society (SURVSOC).

Students are encouraged to participate in the activities of their societies. Enquiries should be directed initially to the general offices of the respective Schools.

Students With Disabilities

The University of New South Wales has a policy of equal opportunity in education and seeks wherever possible to ensure maximum participation of students with disabilities.

The University offers a range of assistance: examination support; specialized equipment; educational support; parking provisions; library assistance.

A Resource Guide for students and staff with disabilities and a map showing wheelchair access is available from the Advisor to students with Disabilties, the EEO Unit, the Library and the Students' Union.

It is advisable to make contact with the Adviser to Students with Disabilities prior to, or immediately following enrolment, to discuss your support needs.

The Adviser can be contacted on 697 5418 or at Building F15 (Careers and Counselling Unit).

International Association for the Exchange of Students for Technical Experience – IAESTE

IAESTE is an organization to facilitate overseas work in technical areas in 53 different countries throughout the world for students or recent graduates. It organizes visas, work periods for as little as 6 weeks or up to 12 months, lodging and an initial welcome.

Further information may be obtained from the Association, c/-The Graduate Careers Council of Australia, PO Box 28, Parkville, Vic 3052. Telephone (03) 347 4644.

Professional Institutions

1. The Institution of Engineers, Australia
The professional body for engineering in Australia is the Institution of Engineers, Australia (IEAust), which has as its first objective 'to promote the science and practice of engineering in all its branches'.

The IEAust has its national headquarters in Canberra and functions through a series of divisions, the local one being the Sydney Division. Within each division are branches representing the main interests within the profession, eg civil, mechanical, electrical, engineering managment and environmental engineering.

Students of an approved school of engineering may join the Institution as a student member (StudIEAust). Student members receive the fortnightly publication *Engineers, Australia* and for a small fee they also receive *The Transactions* which contains articles on a particular branch of engineering.

Student members are invited to participate in the Excellence Award for Work Experience, the National Young Engineer of the Year Award and to avail themselves of other IEAust services including the Mentor Scheme and industrial experiences guidance.

For more information and membership application forms, write to The Secretary, The Institution of Engineers, Australia, Sydney Division, 1st Floor, 118 Alfred Street, Milsons Point 2061.

2. The Institution of Surveyors, Australia
During their years as undergraduates, students in the surveying course are encouraged to take the first steps in joining in the activities of the professional body which represents surveyors, The Institution of Surveyors, Australia. The aims of the Institution are to promote scientific, technical and educational aspects of surveying and to maintain high professional standards of practice and conduct. Student members receive the quarterly journal of the Institution, *The Australian Surveyor* and *Azimuth* which is published by the New South Wales Division of the Institution. Membership also entitles the student to attend all meetings of the Institution and to attend the annual Congress at a special concessional rate. Membership application forms are available at the office of the School of Surveying and from the Institution Office, Third Floor, Guild House, 363 Pitt Street, Sydney 2000.

General Information

While this Handbook has been specially designed as a detailed source of reference in all matters related to the Faculty, the University's *Student Guide* is intended to provide general information on some of the most important rules and procedures and introduces students to many of the services available to them. The *Guide,* which helps to put the Faculty into perspective within the University as a whole, is issued free of charge to all enrolled students. For fuller details about some aspects of the University and its activities students might need to consult the *University Calendar.*

Undergraduate Study

The Faculty of Engineering offers the following courses:

Bachelor of Engineering (BE) in:
Aerospace Engineering
*Civil Engineering
Computer Engineering
Electrical Engineering
*Environmental Engineering
Mechanical Engineering
Manufacturing Management
Naval Architecture

These full-time courses are designed to be taken over a period of four years. They may also be taken on a part-time basis which usually involves a combination of mainly day-time study together with some evening attendance over a period of six or seven years. It may not be possible to offer evening classes in the later year subjects.
*Courses in sandwich form after the first year are also available.

Bachelor of Surveying (BSurv)
This course is available on a full-time basis and in sandwich form, the latter providing for alternate periods of full-time study and full-time employment with part-time study.

Combined Degree Courses
Full-time courses are available for the award of the following degrees:

Bachelor of Engineering Bachelor of Science (BE BSc)
(5 years' duration) in:

Aerospace Engineering
Civil Engineering
Electrical Engineering
Manufacturing Management
Mechanical Engineering
Naval Architecture

Bachelor of Engineering Bachelor of Arts (BE BA)
(5 years' duration) in:

Aerospace Engineering
Electrical Engineering
Manufacturing Management
Mechanical Engineering
Naval Architecture

Bachelor of Engineering Bachelor of Laws (BE LLB)
(6 years' duration) in:

Civil Engineering

Bachelor of Surveying Bachelor of Science in Computer Science (BSurv BSc)
(5 years' duration)

Subject Areas
The three major subject areas in engineering and surveying courses are **basic sciences, engineering sciences** and **engineering applications**. The basic sciences area is emphasised in Year 1 since it forms the foundation for the remainder of the course. Engineering sciences form the link between the basic sciences and engineering applications. The engineering applications area provides the opportunity for applying knowledge to the solution of problems and is consequently emphasised later in the course. A feature of the courses at the University of New South Wales is the inclusion of a program of General Education, the requirements for which are set out below.

Basic Sciences consist of Mathematics, Physics and some Chemistry. **Engineering Science** subjects are those which provide the theoretical basis for engineering applications. These include Applied Mechanics, Fluid Mechanics, Electronics, Electricity, Thermodynamics, Structural Mechanics, Materials Science. **Engineering Applications** involve Innovation and Design, Systems and Control,

Production, Technical Communication, Energy Conversion, Management. General Education subjects serve to provide both an introduction to the environments in which humans function – physical, biological, socio-economic, and technological – and an introduction to the cultural bases of knowledge and belief.

Co-op Program

The University's Co-op Program in the Faculty of Engineering consists of industry-linked, five-year courses in Aerospace Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Environmental Engineering, Mechanical Engineering, Manufacturing Management and Naval Architecture.

Co-op scholars are selected largely on the basis of academic attainment, personal skills and motivation as well as on non-academic achievements.

Further information is available from the University's Office of Industry-Linked Education, telephone (02) 697 5116.

Transfer Courses

The University of Melbourne has guaranteed entry for up to three students in the Bachelor of Engineering (Agriculture) degree course who successfully complete the first year of an engineering degree course at the University of New South Wales. Application should be made during the year in which first-year studies are undertaken. Further information may be obtained from the Professor of Agricultural Engineering, Department of Civil and Agricultural Engineering, University of Melbourne, Parkville, Vic 3052.

Students transferring to the University of New South Wales after successful completion of the first year of an engineering degree course at an Australian university would normally be admitted with advanced standing into the degree courses offered by the Faculty of Engineering. Students transferring from related courses at an Australian university are granted exemptions based on parity of all junior courses.

Formal advanced standing procedures apply for entry into the following Bachelor of Engineering (BE) courses at the University of New South Wales with full credit.

BE in Electrical Engineering
Students studying at the University of Western Sydney, Macarthur, who complete at their first attempt the first year of the Science Program are granted enrolment in the second year of the BE course. Entry is restricted to applicants who are residents of the South-Western Region of Sydney.

BE in Aerospace Engineering
BE in Manufacturing Management
BE in Mechanical Engineering
BE in Naval Architecture
Students studying at the Charles Sturt University, Wagga Wagga, may be admitted to the second year of the above course after satisfactorily completing the one-year Bachelor of Engineering Transfer Program (KSZ) at Wagga Wagga.

BE in Aerospace Engineering
Students who satisfy the requirements of the first two years of the Mechanical Engineering full-time degree course at any other Australian university may be admitted to a two-year program leading to the Bachelor of Engineering degree in Aerospace Engineering. (The first and second years of this course are identical with the first two years of the course in Mechanical Engineering.)

BE in Naval Architecture
Students who satisfy the requirements of the first two years of the Mechanical Engineering full-time degree course at any other Australian university may be admitted to the final two years of the Bachelor of Engineering degree course in Naval Architecture. (The first and second years of this course are identical with the first two years of the course in Mechanical Engineering.)

Further information regarding entry into the above listed courses may be obtained from the Dean's Office, Faculty of Engineering.

Course Transfers

Students who have completed the first year of an undergraduate course in one school may apply for a transfer to a course in another school of the Faculty with credit for relevant subjects completed. However, as there are considerable differences in the various Year 1 programs, students are not granted complete exemption from Year 1 of the course to which the transfer is made.

General Rules for Progression

Progression in all undergraduate courses in the Faculty of Engineering is permitted by subject. However:

1. Course programs will continue to be stated and timetabled by year or stage and it cannot be guaranteed that non-standard programs can be completed in the minimum number of years.

2. Students must satisfy the rules governing re-enrolment: in particular, these require students enrolled in the first year of a degree program to pass in at least half that program. Students are also required to show cause why they should be allowed to repeat a subject which has been failed more than once. Students are also required to show cause why they should be allowed to continue with their course if their average mark in a year of study falls below 50%.

3. Students must satisfy the relevant prerequisite and co-requisite requirements. This will usually necessitate students completing or attempting all subjects of a particular year or stage before proceeding to a subject in the next part of a course. Further details are available from the appropriate school.

4. Only in exceptional circumstances will students be permitted to enrol in subjects extending over more than two years of the course or for more than twenty-eight hours of course work per week if a full-time student or fourteen hours per week if a part-time student. Students repeating subjects are required to choose a program which limits their hours of course work to twenty-two per week if a full-time student, and to eleven per week if a part-time student, unless they have the express permission of the Head of School to exceed these hours.

5. Notwithstanding the above, before students can enrol in any non-standard program such program must meet with the approval of the Head of School. A non-standard program is one which involves enrolment in subjects from more than one year

or stage, or comprises subjects which do not normally constitute a particular year's course work.

Prerequisites and Co-requisites

- A prerequisite unit is one which must be completed prior to enrolment in the unit for which it is prescribed.
- A co-requisite unit is one which must either be completed successfully before or be studied concurrently with the unit for which it is prescribed.

Industrial Experience Requirements (Engineering Students)

The Faculty of Engineering endorses the requirement of The Institution of Engineers, Australia, in that all students must complete at least 60 working days of approved industrial experience prior to enrolment in the final year of their course. The staff of the Faculty will, where possible, assist students to obtain this employment, but it is emphasized that the primary responsibility for obtaining suitable industrial experience rests with each student. The award of the degree is dependent on the completion of the requisite periods of industrial employment at a standard approved by the University.

Students enrolled in Bachelor of Engineering courses in the Schools of Civil Engineering, Computer Science and Engineering, Electrical Engineering and Mechanical and Manufacturing Engineering are required to enrol in Industrial Training subjects. Schools' entries under **Course Outlines** should be consulted for details of subject requirements.

Practical Experience Requirements (Surveying Students)

All students in BSurv course must gain at least 60 days of recognised professional practice after the completion of Session 1 in Year 2 as part of the requirements for subject SURV8711. Special instructions will be given before commencement of professional practice.

Subject Identification Scheme

An alpha-numeric subject identification scheme was introduced by the University in 1991. Please locate **Subject Descriptions: Identification of Subjects** in the Contents for further information.

In the Faculty of Engineering, Schools and Centres have allocated the first digit in the numeric suffix of all subject identifiers as indicating the level of the subject. **Please note that the value '9' in this position is reserved for graduate subjects.**

General Education Requirement

The University requires that all undergraduate students undertake a structured program in General Education as an integral part of studies for their degree.

Among its objectives, the General Education program provides the opportunity for students to address some of the *key questions* they will face as individuals, citizens and professionals.

The program requires students to undertake studies in three categories of the program:

CATEGORY A. An introduction in non-specialist terms to an understanding of the environments in which humans function.

CATEGORY B. An introduction to, and a critical reflection upon, the cultural bases of knowledge, belief, language, identity and purpose.

CATGEORY C. An introduction to the development, design and responsible management of the systems over which human beings exercise some influence and control. This category is required only of students in four-year professional and honours programs

There are differing requirements for general education for students commencing before, in, and after 1988. Students must complete a program of general education in accordance with the requirements in effect when they commenced their degree program. Students should consult the appropriate course authority or the Centre for Liberal and General Studies in Morven Brown Building, Room G58.

The key questions addressed by the Program are:

Category A: The External Context

Course requirement: 56 hours

1. How do we, can we, generate wealth? (Australia and the Development of the World Economy) 28 hours
2. How can we, ought we, distribute wealth, status and power? (Human Inequality) 28 hours
3. What steps should we take, and what policies should we adopt, in science and technology? (Science and Civilization) 56 hours
4. What effects do our wealth generating and techno-scientific activities have on the environment? (Ecosystems, Technology and Human Habitation) 28 hours
5. What are the effects of the new mass media of communication? (Mass Media and Communications) 28 hours
6. What are the key social and cultural influences on Australia today? (Australian Society and Culture) 28 hours

Category B: The Internal Context of Assumptions and Values

Course requirement: 56 hours

1. How do we define ourselves in relation to the larger human community? (The Self and Society) 56 hours
2. How do our conceptions of human nature and well-being influence both individual and social behaviour? (Changing Conceptions of Human Nature and Well-Being) 28 hours
3.

3. What are the prevailing conceptions of and challenges to human rationality? (The Pursuit of Human Rationality) 28 hours
4. How do language, images and symbols function as means and media of communications (The Use of Language, Images and Symbols) 28 hours
5. What is the impact of the computer on human society and culture? (The Computer: Its Impact, Significance and Uses) 28 hours
6. Which systems of belief and configurations of values are most conducive to the survival and enhancement of the human species and the planet earth? (Beliefs, Values and the Search for Meaning) 28 hours

Category C: An Introduction to the design and responsible management of the human and planetary future

The central question to be addressed by students in a systematic and formal way is:
For what purpose or purposes will I use my intellectual skills, my expertise, or my technological prowess?

Will these abilities be used, for example.:

(i) in a creative and innovative way?

(ii) to widen the circle of human participation in the benefits they bring?

(iii) to break down the barriers of exclusion and discrimination?

(iv) to enhance the prospects for survival of the human species?

(v) to enhance the capacity of the planet earth to sustain life?

The manner in which the Category C requirement is satisfied varies with each of the Schools and courses in the Faculty. The particular details are shown under each School's handbook entry.

Conditions for the Award of the Degree of Bachelor of Engineering

Conditions for the Award of the Degree of Bachelor of Engineering.

1. A candidate for the award of the degree of Bachelor of Engineering shall:

(1) comply with the requirements for admission;

(2) follow the prescribed course of study in the appropriate School, and satisfy the examiners in the necessary subjects;

(3) complete an approved program of industrial training for such periods as are prescribed. In general, this training must be completed before 31 January in the year in which the degree is to be awarded.

2. During each year a student shall perform laboratory, drawing office and field work, attend demonstrations and excursions to such an extent and in such a manner as is prescribed from time to time by the Academic Board on the recommendation of the Faculty. Those students who are required to undertake field work for any subject must be prepared to pay the appropriate costs and be in attendance at all scheduled examinations except in abnormal circumstances.

3. A student may be granted advanced standing by the Academic Board on the recommendation of the appropriate Faculty, but in each case must complete an adequate period of approved industrial training before being eligible for the degree. In addition to the above requirements a student coming from another institution must comply with the conditions laid down by the Academic Board for admission with advanced standing.

4. The degree shall be awarded in the pass or honours grade. Honours may be awarded in the following categories:

Honours Class I

Honours Class II, Division I

Honours Class II, Division II

5. In special cases the Faculty may approve the variation of any of the preceding conditions.

Conditions for the Award of the Degree of Bachelor of Surveying

1. A candidate for the award of the degree of Bachelor of Surveying shall:

(1) comply with the requirements for admission;

(2) follow the prescribed course of study in the School of Surveying and satisfy the examiners in the necessary subjects;

(3) complete an approved program of professional practice for such periods as are prescribed. In general, this training must be completed before 31 January in the year in which the degree is to be awarded.

2. During each year a student shall perform laboratory, drawing office and field work, attend demonstrations, excursions and field camps to such an extent and in such a manner as is prescribed from time to time by the Academic Board on the recommendation of the Faculty. Those students who are required to undertake field work for any subject must be prepared to pay the appropriate costs and be in attendance at all scheduled examinations except in abnormal circumstances.

3. A student may be granted advanced standing by the Academic Board on the recommendation of the Faculty of Engineering. In addition to the above requirements a student coming from another institution must comply with the conditions laid down by the Academic Board for admission with advanced standing.

4. The degree shall be awarded in the pass or honours grade. Honours may be awarded in the following categories:

Honours Class I

Honours Class II, Division I

Honours Class II, Division II

5. In special cases the Faculty may approve the variation of any of the preceding conditions.

Undergraduate Study

Course Outlines

School of Civil Engineering

Head of School
Professor R. Fell

Senior Administrative Officer
Mr G.J. Harris

The School consists of five departments: **Geotechnical Engineering** (foundation engineering, soil mechanics, rock mechanics, concrete technology, and pavement engineering); **Engineering Construction and Management** (civil engineering systems, engineering economy, project planning and management and civil engineering construction); **Structural Engineering** (structural analysis and structural design); **Transport Engineering** (planning, design and operation of transport systems, statistical analysis, land use and transport modelling, economic evaluations and environmental impact studies); **Water Engineering** (hydraulics, hydrology, water resources, waste management and public health engineering).

Within the five departments the School has a broad spectrum of expertise in the disciplines of **Environmental Engineering.**

In addition to extensive laboratory facilities on the Kensington campus, the School operates laboratories at Govett Street and King Street, Randwick and King Street, Manly Vale. The latter complex houses the School's Water Research Laboratory and the associated Water Reference Library. The School also uses the Fowlers Gap Arid Zone Research Station for construction camps and data collection for arid zone hydrology.

The School offers courses (**3620**) and (**3625**) leading to the award of degrees of Bachelor of Engineering (Civil) (BE) and Bachelor of Engineering (Environmental) (BE), at pass or honours level, which can be taken on a four-year full-time basis, on a part-time basis or on a combined full-time part-time basis subject to the approval of the Head of School. Intending part-time students are advised that most subjects are offered only in the daytime. Part-time students will normally take two years for each equivalent full-time year.

Alternatively, the courses may be taken in a sandwich form in which a student, after completing the first year of the course on a full-time basis, gains industrial experience during one or more periods of employment by taking leave of absence for one academic year.

A six-year full-time course (**4775**) leading to the award of the degrees of Bachelor of Engineering and Bachelor of Laws (BE LLB) is offered.

The University requires that undergraduate students undertake a structured program in General Education as an integral part of their degree. For details of the requirements, please locate General Education in the Contents.

The requirements for the award of the BE degrees include a period of at least sixty working days of approved industrial training prior to enrolment in the final year.

The degree of Bachelor of Engineering (Civil or Environmental) may be conferred as a Pass degree or as an Honours degree. There are two classes of Honours, Class I, and Class II in two divisions, and the award and grade of Honours are made in recognition of superior performance throughout the course with a greater weighting on subjects in the later years.

The award of the degree of Bachelor of Engineering (Civil or Environmental) is recognized by the Institution of Engineers, Australia, as meeting the examination requirements for admission to graduate and corporate membership. Substantial or complete recognition is accorded to the BE course by overseas engineering institutions.

General Education Program
The University requires that undergraduate students undertake a structured program in General Education as an integral part of their degree. For further details, please locate General Education in the Contents.

Requirements for General Education elective and prescribed subjects in courses offered by the School of Civil Engineering are: Years 2 and 3 - one 56 hour or two 28 hour subject/s from each of Categories A and B, respectively. The subject to be studied in Course **3620** in Year 4 In order to satisfy the Category C requirements, is CIVL4306 Engineering and the Environment. The Category C requirements for Course **3625** are yet to be determined.

3620
Civil Engineering – Full-time Course

Bachelor of Engineering BE

Year 1		Hours per week S1	S2
CHEM1808	Chemistry 1CE	0	6
CIVL1106	Computing and Graphics	3	3
CIVL1203	Engineering Mechanics 1	4	4
CIVL1301	Civil Engineering Practice	3	2
GEOL5100	Geology for Civil and Environmental Engineers	3	
MATH1032	Mathematics	6	6
PHYS1989	Physics*	4	3
		23	24

*Students are advised to attempt PHYS1989 Physics 1CE but if timetabling difficulties arise or other exceptional circumstances prevail permission will be given to attempt PHYS1002 Physics 1. Students who intend to apply for transfer to the Combined BE BSc degree program involving Level 2/3 Physics subjects must enrol in PHYS1002.

Year 2			
CIVL2106	Systems Engineering	2	3
CIVL2203	Engineering Mechanics 2	4	4
CIVL2301	Engineering Construction	2	2
CIVL2402	Materials Engineering 1	4	4
CIVL2505	Hydraulics 1	2	2
MATH2009	Engineering Mathematics 2	4	4
MATH2869	Statistics SC	2	0
SURV0441	Surveying for Engineers	0	4.5
SURV0491	Survey Camp*	0	0(3)
	General Education Category A	4	0
		24	23.5 (+3)

* Students are required to attend a one week Survey Camp which is equivalent to 3 class contact hours per week in Session 2.

Year 3			
CIVL3106	Engineering Computations	2	2
CIVL3203	Structural Analysis	3	3
CIVL3303	Structural Design	4	4
CIVL3402	Geotechnical Engineering 1	3	3
CIVL3505	Hydraulics 2	3	3
CIVL3601	Engineering Management 1	2	2
CIVL3705	Water Resources	3	3
CIVL3804	Transport Engineering	2	2
	General Education Category B	2	2
		24	24

Year 4		Hours Per Week S1	S2
CIVL4006	Industrial Training	0	0
CIVL4101	Engineering Management 2	2	0
CIVL4203	Structural Engineering	4	0
CIVL4306	Engineering and the Environment*	4	0
CIVL4403	Materials Engineering 2	3	0
CIVL4502	Geotechnical Engineering 2	3	0
CIVL4605	Water Supply and Wastewater Disposal	3	0
CIVL4704	Highway and Pavement Engineering	3	0
CIVL4906	Project/Thesis	1	6
Plus two of the following five elective majors:			
CIVL4811	Construction Major**	0	9
CIVL4822	Geotechnical Major	0	9
CIVL4833	Structures Major	0	9
CIVL4844	Transport Major	0	9
CIVL4855	Water Major	0	9
		23	24

* Category C (General Education)
** Students are required to attend a one week construction camp.

3625
Environmental Engineering – Full-time Course

Bachelor of Engineering BE

Year 1		Hours Per Week S1	S2
CHEM1002	Chemistry 1	6	6
CIVL1007	Engineering Practice	2	12
CIVL1203	Engineering Mechanics	4	4
GEOG1031	Environmental Processes	0	4
GEOL5100	Geology for Civil and Environmental Engineers	3	0
MATH1032	Mathematics I	6	6
PHYS1989	Physics I	4	3
		25	25

Year 2			
BIOS1021	Biology B	0	6
CIVL1106	Computing and Graphics	3	3
CIVL2007	Engineering Mechanics and Materials	4	4
CIVL2017	Data Survey and Analysis	0	2
CIVL2106	Systems Engineering	2	3
CIVL2505	Hydraulics 1	2	2
INDC4120	Chemistry of the Industrial Environment	3	0
MATH2009	Engineering Mathematics 2	4	4
MATH2869	Statistics SC	2	0
	General Education Category A	4	0
		24	24

Year 3			
BIOS3111	Population and Community Ecology	3	3
CEIC0010	Mass Transfer and Material Balance	2	2
CIVL3007	Environmental Fluid Mechanics	3	3
CIVL3106	Engineering Computations	2	2

Year 3		Hours Per Week S1	S2
CIVL3402	Geotechnical Engineering	3	3
CIVL3601	Engineering Management I	2	2
CIVL3705	Water Resources	3	3
CIVL3804	Transport Engineering	2	2
GEOL9110	Hydro and Environmental Geology	0	4
	General Education Category B	4	0
		24	24
Year 4			
CEIC0020	Fluid/Solid Separation	2	0
CHEM3070	Process Control	2	0
CIVL4006	Industrial Training	0	0
CIVL4007	Waste Management	3	0
CIVL4037	Communications and Ethics	0	2
CIVL4101	Engineering Management 2	2	0
CIVL4605	Water Supply and Wastewater Engineering	3	0
GEOG3042	Environmental Impact Assessment	4	0
GEOL9120	Groundwater Contaminant Transport	4	0
LAWS3410	Environmental Law	0	4
SURV0752	Remote Sensing Techniques and Applications	4	0
Environmental Majors, 2 of			
CEIC0030	Environmental Protection in the Process Industries	0	6
CIVL4017	Water Engineering	0	6
CIVL4027	Geotechnical and Transport Engineering	0	6
CIVL4907	Project/Thesis	1	6
GEOG9110	Soil Erosion and Conservation	0	6
		25	24

Combined Courses

3730
BE BSc in Civil Engineering

Students may seek permission to undertake a five-year full-time combined course leading to the award of the degrees of Bachelor of Engineering (Civil) and Bachelor of Science (BE BSc). The course is administered by the Faculty of Engineering.

Normally, students enrolled in the BE BSc course may be awarded their degrees at the conclusion of five years' study. However, students who commence the course and do not complete the Civil Engineering component may take out a BSc degree on completion of one of the approved programs of the Science and Mathematics Course.

Similarly, students not wishing to complete the BSc degree course may revert to the Civil Engineering program (**3620**) with appropriate credit for subjects satisfactorily completed.

The combined course consists of the Civil Engineering program (**3620**), and at least fourteen units of the Science and Mathematics Course (**3970**) within an approved program.

There are three approved programs but additional ones may be approved if they are relevant. Approval may be given to change the programs listed below to allow for timetabling and the student's academic interests.

Although transfer from Course **3620** to Course **3730** is normally made at the end of Year 1, first year students who are considering to apply for transfer should note the requirements for PHYS1002 Physics 1 in the second program.

The prerequisite for CHEM1002 and CHEM1391 will be waived for students in Course 3730.

Approved Programs

Geography and Environmental Chemistry

Year 1
PHYS1989*
CHEM1808
CIVL1106, CIVL1203, CIVL1301
MATH1032
GEOL5100

Year 2
CHEM2011, CHEM2031, CHEM2041,
CIVL2203, CIVL2301, CIVL2402
MATH2009
GEOG1031 and any other Year 1 Geography subject
One 56-hr or two 28-hr General Education subject/s (Cat A)

Year 3
CHEM3311
CIVL2106, CIVL2505, CIVL3106, CIVL3203, CIVL3303
GEOG3021, GEOG2032
SURV0441, SURV0491
One 56-hr or two 28-hr General Education subject/s (Cat B)

Year 4
CIVL3402, CIVL3505, CIVL3601, CIVL3705, CIVL3804,
GEOG3011, GEOG3042, GEOG3211†
At least 2 units chosen from:
GEOG2021, GEOG3032, GEOG3051, GEOG3062

Year 5
Choose 2 units from Table 1 in the Sciences Handbook at Level II or higher.
CIVL4006, CIVL4101, CIVL4203, CIVL4306‡, CIVL4403, CIVL4502, CIVL4605, CIVL4704, CIVL4906
Two of the following subjects:
CIVL4811, CIVL4822, CIVL4833, CIVL4844, CIVL4855

Note: All material not in italic typeface refers to the BE degree component of this combined course.
*See footnote at end of Course Outline.
†Two field tutorials, equivalent to 16 tutorial hours, are compulsory.
‡ General Education (Cat C).

Physics with Mathematics

Year 1
PHYS1002
CHEM1808
CIVL1106, CIVL1203, CIVL1301
MATH1032
GEOL5100

Year 2
PHYS2011, PHYS2021, PHYS2031
CIVL2203, CIVL2301, CIVL2402
MATH2510, MATH2520, MATH2100, MATH2120
MATH2869
One 56-hr or two 28-hr General Education subject/s (Cat A)

Year 3
PHYS2001, PHYS3021, PHYS3041
CIVL2106, CIVL2505, CIVL3203, CIVL3303
MATH2501
SURV0441, SURV0491
One 56-hr or two 28-hr General Education subject/s (Cat B)

Year 4
PHYS3030
CIVL3402, CIVL3505, CIVL3601, CIVL3705, CIVL3804
Choose 1 unit from: PHYS3631, PHYS3110, PHYS3010, PHYS3050
Choose 2 Level II or Level III Mathematics units from Table 1 in the Sciences Handbook.

Year 5
CIVL4006, CIVL4101, CIVL4203, CIVL4306‡, CIVL4403, CIVL4502, CIVL4605, CIVL4704, CIVL4906
Two of the following subjects:
CIVL4811, CIVL4822, CIVL4833, CIVL4844, CIVL4855
Choose 1 unit from Table 1 in the Sciences Handbook at Level 11 or higher

Note: All material not in italic typeface refers to the BE degree component of this combined course.
‡General Education (Cat C)

Computing with some Mathematics

Year 1
PHYS1989*
CHEM1808
CIVL1106, CIVL1203, CIVL1301
MATH1032
GEOL5100

Year 2
COMP1011, COMP1021
CIVL2106, CIVL2203, CIVL2301, CIVL2402
MATH2501†, MATH2510†, MATH2520†, MATH2869
One 56-hr or two 28-hr General Education subject/s (Cat A)

Year 3
COMP2011, COMP2021, COMP2031
CIVL2505, CIVL3203, CIVL3303
MATH2100†,
MATH2120†,
SURV0441, SURV0491
One 56-hr or two 28-hr General Education subject/s (Cat B)
Choose ½ Level II or Level III Mathematics unit from Table 1 in the Sciences Handbook.

Year 4
COMP3121, CIVL3402, CIVL3505, CIVL3601, CIVL3705, CIVL3804
Choose three units, at least one of which is a Computer Science Unit, from COMP3211, COMP3231, COMP3311 or Level II or Level III Mathematics units from Table 1 in the Sciences Handbook.

Year 5
CIVL4006, CIVL4101, CIVL4203, CIVL4306#, CIVL4403, CIVL4502, CIVL4605, CIVL4704, CIVL4906
Two of the following subjects:
CIVL4811, CIVL4822, CIVL4833, CIVL4844, CIVL4855
Choose 1 unit from Table 1 in the Sciences Handbook at Level II or higher.

Note: All material not in italic typeface refers to the BE degree component of this combined degree course.
*Students are advised to attempt PHYS1989 Physics 1CE but if time-tabling difficulties arise or other exceptional circumstances prevail permission will be given to attempt PHYS1002 Physics 1
#General Education (Cat C).
† Students are encouraged to select higher level Mathematics units where applicable.

4775
BE (Civil Engineering) LLB

This course is administered by the School of Law. Further information may be obtained from that School or from the School of Civil Engineering.

School of Computer Science and Engineering

Head of School
Professor J Hiller

Executive Assistant to Head of School
Dr G R Whale

Executive Officer
Mr P Ivanov

Administrative Assistant
Ms V Joubert

The School, which was formerly the Department of Computer Science in the School of Electrical Engineering and Computer Science, was established on 1 January 1991. At the same time, the School of Electrical Engineering and Computer Science with its remaining four departments was restructured to form the School of Electrical Engineering. There are still very close ties between the schools, including research interests that cross the school boundaries, and joint responsibility for the curriculum of the Computer Engineering course.

The staff of the School are grouped around the activity areas of Artificial Intelligence, Formal Methods and Software Engineering, Computer Architecture and VLSI Design, Information Science, Algorithms and Programming Techniques, Networks and Operating Systems and Human-computer interaction. Subjects in these areas are offered to students taking major studies in computer science or computer engineering, while introductory-level computing subjects are available more generally to students studying Science, Arts or Engineering. Computer science has links with discrete mathematics, which furnishes the theory behind the algorithms that computer software implements, and electrical engineering, which supplies the present technology underlying physical computing devices.

Summary of Courses

Course	Degree(s)	Normal full-time Duration
3645	BE in Computer Engineering	4 years
3725	BE BSc in Electrical Engineering	5 years
3730	BE BSc in Civil Engineering	5 years
3611	BE BSc in Aerospace Engineering	5 years
3661	BE BSc in Manufacturing Management	5 years
3681	BE BSc in Mechanical Engineering	5 years
3701	BE BSc in Naval Architecture	5 years
3745	BSurv BSc in Surveying	5 years
Majors		
3970	BSc	3 years (Pass) 4 years (Hons)
3400	BA	3 years (Pass) 4 years (Hons)
3420	BSoc Sc	3 years (Pass) 4 years (Hons)
4770	BSc LLB	5 years

For a description of the combined BE BSc and BSurv BSc courses, see the entries in this Handbook for the schools conducting the engineering/surveying major. For a description of the Computer Science major in the BSc degree course, see the Sciences Handbook; for the BA and BSocSc degree courses, see the Arts Handbook and for the BSc LLB course, see the Law Handbook.

The computer science content of all undergraduate programs is in the latter stages of substantial review following the introduction of the Computer Engineering course in 1989. The first intake of this course reaches its final year in 1992: computing subjects from the earlier years are incorporated into the other courses where appropriate.

Computer Engineering

The Computer Engineering course (3645) is presently the joint responsibility of the Schools of Computer Science and Engineering and Electrical Engineering. For convenience, day-to-day administration of the course is conducted through the Computer Science and Engineering School Office, Room 313, to which enquiries should be directed. The course description is detailed below.

Honours

In the Computer Engineering course the same formal program is offered to both pass students and to those students aiming at honours. Honours will be awarded for meritorious performance over the course; special attention is paid to a candidate's record in the final year subjects and thesis project.

The award of the BSc, BA or BSocSc at honours level requires an additional full-time year of study. See the handbooks governing those degree courses for details.

General Education Program

All students in the BE courses are required to complete a program of General Education comprising 56 hours each of Category A, B and C subjects (4 hours per week for a session, or 2 hours per week for the whole year). The program is normally taken over years 2, 3 and 4. Category A and B subjects are selected from a large group of electives; a single Category C subject (Managing People) is proposed for year 4. For details of the elective program, see the General Education Handbook.

Industrial Experience

All students in the BE degree courses must complete at least 60 days of approved industrial experience prior to completing their final year (see subject description for COMP4903 Industrial Training). Students will formally enrol in the subject in year 4, although they are strongly encouraged to complete as much industrial experience as possible in the breaks between the early years of the course.

Course Rules

It is the responsibility of students to meet the course requirements applicable at the date of application for the degree.

- Programs and timetables are arranged in preferred year/stage groupings. Progression is, however, by subject.
- Students are not permitted to enrol in subjects that have a timetable clash.
- In addition to specific subject prerequisites a general understanding of the material in the preceding year is assumed. Students are not normally permitted to enrol in subjects spread beyond two years of the course.
- Students who do not pass their full programs in any session will be limited to a reduced load (typically 20 hours per week) in the subsequent session. Previously failed subjects must be included, except that a failed elective may be replaced by another elective.

Re-enrolment

Students must collect enrolment information from the School Office (Room 313, Electrical Engineering building) before the end of session 2. Re-enrolment forms giving details of proposed programs for the year must be lodged by the first week in January. Students not intending to re-enrol should advise the School. Leave of absence for up to one year is usually granted to students in good standing.

It is the responsibility of students to enrol in a program consistent with the rules governing re-enrolment and admission to the degree.

3645
Computer Engineering – Full-time Course

(Jointly administered by the Schools of Computer Science and Engineering and Electrical Engineering)

Bachelor of Engineering BE

Year 1

		Hours per week S1	S2
ACCT9001	Introduction to Accounting A	1.5	-
ACCT9002	Introduction to Accounting B	-	1.5
COMP1011	Computing 1A	6	-
COMP1021	Computing 1B	-	6
ELEC1011	Electrical Engineering 1	-	6
MATH1032 or MATH1042	Mathematics 1 Higher Mathematics 1	6	6
MATH1081	Discrete Mathematics	6	-
PHYS1969	Physics 1	6	6
		25.5	25.5

Year 2

COMP2011	Data Organization	5	-
COMP2021	Digital System Structures	5	-
COMP2031	Concurrent Computing	-	5
ELEC2010	Circuit Theory	2.5	-
ELEC2011	System Theory	-	2.5
ELEC2020	Analog Electronics	-	2.5
ELEC2130	Electrical Engineering Laboratory 2A	1	-
ELEC2131	Electrical Engineering Laboratory 2B	-	2
ELEC4532	Integrated Digital Systems	-	4
MATH2400	Pure Mathematics 2 – Finite Mathematics	2	-
MATH2610	*Higher Pure Mathematics 2 – Real Analysis	2.5	-
MATH2620	*Higher Pure Mathematics 2 – Complex Analysis	2.5	-
MATH2849	Statistics SE1	-	2
MATH3150	Transform Methods	-	2
PHYS2959	Introductory Semiconductor Physics	1.5	-
	(an Economics subject to be determined)	1.5	1.5
	General Education Category A	2	2
		25.5	23.5

* Students may attempt similar material at a lower level.

Year 3

COMP3111	Software Engineering	5	-
COMP3121	Algorithms and Programming Techniques	-	5
COMP3211	Computer Organization and Design	4	-
COMP3221	Microprocessors and Interfacing	-	5
ELEC3032	Signals, Spectra and Filter + Lab.	3.5	-
MATH2601	*Higher Pure Mathematics 2 – Algebra	4.5	-
MATH2859	Statistics SE2	2	-

Year 3

		Hours per week S1	S2
MATH3141	Numerical and Mathematical Methods	-	3.5
	(a Management subject to be determined)	1.5	1.5
	Option A†	5†	-
	Option B†	-	5†
	General Education, Category B	–	4
		25.5†	24†

* Students may attempt similar material at a lower level.
† Options A and B enable students to choose appropriate prerequisite subjects for a major in one of four streams: Communications, Electronics, Computing or Systems and Control. Depending on subject choice the hours per week may be up to one hour less.

Recommended Options for the four streams are listed below:

Communications Stream
Option A: ELEC3031 Integrated Electronics + Laboratory
Option B: ELEC3013 Communications Systems 1

Electronics Stream
Option A: ELEC3031 Integrated Electronics + Laboratory
Option B: ELEC3016 Electronic Signal Processing

Systems and Control Stream
Option A: ELEC3031 Integrated Electronics + Laboratory
Option B: ELEC3014 Systems and Control 1

Students who elect the *Communications, Electronics or Systems and Control Stream* must also take the following subjects in Year 3 or Year 4:

COMP3131 Parsing and Translation
and/or
COMP3231 Operating Systems

COMP3331 Computer Networks and Applications
or
ELEC4351 Digital Communication and Computer Networks

Computing Stream
Option A: Any level 3/4 Computer Science subjects or ELEC3031 Integrated Electronics + Laboratory

Option B: Any level 3/4 Computer Science subject

Students undertaking the computing electives only must complete at least two Level 4 Computer Science subjects in Year 4.

Students who elect the *Computing Stream* must take the following subjects in Year 3 or Year 4:

COMP3131 Parsing and Translation
COMP3231 Operating Systems
COMP3331 Computer Networks and Applications

A complete list of the level 3 and level 4 Computer Science subjects is given later in this section.

Year 4

		Hours per week S1	S2
	5 Professional Electives [1]	15	10
COMP4903	Industrial Training [2]	-	-
COMP4910	Thesis Part A	7	-
COMP4911	Thesis Part B	0	14
	Managing People [3]	2	2
		24	26

Notes:
1. Professional Electives may be chosen from level 3/4 Computer Science Subjects and the Electrical Engineering Professional Elective Subjects listed below. Students should also note the compulsory subjects, which must be taken in Year 3 or Year 4, listed in the previous section.
2. All students in the BE Computer Engineering course must complet at least 60 days of approved industrial training before the end of Year 4.
3. This subject satisfies the requirements for General Education, Category C.

Computer Engineering Professional Electives

Communications Stream

ELEC3016 Electronic Signal Processing
ELEC4042 Signal Processing
ELEC4313 Optical Communications
ELEC4323 Digital and Analogue Communications
ELEC4351 Digital Communication and Computer Networks
ELEC4503 Advanced Electronic Circuits
ELEC4512 Semiconductor Devices
ELEC4532* Integrated Digital Systems

* For 1992 only.

Electronics Stream

ELEC4042 Signal Processing
ELEC4503 Advanced Electronic Circuits
ELEC4512 Semiconductor Devices
ELEC4522 Microelectronics Design and Technology
ELEC4532* Integrated Digital Systems
ELEC4540 Applied Photovoltaics
ELEC9215 VLSI Systems Design

* For 1992 only.

Systems and Control Stream

ELEC4042 Signal Processing
ELEC4412 Systems and Control 2
ELEC4413 Digital Control
ELEC4432 Instrumentation and Control
ELEC4503 Advanced Electronic Circuits
ELEC4512 Semiconductor Devices

Computing Stream

Level 3 Computer Science Subjects

COMP3131† Parsing and Translation
COMP3231† Operating Systems
COMP3311 Database Systems
COMP3331† Computer Networks and Applications
COMP3411 Artificial Intelligence
COMP3421 Computer Graphics
COMP3511 Human-Computer Interaction

Level 4 Computer Science Subjects

COMP4011 Occasional Elective S1 (Computer Engineering)
COMP4012 Occasional Elective S2 (Computer Engineering)
COMP4121 Parallel Algorithms and Architectures
COMP4131 Programming Language Semantics
COMP4211 Advanced Architectures and Algorithms
COMP4215 VLSI Systems Architecture and Design
COMP4216 Distributed Operating Systems
COMP4411 Artificial Intelligence: Knowledge-Based Systems
COMP4412 Artificial Intelligence: Interacting with the World

† Some of these subject must be taken in Year 3 or Year 4 depending the chosen stream – see the list under the Year 3 program.

Award of Honours

Honours will be awarded to students who have achieved superior grades in subjects over the whole course, including the successful completion of a thesis at a sufficient standard. Weighted average marks required for Honours grades are given below.

Honours Class 1: WA ≥ 75

Honours Class 2 :
Division 1 : 70 ≤ WA < 75
Division 2 : 65 ≤ WA < 70

School of Electrical Engineering

Head of School
Professor G A Rigby

Executive Assistant to Head of School
Dr C J E Phillips

Executive Officer
Mr K J Flynn

Administrative Assistant
Miss A G M Johnson

The School comprises four departments and a Special Research Centre: **Communications** (all aspects of theory, applied electronics and engineering relating to communication systems and networks such as telephones, broadcasting and television); **Electric Power** (electrical machines and generation, distribution and utilisation of electric energy); **Electronics** (electronic circuits, devices, micro-electronics and application of electronics to such areas as solar power generation); **Systems and Control** (development of theories for the control of complex systems and the application of these theories including computer simulation). The Centre for Photovoltaic Devices and Systems conducts research into energy efficient silicon solar cells for electricity generation.

Electrical Engineering has close links with the pure sciences and mathematics. Its technology is changing rapidly, and the School's teaching and research programs are constantly under review to meet the ever changing challenges of present and future needs.

The School offers undergraduate and graduate training in all branches of the profession of electrical engineering. A number of inter-departmental and specialised groups (such as Digital Systems, Biomedical Engineering, Measurement, Microelectronics, etc.) are also active.

Summary of Courses

Course	Degree(s)	Usual Duration (years)
3640	BE [1]	4 full-time
3645	BE [2]	4 full-time
3720	BE and BA	5 full-time
3725	BE and BSc	5 full-time

1 Course 3640 Full-time/Part-time Sandwich
Current sandwich students may complete their sandwich pattern but no new students are being accepted into the sandwich pattern.
2 Course 3645
This new course is jointly administered by the Schools of Computer Science and Engineering, and Electrical Engineering.

The undergraduate curriculums are being progressively revised to provide a flexible training to suit the needs of today and tomorrow. Individual student needs can be further met by quite extensive substitution provisions within the course programs.

Recognition

The degree of Bachelor of Engineering (BE) is recognised by the Institution of Engineers, Australia and the Institution of Radio and Electronics Engineers, Australia, as meeting the examination requirements for admission to graduate and corporate membership. Substantial or complete recognition is also accorded to the BE courses by overseas engineering institutions.

Honours

In the Bachelor of Engineering degree course the same formal program is offered to both pass students and to those aiming at honours. Honours will be awarded for meritorious performance over the course; special attention is paid to a candidate's performance in the final year subjects and thesis project.

The award of the BA or BSc degree at honours level requires two additional sessions of study. See the Arts and Sciences Handbooks for details.

Substitution of Subjects

General Education

Students must apply to the Director, Centre for Liberal and General Studies, for permission to substitute a subject for part, or all, of their General Studies (old rules) or General Education (new rules) requirement.

Other Subjects

To suit the special abilities or needs of individual students a limited amount of substitution is permitted within each course. Any such substitution *must have prior approval of the Head of School* who will ensure that:

1. The replacement subject is at least the same length and level as the prescribed subject it replaced; and

2. The resulting overall program of study is suited to the award of the degree as applicable.

Substitution is not permitted in Year 1.

Examples

(i) The normal Year 4 of the BE degree program includes 5 Professional Electives. Students may substitute for *one* of these electives, a subject of suitable level and difficulty from an area outside the School relevant to the profession of Electrical Engineering. A graduate subject of the School may also be substituted in this way, provided that the student has passed the Year 3 Electrical Engineering subjects at an adequate level.

(ii) Part-time BE students in full-time employment may request substitution of Industrial Electives (ELEC0931, ELEC0932, ELEC0933) for up to three subjects in the BE degree course. See Industrial Elective subject descriptions for details.

General Education Program

All students enrolled in the BE degree courses are required to complete a program of General Education from Categories A, B and C. These are normally taken during years 2, 3 and 4 respectively (or their equivalent). One 56 hour or two 28 hour subject/s are selected from each of Categories A and B. The Category C requirement is satisfied by the Year 4 subjects ELEC4010 and ELEC4011. For further details, please locate General Education Program in the Contents.

Students commencing prior to 1988 complete requirements under the General Studies rules established by the Board of Studies in General Education.

Industrial Experience

All students enrolled in the BE degree courses must complete at least 60 days of industrial experience prior to completing their final year (subject ELEC4903 Industrial Training; see subject description for more details). Students will formally enrol in this subject as part of the program for year 4.

Course Rules

It is the responsibility of students to meet the course requirements applicable at the date of application for the degree.

- Programs and timetables are arranged in preferred year or stage groupings. Progression is, however, by subject.
- Students are not permitted to enrol in subjects with clashing timetables.
- In addition to the specific subject prerequisites a general understanding of the material in the preceding Year or Stage is assumed. Students are not normally permitted to enrol in subjects spread beyond two Years or Stages.
- Students who do not pass their full programs in any year will be limited to a reduced load in the following year. Typically, this is 20 hours per week.
- Previously failed subjects must be included, except that a failed elective may be replaced by another elective.

Course Revision

Following each course revision students are assessed on the basis of the new program but retain credit for any subject already completed and are not liable for the increased requirements if progression is normal.

Re-enrolment

Students must collect enrolment information from the School Office before the end of Session 2. Re-enrolment forms, giving details of students' proposed programs must be lodged with the School Office by the start of the third week in the preceding December. Enrolment at the University will not be authorised until the re-enrolment form has been checked and the program approved. Students not intending to re-enrol should advise the School. Leave of absence for up to one year is usually granted to students in good standing.

It is the responsibility of students to enrol in a program consistent with the rules governing re-enrolment and admission to the degree.

3640
Electrical Engineering - Full-time Course

Bachelor of Engineering
BE

Course 3640 has been revised and is shown below.

Year 1		Hours per week S1	S2
CHEM1806	Chemistry 1EE	3	0
COMP1011	Computing 1A	0	6
ELEC1010	Introduction to Electrical Engineering	1.5	0
ELEC1011	Electrical Engineering 1	0	6
MATH1032	Mathematics 1	6	6
MATH1090	Discrete Mathematics	3	0
MECH0160	Introductory Engineering Design and Drawing Practice	3	0
MECH0360	Introductory Engineering Mechanics	3	0
PHYS1969	Physics 1	6	6
		25.5	24

Year 2 †			
COMP1021	Computing 1B	6	0
ELEC2010	Circuit Theory	2.5	0
ELEC2011	System Theory	0	2.5
ELEC2012	Digital Circuits	0	2.5
ELEC2015	Electromagnetic Applications	0	2.5
ELEC2016	Electrical Design and Practice	2	5
ELEC2020	Analog Electronics	0	2.5
MATH2110	Higher Applied Mathematics 2 Vector Calculus*	2.5	0
MATH3150	Transform Methods	0	2
MATH2610	Higher Pure Mathematics 2 Real Analysis*	2.5	0
MATH2620	Higher Pure Mathematics 2 Complex Analysis *	0	2.5
MATH2849	Statistics SE 1	0	2
PHYS2979	Electromagnetic Theory	3.5	0
PHYS2989	Solid State Physics	4.5	0
	One 56-hr or two 28-hr General Education subject/s (Cat A)	0	4
		23.5	25.5

*A mark of 70CR or better in either MATH1032 or MATH1042 is required to do the higher level subjects.
†Students who plan to specialise in Computer Science, Mathematics or Physics in a BE/BSc degree course should consult the School before enrolling in Year 2.

Year 3*			
ELEC3010	Introduction to Electrical Energy	2.5	-
ELEC3011	Integrated Electronics	2.5	-
ELEC3012	Signals, Spectra and Filters	2.5	-
ELEC3013	Communication Systems 1	-	4
ELEC3014	Systems and Control 1	-	4
ELEC3020	Microprocessors and Interfacing	2.5	-
ELEC3110	Electrical Engineering Laboratory 3	6	-
MATH2501	Linear Algebra**	5	-
MATH2859	Statistics SE 2	2	-
MATH3141	Numerical and Mathematical Methods	-	3.5
and two from:			
ELEC3015	Electrical Energy	-	4
ELEC3016	Electronic Signal Processing	-	4
	Technical Elective†	-	4
and:			
	One 56-hr or two 28 h-r General Education subject/s (Cat B)	–	4
		23	23.5

*Students who intend to major in particular disciplines should note that certain subjects are prerequisites for the Professional Electives they choose in Year 4.
**A mark of 70CR or better in either MATH1032 or MATH1042 is required to do the higher level subjects.
†See list of Technical Electives later this section.

Year 4			
	5 Professional Electives*	15	10
ELEC4010	Introduction to Management for Electrical Engineers†	4	0
ELEC4011	Ethics and Electrical Engineering Practice†	0	2
ELEC4903	Industrial Training††	0	0
ELEC4910	Thesis Part A**	6	0
ELEC4911	Thesis Part B**	0	12
		25	24

* Normally 3 electives are taken in Session 1 and 2 in Session 2. See list of Professional Electives later in this section.
** Thesis is done in the last two sessions of the course. Students enrol in ELEC4910 for the first session of their thesis and ELEC4911 for the second.
†Subjects ELEC4010, ELEC4011 satisfy the requirements of General Education, Category C.
††All students in the BE degree course must complete at least 60 days of industrial training before the end of Year 4.

3640
Electrical Engineering – Part-time Course

Bachelor of Engineering BE

Note: As from 1989 no formal part-time course is being offered. However, after completing Year 1 full-time it is possible for students to progress on a semi-part-time basis with a reduced program. It should also be noted that very few undergraduate subjects are offered in the evenings.

3640
Electrical Engineering – Sandwich Course

Bachelor of Engineering BE

Note: **No new enrolments will be accepted into the Sandwich course from 1990.**

After the successful completion of Year 1 of the full-time course 3640, a sandwich pattern is available, comprising alternate periods of full-time study and full-time employment with part-time study.

3645
Computer Engineering – Full-time course

Bachelor of Engineering BE

This course commenced in 1989, and is jointly administered by the Schools of Electrical Engineering, and Computer Science and Engineering. For course details refer to the entry under the School of Computer Science and Engineering.

Technical Electives – all courses

		Hours per week S1		S2
ACCT9062	Accounting for Engineers	1.5		1.5
CIVL0626	Civil Engineering	4		0
COMP2011	Data Organization*	5	or	5
COMP2031	Concurrent Computing*	0		5
ELEC3401	Reliability Engineering in Design and Development	0		4
ELEC3402	Introductory Physiology for Engineers	4		0
FUEL0020	Fuels and Energy	0		4
MATS9640	Materials Science and Engineering for Electrical Engineers	0		4
MECH0760	Mechanical Engineering	4		0
PHYS2999	Mechanics and Thermal Physics	2		2
SAFE9533	Electrical Safety	0		4

* Professional Elective subjects in the computer science area require either COMP2011 or COMP2021 as a prerequisite.

A free choice may not be possible.

Electrical Engineering Professional Electives – all courses

Each elective is 5 hours per week for one session.

ELEC4042	Signal Processing
ELEC4202	Power Systems
ELEC4215	Industrial Electrical Systems
ELEC4216	Electric Drive Systems
ELEC4240	Power Electronics
ELEC4303	Electromagnetic Wave Propagation
ELEC4313	Optical Communications
ELEC4323	Digital and Analog Communications
ELEC4333	Communication Systems 2
ELEC4351	Data Communications and Computer Networks
ELEC4352	Data Networks 2
ELEC4412	Systems and Control 2
ELEC4413	Digital Control
ELEC4432	Computer Control and Instrumentation
ELEC4483	Biomedical Engineering
ELEC4503	Advanced Electronic Circuits
ELEC4512	Semiconductor Devices
ELEC4522	Microelectronics Design and Technology
ELEC4532	Integrated Digital Systems
ELEC4540	Applied Photovoltaics
COMP3211	Computer Organization and Design
COMP3231	Operating Systems
COMP3311	Database Systems
COMP3411	Artificial Intelligence

Because of timetable clashes not all combinations of subjects are possible.

The program selected by each student must be approved by the Head of School. Not all electives are offered each session, nor is the full range available to part-time students. Students are advised each year of the timetable of available electives. Substitution is not permitted if it unduly restricts the range of subjects studied to only one area of electrical engineering or computer science.

Prerequisites and Co-requisites (Course 3640)

Arranged in order of full-time Bachelor of Engineering Degree Course

Subject(s)	Prerequisites	Co-requisites
Year 1		
PHYS1969, MATH1032	See Matriculation and Admission Requirements	
MATH1090		MATH1032
CHEM1806	See Matriculation and Admission Requirements	
MECH0360, MECH0160	See Matriculation and Admission Requirements	
ELEC1011		PHYS1969 (or equivalent)
ELEC1010		
COMP1011		MATH1032
Year 2		
PHYS2979	PHYS1969, ELEC1011	MATH2100
PHYS2989	PHYS1969, MATH1032	MATH2100
COMP1021	COMP1011	
ELEC2010	ELEC1011, MATH1032	MATH2620 or MATH2520
ELEC2011	ELEC2010, MATH2610 or MATH2510	MATH3150, MATH2620 or MATH2520
ELEC2020	ELEC2010, PHYS2989	
ELEC2012	ELEC1011	
ELEC2015	PHYS2979	MATH2100, ELEC2010
ELEC2016	PHYS1969, ELEC1011, ELEC1010	ELEC2010 ELEC2020, ELEC2012,
MATH3150	MATH2520+	
MATH2610	MATH1032(70CR)	
MATH2620	MATH2610#	
MATH2110	MATH1032(70CR)	
MATH2849	MATH1032	
Year 3		
PHYS2999	PHYS1969, MATH1032	MATH2100
MATS9640	PHYS2989	
MECH0760	MATH2100, PHYS1969	
MATH3141	MATH2501*, MATH2520, MATH2100	
MATH2501	MATH1032	
MATH2859	MATH1032, MATH2849	

Year 3

Subject(s)	Prerequisites	Co-requisites
COMP2011	COMP1021	
COMP2031	COMP1021	
ELEC3401	MATH2849	MATH2859
ELEC3015	ELEC3010	
ELEC3016	ELEC3011, ELEC3012	
ELEC3020	ELEC2012	ELEC3110
ELEC3010	ELEC2015	ELEC3110
ELEC3011	ELEC2020	ELEC3110
ELEC3012	ELEC2011, MATH3150	MATH2849, MATH2859 ELEC3110
ELEC3110	ELEC2016	ELEC3020, ELEC3010, ELEC3011, ELEC3012
ELEC3013	ELEC3012	
ELEC3014	ELEC3012	

Year 4

ELEC4010	ELEC2016
ELEC4011	ELEC4010
ELEC4042	ELEC3012
ELEC4202	ELEC3015
ELEC4216	ELEC3010
ELEC4240	ELEC2020, ELEC3010, MATH3150
ELEC4215	ELEC3015
ELEC4303	ELEC2015
ELEC4313	ELEC4303
ELEC4323	ELEC3013, MATH3150, MATH2859
ELEC4333	ELEC3013, ELEC3016
ELEC4351	ELEC3013, ELEC3020
ELEC4352	ELEC4351
ELEC4412	ELEC3014, (ELEC4432 recommended)
ELEC4413	ELEC3014, MATH2859 (ELEC4412 recommended)
ELEC4432	ELEC3014, ELEC3016, ELEC3020
ELEC4483	ELEC3402, ELEC3014, ELEC3016
ELEC4503	ELEC2020, ELEC3011, (ELEC3016 recommended)
ELEC4512	ELEC3011
ELEC4522	ELEC3011, ELEC3016
ELEC4532	ELEC2012
ELEC4540	ELEC3010, ELEC3011, ELEC3020
COMP3211	COMP2021 or ELEC2012
COMP3231	COMP2031
COMP3311	COMP2011
COMP3411	COMP2011

+ MATH2520 or MATH2620 may be taken as a co-requisite
** Attempted at an acceptable level and to be taken as co-requisites.
# MATH2610 may be taken as a co-requisite.
NB Pass Terminated Result (PT) DOES NOT satisfy prerequisite requirements.
* MATH2501 may be taken as a co-requisite.

Combined Courses

Students in Electrical Engineering who maintain a creditable performance may qualify for the award of two degrees in five years of combined full-time study in which the requirements of the degrees have been merged. (The two degrees referred to here are the Bachelor of Engineering/Bachelor of Science BE BSc and the Bachelor of Engineering/Bachelor of Arts BE BA). Students wishing to enrol in a combined course may do so only on the recommendation of the Head of School of Electrical Engineering and with the approval of the Faculty of Engineering and either the Faculty of Arts or the Board of Studies in Science and Mathematics, as appropriate. Students wishing to enrol in, transfer into, or continue in a combined course shall have complied with all the requirements for prerequisite study, sequencing and academic attainment (a creditable performance, ie 65%) average of both the Course Authorities concerned.

Students who commence a course but subsequently do not wish to proceed with both areas of study, or who fail to maintain a creditable performance, revert to a single degree program with appropriate credit for subjects completed. AUSTUDY support is available for the five years of the combined degree courses.

Students may transfer into a combined course after partially completing the requirements for either degree provided suitable subjects have been studied. However, the choice of subjects and the time taken to complete the program can be seriously affected by this. Thus, students considering course **3725** or course **3720** should contact the Electrical Engineering School before completing their Year 2 enrolment. Application for transfer to a combined course must be made in writing to the Head of School by the start of the third week of December in the year that they complete of Year 2 of the BE degree course.

Students wishing to gain a degree at honours level in Arts or Science as part of their combined degree program shall meet all the relevant requirements of the Faculty concerned and of the appropriate Schools. Such students may enrol for the Honours year only on the recommendation of the Head of School of Electrical Engineering and with the approval of the Faculty of Engineering and either the Faculty of Arts or the Board of Studies in Science and Mathematics, as appropriate.

Re-enrolment of students in Courses **3720** and **3725** each year is arranged by the School of Electrical Engineering.

3725
BE BSc in Electrical Engineering

Changes were made to the double degree program in 1991 due to the introduction of revisions to the BE degree course **3640**. Students who commenced course **3640** in 1988 or later, and who wish to study for the double degree, should consult with the School of Electrical Engineering.

Having completed Years 1 and 2 of course **3640** prior to 1990 students in their third year complete a specific course of study consisting of four Level III Science units chosen from related disciplines, the appropriate General Education electives and no less than four other Level II or Level III units, and otherwise

accord with the rules of course **3970** leading to a major in Computer Science, Mathematics or Physics.

Students may open up a wider choice of subjects in their Science Year by including additional Computer Science (viz COMP2011), Physics (viz PHYS2999) or Mathematics (viz MATH2501) in their Year 2 Electrical Engineering program. Any subject omitted will be required to be taken later in the course. The extra subject in Year 2 may be credited towards either the BE or BSc requirements, but not both. Students who commence their BE degree in 1989 or later and wish to do the combined degree program, should consult the School Office at enrolment time before year 2 and before year 3 of their BE degree program.

Students wishing to gain a degree at honours level in Science as part of their combined degree program shall meet all the relevant requirements of the Board of Studies in Science and Mathematics and of the School concerned. Such students may enrol for the honours year only on the recommendation of the Head of the School of Electrical Engineering and with the approval of the Head of the appropriate Science School, the Faculty of Engineering and the Board of Studies in Science and Mathematics. AUSTUDY support is available for the six years of the combined degree programs including honours level Science.

In their fourth and fifth years, for students who commenced the BE prior to 1990, students do Year 3 and Year 4 of course **3640.** Depending on the program followed in their year of Science they may have already completed parts of the normal third and fourth year programs of the Electrical Engineering course, and they will be required to omit these from their program and to include an equivalent amount of other courses chosen with the approval of the Head of School.

Year 1
PHYS1969
CHEM1806
MECH0360
MECH0160
ELEC1010
ELEC1011
COMP1011
MATH1032
MATH1090

Year 2†
COMP1021
ELEC2010, ELEC2011, ELEC2020, ELEC2012, ELEC2015, ELEC2016
MATH2610, MATH2620, MATH2110, MATH3150, MATH2849, PHYS2989, PHYS2979
One 56-hr or two 28-hr General Education subject/s (Cat A).

Year 3†*‡
Either
Computer Science
One 56 hr or two 28-hr General Education subject/s (Cat B).
Choose at least 8 Level II or Level III units including at least 4 Computer Science units at Level III, the balance to be chosen from Level III Computer Science units and other Level II or Level III units in Table 1 or Tables 2 for program 0600**
or
Mathematics
One 56 hr or two 28-hr General Education subject/s (Cat B).
Choose at least 5 Mathematics units, 4 of which are Level III
Choose at least 3 Level II or Level III units from Table 1 or Table 2 for program 1000
or
Physics
One 56 hr or two 28-hr General Education subject/s (Cat B).
Choose 7 Level II or Level III units from Table 1 of which four must be Level III Physics units, chosen to include PHYS3010, PHYS3050, PHYS3021 and PHYS3030.

Year 4‡
Year 3 of Electrical Engineering course, modified as required by Head of School

Year 5
Year 4 of Electrical Engineering course
†Students intending to major in Computer Science should include COMP2011 in their Year 2 enrolment. Students intending to major in Physics are required to take unit PHYS2999 in Year 2. Students intending to major in Mathematics are required to take MATH2501 in year 2.
*For Year 3 refer to course 3970 and the Science Handbook.
‡For students in year 1 in 1989 or later, Years 3 and 4 will most likely be interchanged. Consult the School of Electrical Engineering.

3720
BE BA in Electrical Engineering

The combined course should include

- the requirements of a normal BE degree program in Electrical Engineering less one subject approved by the Head of School. Students should consult the Centre for Liberal and General Studies regarding the General Education requirement;
- subjects equivalent to 108 credit points in accordance with the regulations of the Faculty of Arts provided that this includes a major sequence of subjects available within the Faculty of Arts in addition to the studies in the School of Mathematics and the Department of Computer Science. These include the subjects in Table A or their equivalents.

Table A		**Credit Points**
MATH1032	Mathematics 1	12
MATH2501	Linear Algebra	4
MATH2510	Real Analysis	2
MATH2520	Complex Analysis	2
MATH2100	Vector Calculus	2
MATH3141	Numerical and Mathematical Methods	2
MATH2849	Statistics SE1	1
MATH2859	Statistics SE2	1
PHYS1969	Physics 1	12
PHYS2979	Electromagnetic Theory	2
PHYS2989	Solid-State Physics	4
COMP1021	Computing 1B	4
ELEC2012	Digital Circuits	2
ELEC2015	Electromagnetic Applications	2
		52

Guidance should be sought from the School of Electrical Engineering, the relevant schools in the Faculty of Arts and the Arts Faculty office. After four years of study a student will normally have completed the BA degree requirements of study, together with subjects selected from course **3640** in accordance with an acceptable program loading and in the fifth year will complete requirements for a BE degree.

It is necessary for each individual student entering the course to lodge for approval a complete program of study: changes in detail are usual from year to year. Students should choose their Arts Major early so as to start the sequence in Year 1 if possible.

School of Mechanical and Manufacturing Engineering*

*Incorporating Aerospace Engineering and Naval Architecture

Head of School
Professor B.E. Milton

Executive Assistant to Head of School
Dr E.M. Kopalinksy

Administrative Officer
Mr A.D. Bauman

Following the re-consideration of the needs of mechanical and manufacturing engineering, and in order to better represent the orientation of the School, the name of the School has been changed from Mechanical and Industrial Engineering to **Mechanical and Manufacturing Engineering.** At the same time, a new management structure has been instituted whereby the School operates with five Disciplines which underpin the fundamental areas of the profession. In addition, six Directed Programs of industry-oriented cross-disciplinary activity have been introduced.

The **Disciplines** are: **Applied Mechanics** (engineering mechanics and mechanics of solids); **Design** (conceptual design, machine systems design, optimization and failure analysis); **Fluid and Thermal Engineering** (energy utilization and power generation, refrigeration and air conditioning, gas and liquid handling); **Industrial Technology and Management** (economic analysis, production planning and control, product and process design, methods engineering and operations research); **Mechatronics** (interface between mechanical engineering and electronic engineering).

The **Directed Programs** are: Manufacturing and Automation; Mechanical Building Services; Maintenance Engineering; Energy and Power Systems; Vehicle and Transport Systems; Machine Systems Design.

Please consult the Staff List in the forward section of this handbook for information concerning the Discipline Heads and Program Heads.

The School offers courses in Aerospace Engineering, Mechanical Engineering, Manufacturing Management and Naval Architecture, either singly or in combination with Science or Arts degree courses.

The Co-operative Program

In addition, the School offers the 'Co-op Program', an industry-linked course, for each of the above 4 degrees. In the Co-op Program, students are funded from scholarships awarded by Australia's premier industries.

Co-operative scholars are selected largely on the basis of academic attainment, personal skills and motivation, as well as on non-academic achievements. Together with receiving a rigorous and broadly-based academic education, scholars gain first-hand experience in a wide variety of industries during 4 industrial training periods. These take place at the end of Year 1, end of Year 2 through S1 of Year 3, end of Year 3 and S2 of Year 4 through to the end of Year 4. Hence, the total duration of the course is 5 years, comprising the normal 4 academic years and more than 1 year of experience in industry.

Because of this pattern, the normal third academic year is not taken over consecutive sessions but is incorporated into years 3 and 4 of the program, twelve months of the period being spent in two different industries. Scholars must be prepared to sacrifice leisure during non-academic periods to gain the considerable practical training available.

Summary of Courses

The courses, which lead to the award of the degree of Bachelor of Engineering (BE) are planned to provide the appropriate academic training for the professional engineer in the fields of aerospace, manufacturing and mechanical engineering, and for the naval architect.

The School also offers combined courses in conjunction with other faculties of the University, leading to the award of the two degrees of Bachelor of Engineering and Bachelor of Science (BE BSc) or Bachelor of Engineering and Bachelor of Arts (BE BA). These combined courses enable students to major in the area of computer science, materials science, mathematics, physics, statistics or another relevant field, in addition to studying their chosen engineering specialty.

For the four BE courses, the study of the basic sciences – mathematics, physics and chemistry – together with an introduction to engineering, comprise Year 1. In Year 2 further mathematical studies are undertaken, together with a study of the engineering sciences – thermodynamics, fluid mechanics, engineering mechanics, mechanics of solids – and their application in the field of design.

The first halves of the courses of Mechanical Engineering, Manufacturing Management and Aerospace Engineering and of Naval Architecture are identical, and students attend classes together. The latter halves of these four courses contain a number of common core subjects together with specific disciplinary requirements. In the final years, in addition to core subjects and disciplinary requirements, provision is made for a limited degree of specialization in one or more elective subjects. A student with a good academic record in the Mechanical Engineering course may take, subject to the approval of the Head of School, some graduate subjects offered by the School in lieu of an equivalent quantity of final year undergraduate electives. Each student is required to submit a thesis at the end of the final year and to deliver a short paper on the subject of the thesis.

General Education Program
The University requires that undergraduate students undertake a structured program in General Education as an integral part of their degree. For further details, please locate General Education in the Contents.

Requirements for General Education elective and prescribed subjects are as follows: Year 2 - one 56 hour or two 28 hour subject/s from Category A; Year 3 - one 56 hour or two 28 hour subject/s from Category B. The key questions and issues to be addressed in Category C will be considered in the following subjects: MECH1000/MECH2000/MECH3000/MECH4001 Professional Studies 1-4, MECH1100/MECH2100/MECH3100 Mechanical Engineering Design 1-3, MANF3400 Engineering

Economics, MANF4400 Engineering Management, MECH4002 The Engineer in Society.

Industrial Experience
Industrial experience is an integral part of the courses. Full-time students must complete forty working days of approved industrial experience between both Years 2 and 3 and Years 3 and 4. Students are strongly recommended to gain as much industrial experience as possible between Years 1 and 2.Students taking the course on a full-time/part-time basis must complete an equivalent amount of industrial training.Students who have had suitable experience in industry may qualify for exemption from certain subjects. The Head of School should be contacted for details.

Honours
All BE degree course students are considered for the award of Honours which is granted for meritorious performance in the course with particular emphasis on the later years. Honours in Science or Arts in the BE BSc or BE BA combined degree course require an extra year of study.

Recognition
The Institution of Engineers, Australia, recognizes the degree of BE in any of the undergraduate courses offered by the School as meeting the examination requirements for admission to graduate and corporate membership. Substantial or complete recognition is accorded to the BE degree courses by overseas engineering institutions.

The award of the BE degree in Aerospace Engineering is recognized by the Royal Aeronautical Society as giving exemption from the formal examination requirements for corporate membership. Advancement from graduate membership to associate membership grade is awarded on a case by case basis after a further period of some years of professional experience.

The award of the BE degree in Naval Architecture is recognized by the Royal Institution of Naval Architects (RINA), London, as the academic qualification for corporate membership of that body.

Course Progression Guidelines
It is the responsibility of each student to have met the course requirements by the date of application for the degree. In this context, the student's attention is directed to the Faculty's General Rules for Progression contained in the preceding chapter of this Handbook. As well, the following points should be noted.

- Progression in the School's courses is by subject, although programs and timetables are arranged by year.
- In addition to the specific subject prerequisites for a particular year of a course, a general understanding of the material in the preceding year is assumed.
- Previously failed subjects must be included in a student's current program, except that a failed elective may be replaced by another elective.
- A student who is faced with compiling a mixed year's program must give preference to subjects from the lower year of the course.
- In the event of a student dropping one or more subjects from a mixed year's program, the discarded subjects must be chosen from the higher year's selection.
- The subjects MECH4000 Thesis and MECH4001 Professional Studies 4 can be taken only in the final year of a student's program.

Revision of Courses
An extensive review of all the courses in the School will be completed in 1992. Only those students who commenced their courses before 1989 might not have adopted the pattern now displayed in the Handbook.

The object of the revision has been to modernise the courses, so that a greater emphasis is now placed on electronics, microprocessors, instrumentation, robotics and computing, all of which are important to Mechanical and Manufacturing Engineering. In first year this has resulted in a revised Physics course, emphasising in part the fundamentals of the above areas, and a new, more extensive Computing subject. Subject areas are streamed throughout the courses so that discontinuities in the teaching of material are minimised.

In addition, owing to the increased emphasis in Australia on Manufacturing, the previous Industrial Engineering course has been replaced by a course in Manufacturing Management.

3610
Aerospace Engineering

3660
Manufacturing Management

3680
Mechanical Engineering

3700
Naval Architecture

Bachelor of Engineering BE

Years 1 and 2 of all courses

Note: The program as presented is for full-time study. Alternative programs are available for a combination of full-time and part-time study. Students wishing to commence studies on a part-time basis must, in Year 1, study the subjects: PHYS1919, CHEM1807, MECH1000, MECH1300, MATH1032.

Year 1		Hours per week S1	S2
CHEM1807	Chemistry 1ME	6	0
MANF1100	Workshop Technology	3	0
MANF1110	Manufacturing Technology	0	3
MATH1032	Mathematics 1	6	6
MECH1000	Professional Studies 1	1	0
MECH1100	Mechanical Engineering Design 1	1	2
MECH1110	Graphical Analysis and Communication	0	3
MECH1300	Engineering Mechanics 1	4	0
MECH1400	Mechanics of Solids 1	0	3
MECH1500	Computing 1M	0	3
PHYS1919	Physics 1 (Mechanical Engineering)	4	4
		25	24

An alternative 'Science Arts compatible' course which can be undertaken by all students, and which must be undertaken by potential combined degree students, is:

Year 1		Hours per week S1	S2
CHEM1807	Chemistry 1ME	6	0
MANF1100	Workshop Technology	3	0
MANF1110	Manufacturing Technology	0	3
MECH1000	Professional Studies 1	1	0
MECH1100	Mechanical Engineering Design 1	1	2
MECH1110	Graphical Analysis and Communication	0	3
MECH1300	Engineering Mechanics 1	4	0
MECH1400	Mechanics of Solids 1	0	3
MECH1500	Computing 1M	0	3
MATH1032	Mathematics 1 *and* either (for BE/BSc) 1 relevant level I unit from the School of Physics, Chemistry, Computer Science and Engineering, or Mathematics offerings in Table 1 of Sciences Handbook+ *or* (for BE/BA)	6	6
PHYS1002	Physics 1	0	6
		6	6
		27	29 (or 26)

+Computer Science majors must take COMP1011 Computing 1A. Materials Science majors must take CHEM1201 Chemistry 1B in Session 2.

Year 2			
ELEC0805	Electronics for Measurement and Control	0	3
MATH2009	Engineering Mathematics 2**	4	4
MATH2839	Statistics SM	2	2
MATS9520	Engineering Materials	3	0
MECH2000	Professional Studies 2*	0	0
MECH2100	Mechanical Engineering Design 2	3	3
MECH2300	Engineering Mechanics 2A	3	0
MECH2310	Engineering Mechanics 2B	0	2
MECH2400	Mechanics of Solids 2	3.5	3.5
MECH2600	Fluid Mechanics 1	2	2
MECH2700	Thermodynamics 1	2	2
	General Education subject/s (Cat A)	2	2
		24.5	23.5

*The total contact hours are 4. This subject is preparatory to MECH3010 Industrial Training 1.
**Students may substitute MATH2501, MATH2510, MATH2100 and MATH2120 for MATH2009. Also, if they satisfy prerequisites, they may take one or more of these at the higher level.

3610
Aerospace Engineering

Bachelor of Engineering BE

Years 3 and 4

The Aerospace Engineering course covers the analysis, design and operation of aircraft and spacecraft. Graduates work mainly on the design and manufacture of flight vehicles, their operation with major or satellite airlines and research for civil and military aerospace organisations. Owing to the international nature of the aerospace industry, the topics studied cover a similar area and to, in general, the same depth of understanding as professional training programmes in aerospace in other industrial countries. The aerospace industry is one of Australia's major exporters of high value added manufactured goods.

Subject to the Head of the School being satisfied that the present extent of equivalences is maintained, and on his recommendation, Faculty has approved an arrangement by which students who satisfy the requirements of the first two years of the Mechanical Engineering full-time degree course at any other Australian tertiary institution may be admitted to a two-year program leading to the Bachelor of Engineering degree in Aerospace Engineering.

Year 3		Hours per week S1	S2
AERO3100	Aerospace Design 1	4	2
AERO3400	Analysis of Aerospace Structures 1	0	4
AERO3601	Aerodynamics 1	4	0
AERO3602	Flight Dynamics 1	2	0
ELEC0802	Electrical Power Engineering	0	3
MANF3400	Engineering Economics	2	0
MECH3000	Professional Studies 3	0	2
MECH3010	Industrial Training 1*	0	0
MECH3200	Engineering Experimentation	1.5	1.5
MECH3211	Linear Systems‡	3	0
MECH3212	Principles of Control of Mechanical Systems	0	3
MECH3310	Vibration Analysis	0	2
MECH3400	Mechanics of Solids 3	4	0
MECH3500	Computing 2M	2	0
MECH3800	Numerical Methods+	0	3
	General Education subject/s (Cat B)	2	2
		24.5	22.5

*Report to be submitted by end of Session 1 detailing involvement and experience gained prior to Year 3.
+Combined degree course students who have taken MATH2220 Applied Mathematics 2 – Continuous Time Systems or 10.2216 Higher Applied Mathematics 2 – Continuous Time Systems or MATH3101 or 10.222A Numerical Analysis should substitute a Technical Elective or a half Level II or Level III unit from Table 1 of the Sciences Handbook for this subject.
‡Combined degree course students who have taken MATH3181 or 10.222M Optimal Control Theory should substitute a Technical Elective or a half Level II or Level III unit from Table 1 of the Sciences Handbook.

Year 4			
AERO4100	Aerospace Design 2	3	3
AERO4201	Aerospace Systems	2	0
AERO4202	Space Engineering	0	2
AERO4400	Analysis of Aerospace Structures 2	3	3
AERO4601	Aerodynamics 2	2	2
AERO4602	Flight Dynamics 2	3	0
AERO4700	Aerospace Propulsion	2	2
MANF4400	Engineering Management	2	0
MECH4001	Thesis	6	6
MECH4001	Professional Studies 4	0	2
MECH4002	The Engineer in Society +	0	2
MECH4010	Industrial Training 2 *	0	0
		23	22

+ This subject completes the General Education (Cat C) requirement.
*Report to be submitted by end of Session 1 detailing involvement and experience gained between Years 3 and 4.

3660
Manufacturing Management

Bachelor of Engineering BE

Years 3 and 4

The Manufacturing Management course is designed for students with engineering ability whose interests lie in the planning, developing and control of manufacturing or service operations.

In the Manufacturing Management subjects, the problems associated with the practical economics of manufacturing operations are stressed. The aim is to provide the student with the education necessary to carry out an industrial job and to examine it critically in the light of economic efficiency. Traditional engineering courses do not embrace the problems which are characteristic of Manufacturing Management. These problems include the analysis of a product to ensure satisfactory functioning with regard to methods and sequence of manufacturing operations; the disposition of buildings and of equipment within them to permit efficient handling of materials; the avoidance of bottlenecks; the related problems of quality and cost control, testing and inspection; labour and personnel relations; and, finally, the problem of distribution and sales.

The financial and economic aspects are studied as the problem in manufacturing has not been solved until the final translation of the product into money has been accomplished successfully. While it is not intended to develop an expert in accounting practice or economics, it is intended to produce an engineer with an appreciation of the problems of cost and one who can apply considerations of ultimate economy to all industrial problems. The techniques of operations research may be applied here, where mathematical models of real-life situations are constructed and manipulated to yield optimal solutions as guides to management.

An engineer trained in Manufacturing Management may initially be employed in any of the following major areas of industrial activity: industrial economic analysis; planning and control of production; product and process design; methods engineering; operations research.

Year 3		Hours per week S1	S2
ACCT9001/2	Introduction to Accounting A/B	1.5	1.5
MANF3200	Product Design and Manufacturing Technology	4	0
MANF3300	Design of Manufacturing Facilities 1	0	4
MANF3400	Engineering Economics	2	0
MANF3410	Quality Systems 1	4	0
MANF3500	Computers in Manufacturing 1	0	4
MANF3600	Information and Decision Making Technology 1	4	2
MANF3800	Introduction to Numerical Methods†	0	1.5
MECH3000	Professional Studies 3	0	2
MECH3010	Industrial Training 1*	0	0
MECH3211	Linear Systems+	3	0
MECH3212	Principles of Control of Mechanical Systems	0	3
MECH3500	Computing 2M	2	0
	General Education subject/s (Cat B)	2	2
		22.5	20

†Combined degree course students who have taken MATH3101 or 10.222A Numerical Analysis should substitute a Technical Elective or a half Level II or Level III unit from Table 1 of the Science Handbook for this subject.

+Combined degree course students who have taken MATH3181 or 10.222M Optimal Control Theory should substitute a Technical Elective or a half Level II or Level III unit from Table 1 of the Sciences Handbook.

*Report to be submitted detailing involvement and experience gained prior to Year 3.

Year 4		Hours per week S1	S2
MANF4010	Manufacturing Systems Design	0	4
MANF4300	Design of Manufacturing Facilities 2		4
MANF4410	Quality Systems 2	2	0
MANF4420	Management of Manufacturing Systems	6	2
MANF4500	Computers in Manufacturing 2	2	0
MANF4600	Information and Decision Making Technology 2	4	0
MECH4000	Thesis	6	6
MECH4001	Professional Studies 4	0	2
MECH4002	The Engineer in Society *	0	2
MECH4010	Industrial Training 2+	0	0
		20	20

+Report to be submitted by end of Session 1 detailing involvement and experience gained between Years 3 and 4.

* This subject completes the General Education (Cat C) requirement.

3680
Mechanical Engineering

Bachelor of Engineering BE

Years 3 and 4

The Mechanical Engineering course provides a versatile, comprehensive coverage of areas involving the conception and design of machinery and mechanical plant, the supervision of its construction, operation and maintenance, the planning and supervision of large engineering projects, and general engineering management. Due to its wide range, a number of options are provided as Technical Electives in the final year. These are preferentially linked to provide a direction appropriate to the needs of Australian industry and to the specific interests of students, although some flexibility is available if required. Typical fields which may be encompassed by the course include building services, computer-aided design, power generation, energy and environmental systems, gas and liquid handling, bio-mechanics, materials handling, control systems, mechatronics and robotics, and transport. An emphasis is placed on the application of engineering science, development and management in these fields.

Year 3		Hours per Week S1	S2
MECH3000	Professional Studies 3	0	2
MECH3010	Industrial Training 1*	0	0
MECH3100	Mechanical Engineering Design 3	3	3
MECH3200	Engineering Experimentation	1.5	1.5
MECH3211	Linear Systems‡	3	0
MECH3212	Principles of Control of Mechanical Systems	0	3
MECH3300	Engineering Mechanics 3	2	0
MECH3310	Vibration Analysis	0	2
MECH3400	Mechanics of Solids 3	4	0

Year 3

		Hours per week S1	S2
MECH3500	Computing 2M	2	0
MECH3600	Fluid Mechanics 2	2	0
MECH3701	Thermodynamics 2	2	0
MECH3702	Heat Transfer	0	2
MECH3800	Numerical Methods†	0	3
MANF3400	Engineering Economics	2	0
ELEC0802	Electrical Power Engineering	0	3
	General Education subject/s (Cat B)	2	2
		23.5	21.5

Note:
*Report to be submitted in by end of Session 1 detailing involvement and experience gained prior to Year 3.
†Combined degree course students who have taken MATH3101 or 10.222A Numerical Analysis should substitute a Technical Elective or a half Level II or Level III unit from Table 1 of the Sciences Handbook for this subject.
‡Combined degree course students who have taken MATH3181 or 10.222M Optimal Control Theory should substitute a Technical Elective or a half Level II or III unit from Table 1 of the Sciences Handbook.

Year 4

MANF4400	Engineering Management	2	0
MECH4000	Thesis	6	6
MECH4001	Professional Studies 4	0	2
MECH4002	The Engineer in Society+	0	2
MECH4010	Industrial Training 2 *	0	
MECH4500	Computing 3M	2	
	Programme Options/Technical Electives	12	9
		22	19

Note 1: Technical Electives must be chosen primarily in accordance with the Directed Programme nominated by each student and, in any case, at least 12 session-hours must be selected from the Mechanical Engineering list. The remaining ones may be taken from Years 3 or 4 of other courses in the School, provided that pre- and co-requisites can be satisfied. Appropriate details of the Directed Programmes and the recommended electives will be provided to students to enable them to make selections before proceeding to the final year. A student with a good academic record may be permitted to choose some post-graduate subjects as Technical Electives. Express approval is also required for the selection of a subject from outside the School and such choice will normally be limited to three session-hours. The selection of certain subjects or combinations of subjects might require the approval of the Head of School as will any variation from the foregoing guidelines.
Note 2: It is unlikely that all of the Technical Electives listed below can be offered each year. Those to be made available are decided on the basis of staff availability and student demand. Students are advised in September of each year which Technical Electives will be offered in the following year.
*Report to be submitted by end of Session 1 detailing involvement and experience gained between Years 3 and 4.
+ This subject completes the General Education (CAT C) requirement.

Mechanical Engineering Technical Electives

		Hours per week S1		S2
Applied Mechanics				
MECH4301	Plane Mechanism Kinematics	3	or	3
MECH4310	Advanced Vibration Analysis	3	or	3
MECH4321	Engineering Noise 1	3		0
MECH4322	Engineering Noise 2	0		3
MECH4361	Lubrication	0		3
MECH4400	General Mechanics of Solids	3	or	3
MECH4410	Engineering Applications of Finite Elements	3	or	3
MECH4420	Plates and Shells	3	or	3
MECH4430	Theory of Elasticity	3	or	3
MECH4440	Theory of Plasticity	3	or	3
MECH4450	Structural Instability	2		0
Design				
MECH4110	Design Project	3		3
MECH4120	Design Technology	3		0
MECH4130	Computer-Aided Engineering Design	0		3
Fluid and Thermal Engineering				
MECH4600	Viscous Flow Theory	1.5		1.5
MECH4610	Hydraulic Transients	3	or	3
MECH4690	Special Fluid Mechanics Elective*	3	or	3
MECH4700	Turbomachines and Engines	3	or	3
MECH4710	Convection Heat Transfer	3	or	3
MECH4720	Solar Energy	3	or	3
MECH4730	Multiphase Flow	3	or	3
MECH4740	Thermal Power Plants	3	or	3
MECH4790	Special Thermodynamics Elective*	3	or	3
General				
MECH4020	Group Engineering Project	6		0
		or 3		3
MECH4800	Optimal Engineering Strategies	3		0
Recommended External Technical Electives				
MATS9530	Materials Engineering	3	or	3
SAFE9213	Introduction to Safety Engineering M	3		0

*This subject is variable in content in order to allow the presentation of material of particular interest and merit by a visiting expert in a field not otherwise covered.

3700
Naval Architecture

Bachelor of Engineering BE

Years 3 and 4

Naval Architecture is the branch of engineering which is concerned with the design, building and utilisation of all types of ships and marine vehicles. Naval architects must be conversant with a wide variety of skills, including most forms of engineering and architecture. This is because a ship or a boat must be a completely self-sufficient vehicle containing a number of systems and able to withstand the loads from the sea. Yachts, fishing boats, frigates, ferries, catamarans and pleasure craft are just a few of the types of vessels that are studied during the course, which is the only Naval Architecture degree (Bachelor) course in Australia.

The Faculty of Engineering has approved an arrangement whereby, upon the recommendation of the Head of School, students who satisfy the requirements for the first two years of the Mechanical Engineering full-time degree course at any other Australian tertiary institution may be admitted to the final two years of the BE degree course in Naval Architecture.

Year 3		Hours per week S1	S2
NAVL3100	Principles of Ship Design 1	1.5	1.5
NAVL3400	Ship Structures 1	2	2
NAVL3600	Ship Hydrostatics	5	0
NAVL3610	Ship Hydrodynamics	2.5	2.5
MECH3000	Professional Studies 3	0	2
MECH3010	Industrial Training 1*	0	0
MECH3200	Engineering Experimentation	1.5	1.5
MECH3211	Linear Systems**	3	0
MECH3212	Principles of Control of Mechanical Systems	0	3
MECH3310	Vibration Analysis	0	2
MECH3400	Mechanics of Solids 3	4	0
MECH3500	Computing 2M	2	0
MECH3800	Numerical Methods+	0	3
ELEC0802	Electrical Power Engineering	0	3
	General Education subject/s (Cat B)	2	2
		23.5	22.5

*Report to be submitted by end of Session 1 detailing involvement and experience gained prior to Year 3.
+Combined degree course students who have taken MATH2220 Applied Mathematics 2 – Continuous Time Systems or 10.2216 Higher Applied Mathematics 2 – Continuous Time Systems or MATH3101 or 10.222A Numerical Analysis, should substitute a Technical Elective or a half Level II or Level III unit from Table 1 of the Sciences Handbook for this subject.
**Combined degree course students who have taken MATH3181 10.222M Optimal Control theory should substitute a Technical Elective or a half Level II or III unit from Table 1 of the Sciences Handbook.

Year 4			
NAVL4000	Ship Management Economics	2	
NAVL4100	Principles of Ship Design 2	4	2
NAVL4110	Ship Design Project	3	4
NAVL4400	Ship Structures 2	2	2
NAVL4700	Ship Propulsion and Systems	4	4
MECH4000	Thesis	6	6
MECH4001	Professional Studies 4		2
MECH4002	The Engineer in Society+		2
MECH4010	Industrial Training 2 *		
MECH4500	Computing 3M	2	
		23	22

*Report to be submitted by end of Session 1 detailing involvement and experience gained between Years 3 and 4.
+ This subject completes the General Education (Cat C) requirement.

Combined Courses
Bachelor of Engineering/Bachelor of Science

3611
BE BSc In Aerospace Engineering

3661
BE BSc In Manufacturing Management

3681
BE BSc In Mechanical Engineering

3701
BE BSc In Naval Architecture

The combined degree course of five years full-time study enables a student in the School to qualify for the award of the two degrees of Bachelor of Engineering and Bachelor of Science (BE BSc). The course enables such combined degree students to major in the areas of computer science, materials science, mathematics, physics or statistics. It is administered by the Faculty of Engineering.

All students who are accepted into the Year 1 'Science/Arts compatible' course in the School may enrol directly into this course. Continued enrolment in Year 2 requires a pass in all subjects by the end of Year 1 and students who fail to achieve this will automatically be transferred to the normal Engineering program. Alternatively, students may transfer into the Year 2 of this course, provided they have passed all subjects of the 'Science/Arts compatible' course by the end of Year 1.

Normally, students enrolled in this BE BSc degree course are awarded their degrees at the conclusion of five years study. However, it is possible for students to take out the Science degree prior to the Engineering degree provided they have: **1.** completed the requirements for Years 1, 2 and 3. **2.** completed the General Education requirements for the Science degree, and **3.** obtained approval from the Board of Studies in Science and Mathematics.

Students may also undertake an additional honours year in Science and Mathematics and automatically re-enter this course without having to re-apply for admission. To undertake such an honours year in Science and Mathematics, permission is to be obtained at the end of Year 3 both from the Head of the School in which the honours year is to be undertaken and from the Head of the School of Mechanical and Manufacturing Engineering.

Students who commence the course and do not complete the Engineering component may take out a BSc degree on completion of one of the approved programs in the Science and Mathematics course. Similarly, students not wishing to complete the BSc degree course may revert to the normal Engineering program with appropriate credit for subjects satisfactorily completed.

Year 1 of the combined course is equivalent to the Year 1 'Science/Arts compatible' course in the School of Mechanical and Manufacturing Engineering, and is as detailed in course 3680 Mechanical Engineering. Having completed Years 2 and 3, as outlined below, students in Years 4 and 5 do Year 3 and Year 4 of their selected Engineering course except that significant repetition of subject material is not allowed. Instead, students are required to substitute either an appropriate Technical Elective or an appropriate Level II or III subject from Table 1 or Table 2, or in exceptional circumstances, some other equivalent subject with the permission of the Head of the School of Mechanical and Manufacturing Engineering.

Note: In order to limit the combined degree courses to five years, the workload in the first three years is higher than in the single degree course. Students who have barely satisfied the minimum entrance requirements are therefore advised against enrolling for the combined degree course. Those who do enrol and whose average mark at the end of Session1 of Year 1 is less than 65% are advised to contact the School to see whether or not they should continue in the combined course in Session 2 of Year 1, as the workload in Session 2 is higher than in Session 1.

Year 2[1,11].		Hours per week S1	S2
MECH1500	Computing 1M	0	3
MECH2300	Engineering Mechanics 2A	3	0
MECH2400	Mechanics of Solids 2	3.5	3.5
MATH2100	Applied Mathematics 2 – Vector Calculus	2.5	0
MATH2120	Applied Mathematics 2 – Mathematical Methods for Differential Equations	0	2.
MATH2501	Pure Mathematics 2 – Linear Algebra	2.5	2.5
MATH2510	Pure Mathematics 2 – Multivariable Calculus	2.5	0
MATH2520	Pure Mathematics 2 – Complex Analysis	0	2.5
	4.5 appropriate Level II units from Table 1* or Table 2* for course 3681[2]	9+	9+
		23+	23+
Year 3			
MECH2000	Professional Studies 2**	0	0
MECH2100	Mechanical Engineering Design 2	3	3
MECH2310	Engineering Mechanics 2B	0	2
MECH2600	Fluid Mechanics 1	2	2
MECH2700	Thermodynamics 1	2	2
	At least 5 appropriate Level II or III units from Table 1* or Table 2* for course 3681[2] of which at least 4 must be Level III	10+	10+
	One 56-hr or two 28-hr General Education subject/s (Cat A)[6]	2	2
		19+	21+

Subject selections which satisfy the specific requirements for the various majors are summarised below. Provided co- and prerequisites are satisfied, there is scope for some subjects to be taken either in Year 2 or Year 3.

* Tables refer to the Sciences Handbook.

** The total number of contact hours is 4. This subject is preparatory to MECH3010 Industrial Training 1.

Computer Science Majors 3

Year 2

MATS9520
MECH2300, MECH2400, MECH1500[4]
COMP1021, COMP2011, COMP2021, COMP2031
MATH2501 (or MATH2601), MATH2510 (or MATH2610), MATH2520 (or MATH2620),
MATH2100 (or MATH), MATH2120 (or MATH2130)

Year 3

MECH2000, MECH2100, MECH2310, MECH2600, MECH2700
ELEC0805
MATH2841 (or MATH2839)
4 Level 3 units from Table 2* offerings of School of Computer Science and Engineering for course 3681. One 56 hour or two 28 hour General Education subject/s (Cat A)[6].

Materials Science Majors

Year 2

CHEM2011[12], CHEM2021[12]
MATS4363[5] (Units 1 and 3), MATS1002, MATS1253, MATS1072
MECH2300, MECH2400, MECH1500
MATH2501 (or MATH2601), MATH2510 (or MATH2610), MATH2520 (or MATH2620)
MATH2100 (or MATH), MATH2120 (or MATH2130)

Year 3

MATS4363 (Units 2 and 4), MATS9323[5] (Units 1 and 3), MATS1263, MATS1083, MATS1042
MECH2000, MECH2100, MECH2310, MECH2600, MECH2700
ELEC0805
MATH2841 (or MATH2839)
POLY3010
3 appropriate Level 3 units from School of Materials Science and Engineering offerings in Table 2* for course 3681[5]
One 56 hour or two 28 hour General Education subject/s (Cat A)[6].

Mathematics Majors

Year 2

Same Year 2 as for Computer Science[7] or Materials Science[7] or Physics or Statistics[8] majors
or
MATS9520
MECH2300, MECH2400, MECH1500
ELEC08059
MATH2501 (or MATH2601), MATH2510 (or MATH2610), MATH2520 (or MATH2620)
MATH2100 (or MATH), MATH2120 (or MATH2130)

3.5 appropriate Level 2 units from Table 1* or Table 2* for course 3681, including some from the School of Mathematics[9].

Year 3

MECH2000, MECH2100, MECH2310, MECH2600, MECH2700, MATH2841 (or MATH2839)
4 Level 3 units from School of Mathematics offerings in Table 1*
One 56 hour or two 28 hour General Education subject/s (Cat A)[6].

Physics Majors

Year 2

PHYS2001, PHYS2011, PHYS2021, PHYS2031
MATS9520
MECH2300, MECH2400, MECH1500
MATH2501 (or MATH2601), MATH2510 (or MATH2610), MATH2520
(or MATH2620), MATH2100 (or MATH), MATH2120
(or MATH2130)

Year 3

PHYS3010[10], PHYS3021, PHYS3030[10], PHYS3041[10]
1 Level 3 unit from School of Physics offerings in Table 1*
MECH2000, MECH2100, MECH2310, MECH2600, MECH2700
MATH2841 (or MATH2839)
One 56 hour or two 28 hour General Education subject/s (Cat A)[6].

Statistics Majors

Year 2
MATS9520
MECH2300, MECH2400, MECH1500
ELEC0805[9]
MATH2501 (or MATH2601), MATH2510 (or MATH2610), MATH2520 (or MATH2620), MATH2100 (or MATH), MATH2120 (or MATH2130), MATH2801 (or MATH2901), MATH2821 (or MATH2921), MATH2810 (or MATH2910), MATH2830 (or MATH2930)
1/2 appropriate Level 2 unit from Table 1* or Table 2* for course 3681[8]

Year 3
MECH2000, MECH2100, MECH2310, MECH2600, MECH2700
4 Level 3 units from Statistics offerings in Table 1*
1 Level 2 or III unit from School of Mathematics or School of Physics offerings in Table 1*
One 56 hour or two 28 hour General Education subject/s (Cat A)[6].
* Tables refer to the Sciences Handbook.

Notes

1. Years 2 and 3 are requirements pertaining to students who commenced Year 1 in 1989, or later. Students who commenced in earlier years should consult the Handbook appropriate to their year.
2. The following considerations pertain to the choice of additional units in Years 2 and 3:

   (a) The Level 3 units satisfy the relevant major requirements.

   (b) They be from the Schools of Chemistry, Computer Science and Engineering, Electrical Engineering, Mathematics, Materials Science and Engineering and/or Physics.

   (c) They include MATH2841 Statistics or MATH2839 Statistics SM or MATH2821 Basic Inference.

   (d) They include PHYS2031 Laboratory or ELEC0805 Electronics for Measurement and Control.

   (e) They include MATS9520 Engineering Materials or MATS1253 Ferrous Alloys.

   (f) They exclude MATH2301 Mathematical Computing.

   (g) All pre and co-requisites are satisfied.
3. Quota restrictions apply to certain Computer Science Level 3 units and application must be made in writing to the Head of the School of Computer Science and Engineering before the end of Session 2 in the preceding year. Prospective Computer Science Majors should aim for a creditable academic attainment (65%) over Years 1 and 2.
4. With permission of the School of Mechanical and Manufacturing Engineering, students may delay this subject till Year 3.
5. Provided MECH2400 is taken concurrently or has been taken, the pre or co-requisite requirement of MATS1062 is assumed to be satisfied.
6. General Education requirements correspond to whatever is required in the second year of the normal Mechanical Engineering, Manufacturing Management, Aerospace Engineering or Naval Architecture degree course.
7. These Mathematics Majors need to add ELEC0805 Electronics for Measurement and Control to Year 3.
8. These Mathematics Majors should substitute 1 Level 2 or 3 units from the Schools of Physics, Chemistry or Mathematics offerings in Table 1 for MATH2841 Statistics in Year 3.
9. Students may substitute PHYS2031 Laboratory for ELEC0805 plus a .5 Level 2 unit.
10. Under special circumstances, with permission of the Head of the School of Physics, a student may substitute alternative Physics Level 3 offerings of equivalent unit value.
11. The Mathematics units are also offered at higher level.
12. Students who have satisfactorily completed CHEM1807 Chemistry 1ME and CHEM1201 Chemistry 1B will be considered to have satisfied the prerequisites for CHEM2011 Physical Chemistry and CHEM2021 Organic Chemistry.

* Tables refer to the Sciences Handbook.

Combined Courses
Bachelor of Engineering/Bachelor of Arts

3612
BE BA in Aerospace Engineering

3662
BE BA in Manufacturing Management

3682
BE BA in Mechanical Engineering

3702
BE BA in Naval Architecture

Introduction

The Bachelor of Engineering and Bachelor of Arts combined degree course provides the opportunity of taking one of the normal accredited Engineering courses offered by the School together with a normal Arts degree course. Common content between the two courses makes it possible to complete the combined degree course in 5 years, although the minimum time required could be longer, depending upon the choice of Arts subjects. The course is administered by the Faculty of Engineering.

The Engineering content follows that of the standard courses offered by the School. It includes the Science Arts compatible first year program which provides a wide range of course options at the end of Year 1. The options include, in addition to the BE BA combined program, a BE BSc combined program and a normal BA degree program, a normal BSc degree program and a normal BA degree program. (The Science/Arts

compatible first year provides up to 30 Arts credit points towards a BA degree program.)

The Arts content is to be chosen from the Faculty of Arts offerings in the usual way and would depend upon the interests of each individual student. Refer to the Faculty of Arts handbook for further details.

Requirements
The broad requirements of the BE BA course are given below. The details of a particular student's program will depend upon the student's interests and the Arts content which is chosen. Sample programs are available on request to show typical arrangements. Students should consult the Centre for Liberal and General Studies for advice regarding the General Education requirement.

Engineering
The program is to contain the Science/Arts compatible first year segment followed by the full program for one of the strands offered by the School of Mechanical and Manufacturing Engineering. Course variations may be permitted in some cases on application to the Head of School.

Arts

The Arts component of the program is to contain at least 60 Arts credit points in addition to Arts credit points allocated to components of the Engineering strand. (A session-length Arts subject normally carries 6 credit points.) The 60 must include:

- no more than 30 First Level credit points (typically 5 one session subjects)
- at least 24 Upper Level credit points forming a major sequence (typically 4 one-session subjects)
- at least 6 Upper Level credit points in a school other than that in which the major is taken. Computing and mathematics majors are not permitted. The combined BE BSc program would be more appropriate in these cases.

Honours
In the Engineering component, Honours are awarded for superior performance in the standard program.In the Arts components, the award of Honours requires at least one further year of study devoted exclusively to the Honours subject(s). Consult the Faculty of Arts for further details.

General
A BE BA proposal should be discussed with representatives of the School and the Faculty of Arts as early as possible. In many cases this will be at (or preferably before) first year enrolment, but a student who has satisfactorily completed the Science/Arts compatible first year will normally be able to transfer to the second year of a combined BE/BA program, and the discussions could then take place at any time before second year enrolment. Enquiries should be directed to the Executive Assistant to the Head of the School and the Executive Assistant to the Dean of Faculty of Arts.

School of Surveying

Head of School
Professor J.C. Trinder

Administrative Assistant
Mr L. Daras

What is Surveying?
Surveying is a professional science dealing with measuring processes and the handling and computation of data. Traditionally, surveyors measure land and water areas and produce maps for use in development projects such as land subdivision, town planning, building construction, engineering works (eg dams and railways), mining and navigation.

Today in Australia, a surveyor may choose to work in one of the specialised areas of: **Satellite Surveying** (position determination techniques using satellite signals); **Geodetic Surveying** (determining the mathematical model of the Earth, and its gravity field, and the practice of surveying on the Earth's surface); **Hydrographic Surveying** (mapping the seabed and waterways for navigation and off-shore resource management); **Engineering Surveying** (the precise surveying for engineering projects); **Cadastral Surveying** (knowledge of the laws and practices for survey of property boundaries); **Land Management and Development** (environmental assessment for resource management and change of land use); **Land Information Management** (the use of computer-based information systems of spatially related data for planning purposes); **Photogrammetry and Remote Sensing** (the use of photographs and remotely sensed images for mapping and resource surveys).

Modern technology is playing an increasingly important role in the professional life of the surveyor. For example, the use of computers and small electronic distance measuring devices is common. The next generation of surveyors will be able to determine accurate positions on the Earth from radio signals transmitted from satellites. Field survey techniques are being revolutionised through the use of satellite systems which are due to come into full operation in the 1990s.

Who should become a Surveying Professional?
New technology and techniques have paved the way for surveying to be a career suited to both **men** and **women** who have an aptitude for computing, mathematics and environmental sciences.

Because of the unique nature of the profession, surveying offers opportunities to satisfy a wide range of individual preferences.

A professional qualification in surveying will provide a start towards realising the ambitions of students whether they would like to:

- work in the field or in the office,
- work on their own or as a member of a multi-disciplinary team,
- work in private industry or in government service,
- work as a self-employed consultant,
- work in Australia or overseas.

What can a student look forward to in a surveying course at University?

- A well-rounded education enabling him or her to enter the surveying profession.
- A challenging and rewarding course.
- An awareness of many related areas such as town planning, engineering, land law, optics and computing technology.
- On completion, a degree which is recognised and respected throughout the world.
- The chance to enter a career with excellent prospects.
- The chance to choose a career with a combination of indoor and outdoor lifestyles and the opportunity to travel.
- A degree which can lead to further studies towards a higher degree in one of the specialist areas.

How to become a surveyor?
The method of entry to a professional career in surveying is by completion of a university degree.

The Bachelor of Surveying Course

The School offers a full-time course of four years duration leading to the award of the degree of Bachelor of Surveying (BSurv). Alternatively, the course may be taken in a sandwich form in which a student may, after completing the first year of the course on a full-time basis, alternate his or her studies with one or more periods of employment by taking leaves of absence of two consecutive sessions. The BSurv degree course is a well rounded course aimed at preparing the graduate for a broad range of career opportunities in the various branches of Surveying and in associated fields referred to above. The course recognises that its graduates may be called on to act as survey practitioners, consultants, managers, teachers or researchers, and indeed a single graduate may take on several of these roles during his or her career. To this end, the BSurv degree course covers general scientific principles with special emphasis on computing, as well as specialised surveying applications. Throughout the course, theoretical studies are complemented by practical exercises in the field and in the laboratory.

The Bachelor of Surveying/Bachelor of Science in Computer Science Course

This new combined degree course of five years full-time study enables a student to qualify for the award of the two degrees of Bachelor of Science in Computer Science and Bachelor of Surveying. The course authority for the combined degree is the School of Surveying. All students admitted to the combined course will be part of the Surveying UAC quota (NSU Code) but must also have achieved a level equivalent to the Computer Science cut-off (NCS) for the year of admission.

The course is specifically designed for students wishing to enter a career in computer science specializing in surveying, satellite positioning, spatial data handling for land and geographic information systems, remote sensing, digital mapping and terrain analysis. The content of the course comprises subjects from the BSc in Computer Science and BSurv degree courses with some variations to accommodate the requirements of both degrees. It should be possible to complete the requirements for the award of the BSc degree after four years study and the BSurv degree after five years.

Recognition
The degree of Bachelor of Surveying is recognised by the New South Wales Surveyors' Board as meeting all examination requirements for registration as a Registered Surveyor in New South Wales, and is recognised by the Institution of Surveyors, Australia for admission as corporate members.

Students wishing to become Registered Surveyors with the New South Wales Surveyors' Board after graduation are advised to gain practical experience under a Registered Surveyor during their course. Some reduction in the period of practical experience required before registration may be granted because of practical experience gained during the University course, provided the New South Wales Surveyors' Board is informed in the prescribed manner. Details are obtainable from the Registrar, Surveyors' Board, Department of Lands, Bridge Street, Sydney 2000.

Honours
In the BSurv degree course the same formal program is offered to both pass students and to those aiming for an honours grading. Honours will be awarded for meritorious performance throughout the course.

Scholarships and Prizes
Please locate Scholarships and Prizes in the Contents. In addition, substantial prizes are offered for the best performance by a woman student at the end of Year 1 and the best performance by all students at the end of Years 2 and 3. There is also a range of prizes available for the graduating class.

Professional Practice
All students in BSurv degree course must gain at least 60 days of recognised professional practice after the completion of Session 1 in Year 2 as part of the requirements for subject SURV8711. Special instructions will be given before commencement of professional practice.

Field Excursions
Students must complete all necessary fieldwork for any subject and be prepared to pay all the appropriate costs, and must be in attendance at all scheduled examinations except in exceptional circumstances.

Course Rules

- Students are not permitted to enrol in subjects with clashing timetables.-
- In addition to the specific subject prerequisites and co-requisites a general understanding of the material in the preceding year is assumed. Students are not normally permitted to enrol in subjects spread beyond two years.
- Students who do not pass their full programs in any year will be limited to a reduced load in the following year. Typically, this is 20 hours per week.
- Previously failed subjects must be included, except that a failed elective may be replaced by another elective.

Course Revision
Following each course revision, students are assessed on the basis of the new program but retain credit for any subjects already completed and are not liable for the increased requirements if progression is normal.

It is the responsibility of students to enrol in a program consistent with the rules governing re-enrolment and admission to the degree.

The BSurv degree course was recently revised. Years 1 and 2 of the new course have been introduced in 1989, while year 3 was introduced in 1990, and year 4 in 1991.

Students with broken programs will have their status in the new course determined according to a table of equivalent subjects in the new and old courses.

Re-enrolment

Students must collect enrolment information from the School Office before the end of Session 2 for re-enrolment in the following February. Students not intending to re-enrol should advise the School. Leave of absence for up to one year is usually granted to students in good standing.

General Education Program

The University requires that undergraduate students undertake a structured program in General Education as an integral part of their degree. For further details, please locate General Education in the Contents.

Requirements for General Education elective and prescribed subjects are as follows: Year 2 - one 56 hour or two 28 hour subject/s from Category A; Year 3 - one 56 hour or two 28 hour subject/s from Category B. The key questions and issues to be addressed in Category C will be considered in the following subjects: SURV1711 Introduction to Surveying, SURV7711 Land Management and Development Project and SURV8711 Professional Practice.

3740
Surveying

Bachelor of Surveying
BSurv

Year 1		**Hours per week**
Session 1		
PHYS1929	Physics 1	4
MECH0130	Engineering Drawing and Descriptive Geometry	4
MATH1032	Mathematics 1	6
SURV1111	Introduction to Computing	4
SURV1711	Introduction to Surveying[+]	3
		21
Session 2		
PHYS1929	Physics 1	4
MATH1032	Mathematics 1	6
SURV1711	Introduction to Surveying[+]	3
SURV2041	Survey Data Presentation	3
SURV2111	Principles of Computer Processing	4
SURV2221	Introduction to Geodetic Science	3
		23

Year 2		**Hours per week**
Session 1		
PHYS2969	Physics of Measurements	3
MATH2009	Engineering Mathematics 2	4
MATH2829	Statistics SU	3
SURV3011	Surveying Instruments	4
SURV3111	Survey Computations	3
SURV3231	Geodetic Computations	3
	28-hr General Education subject (Cat A)	2
		22
Session 2		
MATH2009	Engineering Mathematics 2	4
SURV4051	Survey Camp 1*	3
SURV4011	Surveying Techniques	6
SURV4111	Data Analysis and Computing 1	3
SURV4221	Geodetic Positioning 1	3
SURV4721	Project Management 1	2
	28-hr General Education subject (Cat A)	2
		23

*Students are required to attend a one-week survey camp, which is equivalent to 3 class contact hours per week.

Year 3		
Session 1		
CIVL0646	Engineering for Surveyors 1	3
PLAN9111	Town Planning	2
SURV5011	Engineering Surveying	4
SURV5111	Data Analysis and Computing 2	3
SURV5221	Geodetic Positioning 2	3
SURV5621	Cadastral Surveying 1	3
SURV5721	Project Management 2	2
	28-hr General Education subject (Cat B)	2
		22
Session 2		
CIVL0656	Engineering for Surveyors 2	3
SURV6051	Survey Camp 2*	4
SURV6121	Computer Graphics	3
SURV6511	Photogrammetry and Mapping 1	3
SURV6621	Cadastral Surveying 2	3
SURV6721	Project Management 3	2
SURV6811	Land Economics and Valuation	3
	28-hr General Education subject (Cat B)	2
		23

*Students are required to attend a one week Survey Camp which is equivalent to 3 class contact hours per week together with one hour per week evaluation on campus for preparation of report.

Year 4		
Session 1		
SURV7051	Survey Camp 3*	7
SURV7311	Offshore Surveying	3
SURV7511	Photogrammetry and Mapping 2	3
SURV7521	Remote Sensing and Resource Surveys	3
SURV7531	Spatial Information Systems 1	3
SURV7711	Land Management and Development Project*	2
SURV7811	Land Subdivision and Development	3
SURV8001	Project	1
		25

Year 4		Hours per week
Session 2		
SURV7711	Land Management and Development Project+	2
SURV8011	Project Surveying	3
SURV8221	Advanced Geodesy	3
SURV8531	Spatial Information Systems 2	3
SURV8711	Professional Practice**+	2
SURV8001	Project	8
		21

* Students are required to attend 2 weeks of Survey Camp, equivalent to 6 class contact hours per week, together with one hour per week evaluation on campus for preparation of report.
** 60 days approved professional practice required as part of this subject together with two hours per week seminar and field work.
+ The subject/s contribute to fulfilment of the Category C General Education requirement.

Combined Course Bachelor of Surveying/Bachelor of Science in Computer Science

3754
BSurv BSc in Computer Science

The structure of this new course is flexible to accommodate timetabling but a recommended program which will satisfy prerequisites throughout the course is:

Year 1
PHYS1929, MATH1032, SURV1711+, MECH0130, SURV1111, SURV2041, SURV2221, SURV3011, SURV4011

Year 2
PHYS2969, MATH2841, MATH2501, MATH2510, MATH2520, COMP1011, COMP1021, SURV3111, SURV3231, SURV4051*, SURV4111, SURV4221, SURV4721, General Ed. Cat. A
* Students are required to attend one week Survey Camp, which is equivalent to 3 class hours per week.

Year 3
SURV5011, SURV5111, SURV5221, SURV5721, SURV6051*, SURV6511, SURV6721, SURV6811, PLAN9111, MATH2100, MATH2120, COMP2011, COMP2021, COMP2031, General Ed. Cat. B.
* Students are required to attend one week Survey Camp, which is evaluated to 3 class hours per week together with one hour per week evaluation on campus for preparation of report.

Year 4
CIVL6140, CIVL6150, SURV5621, SURV6621, COMP3111, COMP3121, COMP3311, COMP3421 Plus 2 units (4 or 5 hours per week each) at level 2 or higher either from Table 1 of the Sciences Handbook, or from Table 2 for Program 0600.

Year 5
SURV7051*, SURV7311, SURV7511, SURV7521, SURV7531, SURV7711, SURV7711+, SURV7811, SURV8001, SURV8011, SURV8221, SURV8531, SURV8711**+

* Students are required to attend 2 weeks of Survey Camp, equivalent to 6 class contact hours per week, together with one hour per week evaluation on campus for preparation of report.
** 60 days approved professional practice required as part of this subject together with two hours per week seminar and field work.
+ Cat C General Education.

Subject Descriptions

Identification of Subjects

A subject is defined by the Academic Board as 'a unit of instruction approved by the University as being a discrete part of the requirements for a course offered by the University'.

Each approved subject of the University is identified by a sequence of eight characters, consisting of a four character alphabetical prefix which identifies the organizational unit responsible for administering the subject, and a four digit numeric suffix identifies the subject.

Subject identifiers are approved by the Registrar and the system of allocation is based on the following guidelines:

1. The authority offering the subject, normally a School of the University, is indicated by the four character alphabetical prefix.

2. Each subject identifier is unique and is not used for more than one subject title.

3. Subject numbers which have previously been used are not used for new subject titles.

Subjects taught are listed in full in the handbook of the faculty or board of studies responsible for the particular course within which the subjects are taken. Subject descriptions are contained in the appropriate section in the handbooks.

Appropriate subjects for each school appear at the end of each school section.

The identifying alphabetical prefixes for each organizational unit are set out on the following pages.

Servicing Subjects are those taught by a school or department outside its own faculty. Their subject descriptions are published in the handbook of the faculty which originates the subject and are also published in the handbook of the faculty in which the subject is taught. The following pages contain descriptions for most of the subjects offered for the courses described in this book, the exception being General Education subjects. For General Education subjects see the *Centre for Liberal and General Studies* Handbook which is available free of charge.

HSC Exam Prerequisites
Subjects which require prerequisites for enrolment in terms of the HSC Examination percentile range, refer to the 1978 and subsequent Examinations.

Candidates for enrolment who obtained the HSC in previous years or hold other high school matriculation should check with the appropriate school on what matriculation status is required for admission to a subject.

Information Key
The following is the key to the information which may be supplied about each subject:

S1 session 1, **S2** session 2
F session 1 *plus* session 2, ie full year
S1 or **S2** session 1 *or* session 2, ie choice of either session
SS single session, but which session taught is not known at the time of publication
CCH class contact hours
P/T part-time
L lecture, followed by hours per week
T laboratory/tutorial, followed by hours per week
hpw hours per week
wks weeks of duration
C credit or credit units
CR Credit level
DN Distinction
HD High Distinction
X External

In the Faculty of Engineering, Schools and Centres have allocated the first digit in the numeric suffix of all new subject identifiers as indicating the level of the subject. **Please note that the value '9' in this position is reserved for graduate subjects.**

Prefix	Organizational unit	Faculty
ABIO	School of Applied Bioscience	Applied Science
ACCT	School of Accounting	Commerce & Economics
ACHM	Department of Chemistry	University College
ACMA	Department of Civil Engineering	University College
ACSC	Department of Computer Science	University College
ADSC	Australian Defence Studies Centre	University College
AECM	Department of Economics & Management	University College
AELE	Department of Electrical Engineering	University College
AENG	Department of English	University College
AERO	Aerospace Engineering	Engineering
AGOC	Department of Geography & Oceanography	University College
AHIS	Department of History	University College
AINT	University College(Interdisciplinary)	University College
AMAT	Department of Mathematics	University College
AMEC	Department of Mechanical Engineering	University College
ANAT	School of Anatomy	Medicine
APHY	Department of Physics	University College
APOL	Department of Politics	University College
APSC	Faculty of Applied Science	Applied Science
APSE	Faculty of Applied Science	Applied Science
ARCH	School of Architecture	Architecture
ARTS	Faculty of Arts and Social Sciences	Arts and Social Sciences
ASIA	Asian Studies	Arts and Social Sciences
ATAX	Board of Studies in Taxation	
AUST	Australian Studies	Arts and Social Sciences
BIOC	School of Biochemistry	Biological & Behavioural Sciences
BIOM	Centre for Biomedical Engineering	Engineering
BIOS	School of Biological Science	Biological & Behavioural Sciences
BIOT	Department of Biotechnology	Applied Science
BLDG	School of Building	Architecture
BSSM	Board of Studies in Science & Mathematics	
CEIC	School of Chemical Engineering & Industrial Chemistry	Applied Science
CHEM	School of Chemistry	Science
CHEN	Department of Chemical Engineering	Applied Science
CHIN	Chinese	Arts and Social Sciences
CIVL	School of Civil Engineering	Engineering
CMED	School of Community Medicine	Medicine
COFA	College of Fine Arts	
COMM	Faculty of Commerce and Economics	Commerce & Economics
COMP	School of Computer Science and Engineering	Engineering
ECOH	Department of Economic History	Commerce & Economics
ECON	School of Economics, Departments of Economics and Econometrics	Commerce & Economics
EDST	School of Education Studies	Professional Studies
ELEC	School of Electrical Engineering	Engineering
ENGL	School of English	Arts and Social Sciences
EURO	European Studies	Arts and Social Sciences
EXPA	School of Arts and Music Education	Professional Studies
FIBR	School of Fibre Science & Technology	Applied Science
FILM	Department of Theatre and Film Studies	Arts and Social Sciences
FINS	School of Banking & Finance	Commerce & Economics
FOOD	Department of Food Science and Technology	Applied Science
FREN	School of French	Arts and Social Sciences
FUEL	Department of Fuel Technology	Applied Science
GENS	Centre for Liberal & General Studies	
GEOG	School of Geography	Applied Science
GEOL	Department of Applied Geology	Applied Science
GERS	Department of German Studies	Arts and Social Sciences
GREK	Modern Greek	Arts and Social Sciences
GSBE	Graduate School of the Built Environment	Architecture
HEAL	School of Health Services Management	Professional Studies
HIST	School of History	Arts and Social Sciences
HOSP	School of Marketing	Commerce & Economics
IDES	Department of Industrial Design	Architecture
INDA	Industrial Arts	Architecture
INDC	Department of Industrial Chemistry	Applied Science
INDO	Indonesian	Arts and Social Sciences
INFS	School of Information Systems	Commerce & Economics
INTD	Interdisciplinary Studies	Arts and Social Sciences
IROB	School of Industrial Relations & Organizational Behaviour	Commerce & Economics
JAPN	Asian Studies Unit	Commerce & Economics
KCME	Key Centre for Mines	Applied Science
LAND	School of Landscape Architecture	Architecture
LAWS	School of Law	Law
LEGT	Department of Legal Studies & Taxation	Commerce & Economics
LING	Linguistics	Arts and Social Sciences
LIBS	School of Librarianship	Professional Studies
MANF	Manufacturing Management	Engineering
MARK	School of Marketing	Commerce & Economics
MATH	School of Mathematics	Science
MATS	School of Materials Science and Engineering	Applied Science

Prefix	Organizational unit	Faculty
MDCN	School of Medicine	Medicine
MDSG	Medicine Surgery Clinical Studies	Medicine
MECH	School of Mechanical and Manufacturing Engineering	Engineering
MEED	School of Medical Education	Medicine
MFAC	Medical Faculty (Administration)	Medicine
MICR	School of Microbiology	Biological & Behavioural Sciences
MINE	Department of Mining Engineering	Applied Science
MNGT	Australian Graduate School of Management	
MSCI	Board of Studies and Mathematics	Board of Studies
MUSI	Department of Music	Arts and Social Sciences
NAVL	Naval Architecture	Engineering
OBST	School of Obstetrics & Gynaecology	Medicine
OCEA	Faculty of Science	Science
OPTM	School of Optometry	Science
PAED	School of Paediatrics	Medicine
PATH	School of Pathology	Medicine
PDCS	Professional Development Centre	Professional Studies
PHIL	School of Philosophy	Arts and Social Sciences
PHPH	School of Physiology & Pharmacology	Medicine
PHYS	School of Physics	Science
PLAN	School of Town Planning	Architecture
POLS	School of Political Science	Arts and Social Sciences
POLY	Department of Polymer Science	Applied Science
PROF	Faculty of Professional Studies	Professional Studies
PSCY	School of Psychiatry	Medicine
PSYC	School of Psychology	Biological & Behavioural Sciences
PTRL	Department of Petroleum Engineering Studies	Applied Science
REMO	Centre for Remote Sensing	Engineering
RUSS	Department of Russian Studies	Arts and Social Sciences
SAFE	Department of Safety Science	Applied Science
SCTS\ HPST	School of Science & Technology Studies	Arts and Social Sciences
SLSP	Department of Social Science & Policy	Arts and Social Sciences
SLST	School of Sport & Leisure Studies	Professional Studies
SOCI	School of Sociology	Arts and Social Sciences
SOCW	School of Social Work	Professional Studies
SPAN	Spanish & Latin American Studies	Arts and Social Sciences
SURG	School of Surgery	Medicine
SURV	School of Surveying	Engineering
TEDG	School of Teacher Education (graduate)	Professional Studies
TEED	School of Teacher Education (undergraduate)	Professional Studies
TESL	TESOL	Arts and Social Sciences
TEXT	Department of Textile Technology	Applied Science
THFI	Department of Theatre and Film Studies	Arts and Social Sciences
THST	Department of Theatre and Film Studies	Arts and Social Sciences
USOM	School of Mines	Applied Science
WOMS	Women Studies	Arts and Social Sciences
WOOL	Department of Wool & Animal Science	Applied Science

Accounting

ACCT9001 Introduction to Accounting A **S1 L1.5**

Architecture: 2 credit points compulsory for BBuild degree course students.
Prerequisite: Nil.

An introduction for non-commerce students to the nature, purpose and conceptual foundation of accounting. Information systems including accounting applications. Analysis and use of accounting reports.

ACCT9002 Introduction to Accounting B **S2 L1.5**

Architecture: 2 credit points; compulsory for BBuild degree course students.
Prerequisite: 14.001.

An introduction for non-commerce students to managerial accounting. Long-range planning, budgeting and responsibility accounting: cost determination, cost control and relevant cost analyses.

Aerospace Engineering

Aerospace Engineering is a course offered by the School of Mechanical and Manufacturing Engineering.

AERO3100 Aerospace Design 1 **S1 L/T 4 S2 L/T2**

Prerequisites: MECH2100, MECH2300, MECH2400, MATS9520. Co-requisites: AERO3400, AERO3601, AERO3602.

Introduction to the special constraints involved in the design of an aerospace vehicle. The development of detail design skills and the methodology of aerospace design. An introduction to airworthiness regulations, ESDU data sheets and the use of computer-aided design techniques. The production of engineering design reports on selected areas and the design work carried out.

AERO3400 Analysis of Aerospace Structures F L1.5 T.5

Prerequisites: MECH2300, MECH2400, MATH2009. Co-requisite: MECH3400.

Equilibrium of forces: aerospace applications of plane frames and space structures. Beams; shear and bending stress distribution in thin-webbed beams, close-section thin-wall beams, tapered beams, beams with variable flange areas. Semi-monocoque structures; ribs and bulkheads. Deflection of structures: stresses due to torsion and shear in multicell tubes. Statically indeterminate structures; beams, trusses and frames. Structural instability; buckling of perfect and imperfect columns; bending and buckling of thin flat plates.

AERO3601 Aerodynamics 1 **S1 L/T 4**

Prerequisites: MECH2600, MECH2700, MATH2009. Co-requisites: AERO3602. Excluded: 5.811.

Potential flow. Airfoil and wing theory: Inviscid conservation relations. Source, sink, doublet and point vortex; superposition with uniform flow. Airfoil formation and kutta condition. Computational methods. Lifting line and pradtl wing theory, spanwise lift, induced drag and downwash. Low speed aerodynamics: viscous boundary layers, transition, separation, wakes-reynolds number. Form drag. Wind tunnels. Isolated airfoil characteristics. Cascade characteristics. One-dimensional gas flow. Conservation thermodynamics and sonic speed relations. Mach number. Isentropic, variable area flow. Diabatic, inviscid and viscous adiabatic channel flow. Normal shock waves. Supersonic wind tunnels and diffusers.

AERO3602 Flight Dynamics 1 **S1 L/T 2**

Prerequisites: MECH2300, MECH2310, MECH2600. Co-requisite: AERO3601. Excluded: 5.811.

Introduction to atmospheric and space environment; standard atmospheric gas law; pressure, temperature and density profiles; turbulence, gusts and atsmospheric disturbances. Aerospace vehicle performance: drag, drag power, thrust, thrust power, excess power. Minimum and maximum speeds and endurance. Climb rates and engineering height methods. Mission profiles. Longitudinal static stability; elevator control; balance and trim. Neutral and manoeuvre points and margins. Flight test measurements and handling qualities.

AERO4100 Aerospace Design 2 **F L2 T1**

Prerequisites: AERO3100, AERO3601, AERO3602. Co-requisites: AERO4400, AERO4601, AERO4602, AERO4700. Excluded: AERO4109.

The students are formed into project teams to carry out initial design of an aerospace vehicle. A lecture program supports this work, along with tutorials and project team meetings.

AERO4201 Aerospace Systems **S1 L/T2**

Prerequisites: AERO3601, AERO3602, MECH3212, MECH3310. Corequisite: AERO4602.

A basic understanding of information, power and mass transport systems used on current craft; how the systems inteface with the flight management on the vehicle.

AERO4202 Space Engineering **S2 L/T2**

Prerequisites: AERO3602. Co-requisite: AERO4201.

Introduction to the particular problems in vehicles that operate outside the sensible atmosphere. The dynamics of such vehicles, their on-board systems and their management and control.

AERO4400 Analysis of Aerospace Structures 2 F L2 T1

Prerequisites: AERO3400, MECH3400. Excluded:: AERO4409, MECH4410, MECH9410.

Introduction to finite element and associated graphic packages. Principles of mechanical design and validation, including cost assessment. Selection of applications from linear and non-linear elasticity, 3-D solids, plates and shells, buckling and post-buckling behaviour, thermal stresses and aero-elasticity.

AERO4601 Aerodynamics 2 **F L1.5 T.5**

Prerequisite: AERO3601. Excluded: AERO4609.

Concentrates on high-speed flow and viscous compressible flows. As well as obtaining a good theoretical grounding, the student is introduced to the measurement of the properties of these flows in the laboratory and the use of computer modelling techniques (CFD).

AERO4602 Flight Dynamics 2 **S1 L2 T1**

Prerequisites: AERO3602, MECH3211. Excluded: AERO4609.

An introduction to the dynamic stability and control of atmospheric vehicles, including an understanding of the characteristics of such vehicles, and their testing in flight and evaluation.

AERO4700 Aerospace Propulsion **F L1.5 T0.5**

Prerequisites: MECH2600, MECH2700 or AERO3601

Propulsion systems: history, types, basic thrust, efficiency equations. Propellers, rotors and fans: engine cycle thermodynamics, performance, testing. Engine intakes: subsonic, supersonic, ramjets. Gas turbine, piston engine, design, performance. Rockets. Noise, pollution.

Anatomy

ANAT2111 Introductory Anatomy **S1 L2 T4**

Prerequisites: BIOS1011, BIOS1021.

Introduction to gross anatomy, based on a study of prosected specimens. Musculoskeletal, cardiovascular, respiratory, gastrointestinal, genitourinary and nervous systems. General topographical and surface anatomy.

Biological Science

BIOS1021 Biology B **S2 L2 T4**

Prerequisite: BIOS1011 (however, students without this prerequisite may seek the permission of the Co-ordinator of First Year Biology to enrol). Excluded 17.021.

The evolution, diversity and behaviour of living things and the ways in which they have adapted to varying environments. Emphasis on the structure and function of flowering plants and vertebrate animals, and their roles in Australian ecosystems. The theory covered in lectures and tutorials is illustrated by observation and experiment in laboratory classes which will include dissection of a toad and a rat.

BIOS3111 Population and Community Ecology **S1 L2 T4**

Prerequisite: BIOS1021 and MATH1032 or both MATH1011 and MATH1021. Excluded: 45.152.

Factors regulating dynamics of interacting populations, renewable resource management, ecosystem stability, cycles and chaos, simulation modelling in ecology, niche theory, competition, habitat selection, community structure,species diversity, island biogeography, ecological gradients. Succession in following disturbance (fire, mining, or logging). Participation in field work is essential.

Chemical Engineering and Industrial Chemistry

CEIC0010 Mass Transfer and Material Balances **FL1T1**

Prerequisites: CHEM1101, CHEM1201, CIVL2505.

Fundamentals of Mass Transfer: diffusion, mechanisms of mass transfer, models for mass transfer at fixed and free interfaces. Calculation of mass transfer rates at surfaces with simple geometry. Mass transfer in dispersions. Material balances: applications of process calculations in chemical process operations, conventions in methods of analysis and measurement. The chemical equation and stoichiometry. Process calculations associated with gases, vapours and liquids. Problems involving bypass, recycle and purge. Differential material balances.

CEIC0020 Fluid/Solid Separation **SS L1.5 T.5**

Particle Characterisation: Size analysis, sphericity, surface area, density. Fluid-particle Interactions: Drag coefficient, effect of Reynolds number. Terminal velocity, effect of shape, concentration. Drops and bubbles. Particle-particle interactions including flocculation. Flow through porous media. Darcy, Carmen-Kozeny, Ergun equation. Applications of Fluid-Particle Systems: Sedimentation and thickening, elutriation, cyclones, filtration, constant pressure filtration, specific resistance, equipment, filter aids, centrifugal separations.

CEIC0030 Environmental Protection in the Process Industries **SS L3 T3**

Prerequisites: CEIC0010, INDC3070, INDC4120.

Selection of 3 topics from:

Environmental Pollutants

The characteristics of pollutants in air and water. Consequences of pollutions by aqueous, gaseous and solid wastes; case histories. Standards and regulations; legislative aspects. Measurement, analysis and sampling - modern techniques of environmental chemical analysis.

Pollution Control Techniques

Water - primary, secondary and tertiary treatment. Air - removal of particles, chemicals and odours. Solid - disposal procedures. Noise - reduction techniques.

Water Pollution Control Engineering

Screening. Settling tank design. Coagulation and flocculation (colloid chemistry, double-layer theory and flocculation theory). Clarifier design. Filtration technologies - deep bed filtration. Biological treatment plant design - trickling filters - activated sludge processes (and variants) -anaerobic digesters. Sludge processing and disposal.

Air Pollution Control

Case histories, statistics. Single component failure, failure rate data. Reliability theory, series, parallel and redundant systems. Hazard and operability studies. Quantitative risk assessment - hazard identification - failure frequency - consequence calculations (preliminary methods). Laboratory safety.

Laboratory for Environmental Analysis

14 hour laboratory unit developing techniques in modern environmental analysis.

Advanced Environmental Protection

This comprises a series of elective strands which build upon the core subject as follows:

1. Advanced treatment methods (water)
2. Advanced treatment methods (air)
3. Hazardous wastes
4. Computer-aided risk assessment
5. Advanced laboratory
6. Occupational Health Laboratory

Chemical Engineering

Chemical Engineering is a department within the School of Chemical Engineering and Industrial Chemistry.

CHEN3070 Process Control **F L1**

Prerequisites: CEIC2010, CEIC2020, MATH2021.

Unsteady state modelling of simple processes: linearisation, transfer function, concept of input-output models. Lumped parameter versus distributed parameter systems. *Process identification:* transient, frequency, pulse and correlation analysis. *Control system hardware:* transducers, valves, measuring devices for flow, pressure, temperature.

Chemistry

Level 1 Units

CHEM1002 Chemistry 1 **F L3T3**

Prerequisites:	*HSC Exam Score Range required*
2 unit Mathematics or	*55-100*
3 unit Mathematics or	*1-50*
4 unit Mathematics	*1-100*
and	
2 unit Chemistry or	*53-100*
3 unit Science or	*90-150*
4 unit Science or	*1-50*
2 unit Physics	*53-100*

Stoichiometry and solution stoichiometry. Atomic and molecular structure. Changes of state, phase diagrams, gases, liquids, solids, solutions. Thermodynamics, equilibrium constants, acid-base and solubility. Oxidation and reduction. Kinetics. Molecular hybridization of orbits. Periodicity of physical and chemical properties of elements and compounds. Organic chemistry including stereoisomerism.

Note: CHEM1002 is the normal prerequisite for Level II Chemistry.

CHEM1201 Chemistry 1B **S2 L3T3**

Prerequisites: CHEM1101, Chemistry 1A.

Molecular geometry, hybridization of orbitals. Periodicity of physical and chemical properties of elements and compounds. Organic chemistry, including stereoisomerism.

Note: The two subjects CHEM1101 and CHEM1201, taken sequentially, are equivalent to CHEM1002.

CHEM1501 Introductory Chemistry B **S2 L3T3**

Prerequisites:	*HSC Exam Score Range required*
CHEM1401 Introductory Chemistry A or	
2 unit Mathematics or	*55-100*
3 unit Mathematics or	*1-50*
4 unit Mathematics	*1-100*
and	
2 unit Chemistry or	*53-100*
3 unit Science or	*90-150*
4 unit Science or	*1-50*
2 unit Physics	*53-100*

Atomic and molecular structure, equilibrium constants, acid-base and solubility. Periodicity of physical and chemical properties of elements and compounds. Organic chemistry including stereoisomerism.

Note: The two subjects CHEM1401 and CHEM1501, taken sequentially, are equivalent to CHEM1302.

CHEM1806 Chemistry 1EE **S1 L2 T1**

Prerequisites:	*HSC Exam Score Range Required*
2 unit Mathematics or	*67-100*
3 unit Mathematics or	*1-50*
4 unit Mathematics	*1-100*
and	
2 unit Science (Physics) or	*53-100*
2 unit Science (Chemistry) or	*53-100*
4 unit Science or	*1-50*
3 unit Science	*90-150*

Atomic and molecular structure and bonding. Chemical equilibrium. Rates of reactions. Thermochemistry. Ionic equilibria. Metals, electro-chemistry and corrosion. Colloids and clays. Colligative properties of solutions. Organic chemistry, polymers. Applications of chemical principles to engineering.

CHEM1807 Chemistry 1ME **S1 L3 T3**

Prerequisite: As for CHEM1806.

Stoichiometry. Atomic and molecular structure. Chemistry of materials. Thermochemistry. Kinetics. Equilibrium. Oxidation and reduction, electrochemistry and corrosion of metals. Introduction to organic chemistry, structure and properties of polymers, fuels and lubricants. Surface chemistry.

CHEM1808 Chemistry 1CE **S2 L3 T3**

Prerequisites: As for CHEM1806.

Atomic and molecular structure and bonding. Chemical equilibrium. Rates of reactions. Thermochemistry. Ionic equilibria. Metals, electro-chemistry and corrosion. Colloids and clays. Colligative properties of solutions. Organic chemistry, polymers. Applications of chemical principles to engineering.

CHEM1809 Biological Chemistry for Optometry Students **F L3 T3**

Prerequisites:	*HSC Exam Score Range required*
2 unit Mathematics or	*60-100*
3 unit Mathematics or	*1-50*
4 unit Mathematics	*1-100*
and	
2 unit Chemistry or	*53-100*
3 unit Science or	*90-150*
4 unit Science or	*1-50*
2 unit Physics	*53-100*

Stoichiometry and solution stoichometry. Atomic and molecular structure. Gases, liquids and solutions. Thermodynamics. Kinetics. Equilibrium constants; acid-base and solubility. Oxidation and reduction. Organic chemistry including stereoisomerism. Amino acids, proteins, carbohydrates, bucleic acids and lipids. Enzymology. Bioenergetics. Carbohydrte metabolism, oxidative phosphorylation. Metabolism and hormone function.

Level II Units

CHEM2011 Physical Chemistry **S1 or S2 L3 T3**

Prerequisites: CHEM1002 or CHEM1101 and CHEM1201 and MATH1042, or MATH1032, or MATH1011 and MATH1021. Excluded 2.002A.

First, second and third laws of thermodynamics. Application of thermodynamics. Chemical and phase equilibria. Solutions of electrolytes and nonelectrolyte. Principles and applications of electrochemistry. Reaction kinetics: order and molecularity; effect of temperature on reaction rates. Surface and colloid chemistry.

CHEM2021 Organic Chemistry **F or S2 L3 T3**

Prerequisite: CHEM1002 or CHEM1201. Excluded 2.002B.

Discussion of the major types of organic reaction mechanisms eg addition, substitution, elimination, free-radical, molecular rearrangement within context of important functional groups. Introduction to application of spectroscopic methods to structure determination.

CHEM2031 Inorganic Chemistry and Structure **S1 or S2 L3 T3**

Prerequisites: CHEM1002 and CHEM1101 and CHEM1201. Excluded 2.042C.

Experimental basis for theories of electronic structures of atoms and molecules. Concepts and consequences of quantum theory. Structure, energetics and bonding in the solid state. Principles of co-ordination chemistry. Occurrence, preparation, proper reactions of selected compounds of transition and main group elements.

CHEM2041 Chemical and Spectroscopic Analysis **S1 or S2 L3 T3**

Prerequisites: CHEM1002 or both CHEM1101 and CHEM1201 and MATH1042, or MATH1032, or MATH1011 and MATH1021. Excluded 2.002D and 2.003H.

General procedures in analytical science, accuracy, propagation of errors, precision. Analytical equilibrium chemistry, titrimetric, and gravimetric, analysis. Solvent extraction. Electroanalytical methods. Chromatography. Instrumental aspects of all major spectroscopic methods. Optical spectroscopy, instrumental acpects of all major spectroscopic methods.

Level III Units

CHEM3311 Environmental Chemistry **S2 L3 T3**

Prerequisites: CHEM2011 and CHEM2041. Excluded 2.043A.

Physical chemistry aspects of the environment. The chemistry of water in the environment; rivers, estuaries, oceans. The chemistry of the atmoshpere: photolysis., primary and secondary pollutants. The distribution of elements in ecosystems. Analysis of naturally occurring species and pollutants.

Civil Engineering

CIVL1007 Engineering Practice **S1 L1T1 S2 L1 T1**

Prerequisites:	*HSC Exam Score Range Required*
2 unit English (General) or	*53-100*
2 unit English	*49-100*
3 unit English	*1-50*
or	
2 unit contemporary English	*60-100*

Excluded: GENS4529

Introduction to the structure, nature and scope of environmental engineering work and the problems resolved by practitioners. History of engineering. Branches of engineering; organisation of the profession. Methodologies employed by engineers in their work. Communication methods and skills. Report preparation.

Introduction to Construction Practice. Construction of concrete and steel structures. Construction of earthworks. Earthworks plant. Construction of rockworks.

Management of Engineering Projects. The nature of civil engineering projects. Management overview. Legal, political and environmental aspects. Technical and economic investigations. Design. Contractual aspects. Construction practice. Hand-over. Operation and management; Demolition.

CIVL1106 Computing and Graphics **F L1T2**

Introduction to programming and development of skills for solving problems and rapid calculation. Computing elements, input-output, data and program structures. Useful and correct algorithms. The use of Pascal and control languages. Introduction to higher level languages and graphics.

Australian Drawing Standards. Descriptive geometry and orthographic projections. Perspective drawing. Introduction to computer aided drafting. Introduction to graphics – primitives, attributes, windows, layers, etc. Elementary graphics programming. Tutorials include supervised and free practice at computing, testing algorithms, data manipulation. Drawing practice includes graphs, systems diagrams; road, concrete and steel work; perspective drawing; pseudo computer aided drafting and a graphics plot.

CIVL1203 Engineering Mechanics **F L2 T2**

Co-requisite: MATH1032.

Two-dimensional concurrent and non-concurrent force systems. Equilibrium of particles and rigid bodies. Distributed forces: centre of gravity and centroid. Internal forces in structural members: shear and bending moment diagrams. Analysis of structures: trusses, frames and machines. Determinacy and constraints. Compatibility. Forces in cables. Properties of cross-sections. Concepts of stress and strain.

Dynamics of particles. Laws governing conservation of energy and momentum. Curvilinear motion and angular momentum. Planar motion of rigid bodies. Derivation and solution of equations of motion for simple spring-mass systems responding to forces of simple form. Applications to civil engineering problems.

CIVL1301 Civil Engineering Practice **S1 L2 T1 S2 L1.5 T.5**

Prerequisites:	*HSC Exam Score Range Required*
2 unit English (General) or	*53-100*
2 unit English	*49-100*
3 unit English or	*1-50*
2 unit contemporary English	*60-100*

Introduction to the structure, nature and scope of civil engineering work and the problems resolved by practitioners. History of civil engineering. Branches of engineering; organisation of the profession. Methodologies employed by engineers in their work. Communication methods and skills. Report preparation. An examination of some leading Australian and world engineering projects.

Construction Practice: Construction of concrete structures. Concrete materials. Batching of concrete materials. Mixing, transporting, placement and finishing of concrete. Construction of earthworks. Earthworks plant. Construction of rockworks. Rock drilling plant. Blasting practice.

Management of Civil Engineering Practice: The nature of civil engineering projects. Management overview. Legal, political and environmental aspects. Technical and economic investigations. Design. Contractual aspects. Construction practice. Handover; Operation and management; Demolition.

CIVL2007 Engineering Mechanics and Materials **F L3 T1**

Prerequisite: CIVL1203.

Mechanics of Solids: Review of properties of cross-sectional shapes. Bars subjected to axial force; stress, strain and deformation. Homogeneous and non-homogeneous bars. Linear and non-linear material behaviour (elastic and plastic deformation). Strain energy. Bars in bending; stresses and deformations. Deflection calculations; step functions; moment area methods. Concepts of stiffness and flexibility. Stability and buckling of compression members. Shear and torsional stresses and deformations. Stresses and strain at a point; Mohr's circle. Combined stresses. Effects of temperature, strain rate, static and dynamic loading, and creep on material behaviour.

Use of Concrete in Civil Engineering Practice: Behaviour of concrete; composition, function and properties of constituents; cements, aggregates, admixtures. Properties of fresh and hardened concrete. Specification, quality control and code requirements. Time dependent behaviour. Durability, permeability, corrosion protection of reinforcing steel in concrete. Destructive and non-destructive testing. Special concrete making materials and techniques.

Metals Technology: Relationship of properties to microstructure, dislocation mechanisms of plastic deformation; micro-mechanism of creep and fracture. Property control by strain hardening, alloying and heat treatment of steel and aluminium.

Polymer and Ceramic Materials: The structure and properties of polymers and ceramics. Ceramic-metal composites.

CIVL2017 Data Survey and Analysis **S2 L1.5 T.5**

Prerequisite: MATH2869.

Planning and design of experiments. Optimal utilization of instrumentation. Analysis of experimental data: analysis of variance and co-variance. Simple and multiple regression. Confidence limits and reliability. Analysis of time series. Sample survey design and analysis.

CIVL2106 Systems Engineering **S1 L1 T1 S2 L2 T1**

Prerequisites: CIVL1106, MATH1032. Co-requisite: MATH2869.

Systems concepts: general systems theory, classification and representation of systems, dynamic behaviour. Modelling concepts. Formulation and analysis of problems. Models of the design process. Evaluation and selection concepts. Case studies in the formulation, modelling and resolution of Civil Engineering problems.

Techniques for numerical analysis and decision making: simulation, optimisation, network models, decision theory. Economic models. Benefit-cost techniques.

The solution of Civil Engineering problems involving probabilistic and statistical aspects. Problems examined include hydrological data fitting, traffic data analysis, structural reliability, limit state design, quality control, geomechanics site investigations and field data gathering and reduction. Regression. Decision processes associated with indefinite information; the modelling of the associated Civil Engineering systems.

CIVL2203 Engineering Mechanics 2 **F L2.5 T1.5**

Prerequisite: CIVL1203.

Review of properties of cross-sectional shapes. The approach to design. Design objectives and criteria. The concept of limit states. Types of structural members. Load paths. Three dimensional statics: concurrent and non-concurrent force systems.

Bars subject to axial force; stress, strain and deformation. Homogeneous and non-homogeneous bars. Linear and non-linear material behaviour. Strain energy. Design of tension and stocky compression members in steel. Connections. Ultimate strength concepts. Bars in bending; stresses and deformations. Deflection calculations; step functions; moment area methods. Concepts of stiffness and flexibility. Design of flexural members. Shear and torsional stresses and deformations. Design for shear. Stresses and strain at a point; Mohr's circle. Combined stresses. Bolted and welded connections. Structural stability and dynamic loading.

CIVL2301 Engineering Construction **F L1.5 T.5**

Prerequisite: CIVL1301.

The handling of heavy materials: elementary machines, motion resistance and analysis. Special purpose cranes. Crane analysis. Work physiology. Earthmoving production. Vehicle terrain mobility. Compressed air. Construction of foundations: caissons, coffer dams and piling. Sand and aggregate production. Tunnelling: hard rock and soft ground. Specialist construction: pipelines, bridges, dams and buildings. Masonry construction. Design of formwork. Blasting practice.

CIVL2402 Materials Engineering 1 **F L2.5 T1.5**

Prerequisites: CIVL1203, GEOL5002, CHEM1808. Co-requisite: CIVL2203.

Use of concrete and metals in Civil Engineering Practice: Behaviour of concrete, composition, function and properties of constituents, cements, aggregates, admixtures. Properties of fresh and hardened concrete. Specification, quality control and code requirements. Mix design and proportioning methods. Time dependent behaviour. Durability, permeability, corrosion protection of reinforcing steel in concrete. Destructive and

non-destructive testing. Special concrete making materials and techniques.

Behaviour of metals and other engineering materials. Response of materials to forces in tension, compression, bending, shear and torsion; elastic and plastic deformation strength brittleness, hardness etc. Effects of temperature and strain rates, static and dynamic loading, fatigue, brittle fracture and creep failures.

Metals Technology Relationship of properties to microstructure, dislocation mechanisms of plastic deformation; micro-mechanism of creep and fracture. Property control by strain hardening, alloying and heat treatment of steel and aluminium.

CIVL2505 Hydraulics 1 **F L1 T1**

Prerequisites: CIVL1203, MATH1032.

Fluid properties: definition of a fluid, density, unit weight, specific volume, relative density, bulk modulus, vapour pressure, surface tension, viscosity, properties of gases. Fluid statics: pressure at a point, absolute and gauge pressure, manometers, forces on plane and curved surfaces, buoyancy, stability of floating bodies, accelerated bodies of fluid.

Kinematics of Fluid Flow: streamlines, pathlines, continuity.

Fluid dynamics: the energy equation, the momentum equation, application of the concepts of flow resistance , energy loss and fluid momentum to steady flows in closed conduits and to steady uniform free-surface flows. Hydrodynamics: the stream function and velocity potentials, rotation, basic flow patterns, flow nets.

CIVL3007 Environmental Fluid Mechanics **FL2 T1**

Prerequisite: CIVL2505.

Shear stress in fluids: laminar and turbulent flow: boundary layers: friction and pressure drag. Flow in pipes: pipe friction. Pumps. Free surface flow, specific energy, controls, hydraulic jumps, gradually varied flow.

Turbulent diffusion and dispersion in rivers, oceans and the atmosphere. Buoyancy effects - jet and plume models. Influence of cross flows. Effects of density stratification. Gravity and turbidity currents.

CIVL3106 Engineering Computations **F L1 T1**

Prerequisites: CIVL1106, MATH2009.

Solution of linear and non-linear equations. Numerical differentiation. Curve fitting and interpolation. Numerical integration. Solution of ordinary and partial differential equations. Eigen value problems. Introduction to finite elements.

CIVL3203 Structural Analysis **F L2 T1**

Prerequisite: CIVL2203.

The requirements of structural analysis. The work theorem and its applications. Flexibility and stiffness analysis of trusses. Flexibility and stiffness analysis of frames. Reciprocal theorems. Introduction of finite element analysis.

CIVL3303 Structural Design **F L3 T1**

Prerequisite: CIVL2203.

Loads on structures; dead, live, wind, earthquake, etc. Reinforced concrete beams and one-way slabs; service load and ultimate behaviour; moment-curvature relationships. Ultimate strength design and ductility. Design for serviceability. Durability. Shear strength. Bond and anchorage.

Reinforced concrete beam-columns; uniaxial and biaxial bending. Slenderness effects. Composite concrete – steel beams. Prestressed concrete determinate beams. Strength and serviceability design.

Design of steel girders; lateral and local buckling, web buckling. Steel beam-columns, slenderness effects. Plastic design of continuous steel beams.

CIVL3402 Geotechnical Engineering 1 **F L2 T1**

Prerequisites: CIVL2203, GEOL5100.

Description of soil, clay mineralogy, plasticity and particle size distribution. Basic relationships of phases. Soil classification and material specification. Hydraulic properties of soils and flow of water through soil. The principle of effective stress. Consolidation theory, stress distributions and settlement. Compaction and basic stabilisation. Mohr's circle, failure criteria, stress paths and strength of soils. Soil testing. Site investigation and selection of design parameters. Slope stability including simple models and methods of slices. Laboratory work to compliment the lectures.

CIVL3505 Hydraulics 2 **F L2 T1**

Prerequisite: CIVL2505.

Shear stress in fluids: laminar and turbulent flow, shear stresses, boundary layers, flow separation, wakes, friction drag and pressure drag. Flow in closed conduits; friction factors, head losses, flow in systems in series, pipes in parallel and pipe networks. Pumps: types, their characteristics and selection. Unsteady flow in pipes: surges, pressure waves, and water hammer. Free surface flow: specific energy, controls, hydraulic jumps, gradually varied flow, flow in channels of non-cohesive alluvial material. Flow in porous media: Darcy equation, seepage flow nets, uplift forces on structures. Hydraulic models: dimensional analysis, similarity criteria and scale selection, scale effects.

CIVL3601 Engineering Management 1 **F L1.5 T.5**

Prerequisites: CIVL1301, CIVL2106.

Basic techniques used in the management of engineering works; purpose and principles of management; management of people, plant, materials, money and sites; management of safety. Planning techniques used in management: networks, critical path method, and PERT. Operations research in management: methodologies for problem solving including simulation and queuing theory. Theory of the management of humans. Theory of the management of organisations. Use and management of information systems. Law and the law of contract.

CIVL3705 Water Resources **F L2 T1**

Prerequisite: MATH2869. Co-requisite: CIVL3505.

Hydrological processes – hydrological cycle, climatology, atmospheric water. Precipitation – processes and analysis. Runoff – process, measurement, analysis. Flood estimation. Urban hydrology – drainage design, retarding basins, flood routing. Groundwater hydrology – aquifers, aquifer modelling, water extraction, groundwater recharge and discharge processes, unsaturated flow. Water resource systems – systems approach, objectives and constraints, modelling, stochastic behaviour, optimisation.

CIVL3804 Transport Engineering **F L1 T1**

Prerequisites: CIVL2106, MATH2869.

Traffic Flow Theory: Traffic measurements. Traffic stream parameters: flow, concentrations, speed, spacing, headway. Fundamental diagram of traffic. Overtaking models, moving observer. Car following theory. Traffic flow and speed sampling. Capacity of highways, uncontrolled and signal controlled intersections.

Transport Systems: Description and analysis of interactions. Feedback, steady state performance, sensitivity analyses. Travel demand: traffic generation, distribution and assignment to modes and routes. Transport supply: capacity and operational measures of public transport modes. Land-use and transport planning. Economic evaluation.

CIVL4006 Industrial Training

Students are required to complete a minimum of 60 working days of approved industrial training, submit a report on this training before the fourth week of Session 1 of fourth year, and to present a seminar during the first session of fourth year outlining their industrial training experiences.

CIVL4007 Waste Management **S1 L2 T1**

Prerequisite: INDC4120.

Chemical fixation, acid waste treatment, metals removal, landfill site selection, leachate testing, toxicity testing, hydrogeological sampling. Transportation of hazardous materials. Legal aspects of hazardous waste.

CIVL4017 Water Engineering **S2 L4 T2**

Prerequisites: CIVL3402, CIVL3007.

Selection of 4 topics from:

Water Resources

The evaluation of water resources planning and management alternatives (the "rational" approach). Water and politics. Water and law.

Hydrology

Introduction to flood estimation. Runoff routing methods of estimating flood hydrographs - principles of methods, description of models, calibration, application of computer models on PC's and mainframe. Extreme flood estimation. Evapotranspiration.

Numerical Modelling of Free Surface Flow

An introduction to one-dimensional and two-dimensional numerical models of unsteady gradually varied canal, river and flood plain flows.

Public Health Engineering

Sewerage systems. Wastewater treatment plant design. Effluent disposal as related to the control of receiving water quality and effluent reuse. Water supply systems. Water treatment.

Advanced Hydraulics

Hyrdraulic modelling. Introduction to unsteady flow in open channels.

Coastal Engineering

Design of ocean outfalls. Ocean wave statistics. Shoaling of waves at a coastline. Introduction to coastal processes.

CIVL4027 Geotechnical and Transport Engineering **S2 L3 T3**

Prerequisites: CIVL3402, CIVL3804.

Four topics selected from:

Soil engineering. Rock engineering. Foundation engineering. Geotechnical engineering. Advanced pavement design. Theoretical soil mechanics. Concrete technology.

Theory of land use/transport interaction - travel demand and transport supply. Economic, social and environmental assessment. Analysis of impacts of transport activity: accidents, noise, air pollution, intrusion and energy consumption.

CIVL4037 Communications and Ethics **S2 L.5 T1.5**

Written and verbal communication skills in engineering practice. Preparation of proposals and reports. Relations to the media. Engineering ethics.

CIVL4101 Engineering Management 2 **S1 L1.5 T.5**

Prerequisite: CIVL3601.

Contract management and administration. Business and financial management: corporate entities; basic accounting to trial balance; income statements; balance sheets; accounting for fixed assets; taxation aspects; financial report. Management of large projects; management of international projects.

CIVL4203 Structural Engineering **S1 L3 T1**

Prerequisites: CIVL3203, CIVL3303.

Slab design: two-way edge-supported slabs and flat slab design; idealised frame and simplified design methods, punching shear, moment transfer at column connections, serviceability approach, detailing. Design of reinforced concrete footings and retaining walls. Plastic analysis and design of steel frames. Approximate analysis and structural form. Variational theorems. Brief discussions of cable structures, arches, plates and shells.

CIVL4306 Engineering and the Environment **S1 L2 T2**

Prerequisite: CIVL3601.

Engineering impact on the environment, the conservation movement and the response of engineers. Principles of ecological systems and the environment: short-term and long-term impact of engineering on land, water, air and noise. The Australian national conservation strategy. Public attitudes: community involvement as an integral part of the planning process, risk perceptions. Environmental methodologies: environmental and social impact statements, methods for measuring and predicting impact. Assessment of engineering on the biophysical and social environment. Impact of current engineering activity on the future distribution of resources. Decision making methodologies for engineering and non-engineering groups. Planning for non-optimal engineering solutions. Professional ethics.

CIVL4403 Materials Engineering 2 **S1 L3**

Prerequisites: CIVL2402, CIVL3303.

Metals used in structures: types, applications and developments in steels, aluminium alloys etc. Corrosion: causes, prevention and control in structural, reinforcing and piling steels. Fatigue and brittle fracture: factors leading to increased risk, significance of welding; empirical and fracture mechanics approaches to design against failures in service.

Timber properties: structure, mechanical properties, creep and shrinkage. Timber grading. Defects in timber. Properties of laminated timber. Design of tension members, columns and solid rectangular beams. Timber connections. Timber framing

in domestic construction. Pre-fabricated structural members. Design of a glue laminated beam.

CIVL4502 Geotechnical Engineering 2 S1 L2 T1

Prerequisite: CIVL3402.

Theoretical and presumptive bearing capacity of shallow foundations. Allowable settlement and foundations on sand and rock. Lateral earth pressures and retaining wall design. Single axially and laterally loaded piles, pile groups. Reactive soils, residential slabs and footings.

CIVL4605 Water Supply and Wastewater Disposal S1 L2 T1

Prerequisite: CIVL2505.

Water demand and sources of supply, transmission and distribution. Wastewater collection and disposal. Water pollution and quality criteria, water analysis. Water Treatment: screening and sedimentation, filtration, coagulation and flocculation, disinfection and fluoridation, water softening and desalination. Waste water treatment: preliminary and primary treatment, biological treatment, sludge digestion, tertiary treatment.

CIVL4704 Highway and Pavement Engineering S1 L2 T1

Prerequisites: CIVL3402, CIVL3804.

Introduction to road design: elements, terminology, standard plans. Road form: drivers perception, speed environment and interactions. Policies for road and intersections design. Horizontal and vertical alignment, visibility, drainage. Design evaluations: perspective, visibility and speed. Urban roads and intersections - different design philosophy. Vehicle turning paths and channelisations design. Introductory discussion on freeways and interchanges.

Pavement terminology, elements, classifications. Subgrades (earth) – variability and water problems. Traffic loads: frequency, weight, distribution, estimation and environmental factors. Bitumen pavements: properties, design and construction. Design and construction of flexible and rigid pavements. Selections of pavement type: serviceability and economic considerations.

CIVL4811 Construction Major S2 L/T9

Prerequisites: CIVL2301, CIVL4101, CIVL4306.

Construction camp: a one week field camp involving several construction procedures and associated performance measurements. Construction planning and design: organisation, management and control to support the conduct of the construction camp. Advanced construction technology and construction management topics. Construction and/or management project.

CIVL4822 Geotechnical Major S2 L/T9

Prerequisites: CIVL4306, CIVL4502, CIVL4704.

Advanced pavement engineering including concrete technology. Rock engineering, slopes and tunnels. Foundation engineering. Soil engineering including site characterization, critical state theory and liquefaction. A two and a half day field trip is included as part of the subject.

CIVL4833 Structures Major S2 L/T9

Prerequisites: CIVL4203, CIVL4403.

Specialisation in each of the following strands of structural engineering: Bridge engineering. Concrete structures. Structural analysis and stability. Structural dynamics.

CIVL4844 Transport Major S2 L/T9

Prerequisite: CIVL4306.

Application of computer aided methods for geometric design of roads. Design for traffic management and control: efficiency, safety, environmental factors, information systems, lighting. Environmental and social impact of transport design. Transport system design and operations.

CIVL4855 Water Major S2 L/T9

Prerequisites: CIVL3505, CIVL3705, CIVL4605.

Specialisation in six of the following strands (only six topics are offered each year): Water resources. Hydrology. Advanced hydraulics. Coastal engineering. Public health engineering. Environmental and social issues. Special topic.

CIVL4906 Project/Thesis S1 1S2 6

Prerequisites: All third year subjects. Corequisite: The appropriate major.

Directed laboratory, investigatory, design, field or research work on an approved subject under the guidance of members of the academic staff. Each student is required to present a seminar and a written project/thesis on the work undertaken. Time devoted to the project/thesis is one hour per week in Session 1 for library methodology instruction and preliminary work, and six hours per week in Session 2 to carry out the major part of the work.

CIVL4907 Project/Thesis S1 S2 6

Prerequisites: All third year subjects. Corequisite: The appropriate major.

Directed laboratory, investigatory, field or research work on an approved subject under the guidance of members of the academic staff. Each student is required to present a seminar and a written project/thesis on the work undertaken. Time devoted to the project/thesis is one hour per week in Session 1 for library methodology instruction and preliminary work, and six hours per week in Session 2 to carry out the major part of the work.

Servicing Subjects

These are subjects taught within courses offered by other schools and faculties.

For further information regarding the following subjects see the Faculty of Applied Science Handbook.

CIVL0616 Structures S1 L1T2

Theory of structures: Moduli of elasticity, simple stress and strain. Compound bars, temperature stresses. Thin shells. Stress at a point. Strain at a point. Principal stresses and strains. Relationship between load, shear force and bending moment. Moments of inertia, principal moments of inertia. Stresses due to axial force, bending moment, shear force, and torsion. Differential equations of simple beam theory. Deflection of beams. Statically indeterminate beams. Strain energy. Deflections at a single load. Shock loads. Theory of centrally loaded column and eccentrically loaded columns.

CIVL0626 Civil Engineering for Electrical Engineers **SS L2 T2**

Includes an introduction to the various branches of civil engineering, the nature and organisation of the profession. Relationship between clients and design consultants. The historical development of civil engineering. Theory of beams and trusses, resultant forces, structural action, stress and strain. Relation between load, shear force and bending moments, geometric properties of sections, deflection of beams. Properties of materials used in structures; various steels, concrete plain, reinforced and prestressed, aluminium and timber. Brittle fracture. Introduction to buckling. Engineering failures. Introduction to design of transmission lines and towers.

CIVL0636 Properties of Materials F L1 T1

Mechanical behaviour of materials. Response to static loading in tension, compression, shear and bending. Use of static test data in analysis and design; variability of material properties; factors of safety. Hardness tests. Creep in solid materials. Response to dynamic loading; fatigue; impact. Deterioration of engineering materials. Rheological classification of materials.

CIVL0646 Engineering for Surveyors 1 **SS L1.5 T1.5**

Aspects of hydraulics: Fluid properties, hydrostatics, motion of fluids, continuity, energy and momentum aspects, closed conduit flow and open channel flow. *Aspects of hydrology:* Scope and applications. Hydrologic measurements, rainfall analysis, storm rainfall-runoff relations, flood estimation. Urban drainage design.

CIVL0656 Engineering for Surveyors 2 **SS L3**

Municipal engineering. Soil mechanics: Soil forming processes; pedological classification; engineering classification of soils; pavement design based on engineering classification; effective stress concept for saturated and unsaturated soils, shear strength, flow of water through soils, consolidation; slope stability and earth pressures. *Public utilities:* Relationship between urban development and each of water supply, wastewater and stormwater drainage, transport.

Computer Science and Engineering

COMP1011 Computing 1A **S1 or S2 L3 T3**

Prerequisite: as for MATH1032. Co-requisite: MATH1032. Excluded: 6.611.

Defining problems. Reasoning about and solving problems using Logic, Abstraction, Specification, Algorithms and Data Structures. Exposure to a functional programming language for practical experience with these concepts. Introduction to Computing Systems: Hardware (CPU, Memory, Peripherals), Software (Operating Systems, Networks, Languages) and Users. Introduction to Computing Applications: Document Processing, Spreadsheets, Data Bases, Graphics and Communications.

COMP1021 Computing 1B **S1 or S2 L3 T3**

Prerequisite: COMP1011. Excluded 6.620, 6.621, 6.021D.

Expansion of the functional approach to computing in 6.711. Introduction to procedural and logic programming styles. Data structure implementation. Control structures: recursion and interaction. The software development process. Program efficiency and complexity – time and space analysis. Practical experience in using a procedural language. The basic structure of a computer, the layered model of a computer, instruction execution, assembly language, computer building blocks, the function of the operation system.

COMP1811 Computing 1 (Procedural) **S1 or S2 L3 T3**

Prerequisites: as for MATH1032. Co-requisite: MATH1032. Excluded: 6.600, 6.611, COMP1011, 6.620, 6.021D.

Defining problems. Reasoning about and solving problems using Logic, Abstraction, Specification, Algorithms and Data Structures. Exposure to a procedural programming language for practical experience with these concepts. Introduction to Computing Systems: Hardware (CPU, Memory, Peripherals), Software (Operating Systems, Networks, Languages) and Users. Introduction to Computing Applications: Document Processing, Spreadsheets, Data Bases, Graphics and Communications.

COMP1821 Computing 2 **S1 or S2 L3T3**

Prerequisite: COMP1811. Excluded: COMP1021, 6.621, 6.021D.

Abstract data types. Lists, stacks, queues, trees. Implementation in a procedural language using linked structures. Searching and sorting. Introduction to functional programming. The layered model of a computer, instruction set, execution cycle, data storage, assembly language programming.

COMP1910 Introduction to Computer Engineering **F L1 T.5**

Prerequisites:	*HSC Exam Score Range Required*
2 unit English (General) or	*53-100*
2 unit English or	*49-100*
3 unit English or	*1-50*
2 unit Contemporary English	*60-100*

Not offered in 1992.

Introduction to the nature, history and scope of computer engineering (including computer architecture, digital systems, software engineering, information processing, electronics, and communications). The roles of computer engineering in industry, government and public utilities. Development of organisation, communication and research skills in engineering.

COMP2011 Data Organisation **S1 or S2 L3 T2**

Prerequisite: COMP1021. Excluded: 6.641.

Data types and data structures: abstractions and implementations. Data representation: logical and physical. Files and file organisation, database structures. Knowledge representation. Concepts of state, scope and binding within programs. Storage policies (VM, caching), addressing and accessing methods. Analysis of performance.

COMP2021 Digital System Structures **S1 or S2 L3T2**

Prerequisites: COMP1021 or COMP1821. Excluded: ELEC2012.

Analysis, design, and realisation of modest digital subsystems, and the organisation and design of major subsystems in a model computer: data path, instruction decode, address generation, arithmetic algorithms, and the fetch-execute cycle of a typical computer. Timing, minimisation techniques.

The translation of higher level programming abstractions and data structures to a real computer using a macro assembler as the target; study of the relationships between a hardware

model, a programming model, and the I/O subsystem of a computer. An understanding of the inter-relationships between the fundamental layers of a modern digital computer system.

COMP2031 Concurrent Computing **S1 or S2 L3 T2**

Prerequisite: COMP1021.

The process model – sequential versus parallel computation. Interprocess communication and synchronisation mechanisms: coroutines, message passing, buffers, pipes, remote procedure calls, semaphores, monitors. Resource sharing, exclusion, deadlock, lifelock, scheduling. Distributed algorithms: detection of deadlock, detection of termination. Protocols for data transfer.

COMP3111 Software Engineering **S1 L3T2**

Prerequisites: COMP2011, COMP2031. Excluded: 6.642, 6.660G.

Informal specification: Data flow diagram methodology, analysis, design, testing, management and documentation of software. Formal specification: set theory, logic, schema calculus, case studies. The Z specification notation. Managing the project lifecycle. CASE tools. A major group project will be undertaken.

COMP3121 Algorithms and Programming Techniques **S2 L3T2**

Prerequisite: COMP2011. Excluded: 6.642, 6.660G.

Computability theory. Deterministic and non-deterministic algorithms. Stochastic algorithms. Computational complexity: time and space bounds. Algorithms for parallel computation and their hardware implementation. Game playing. Branch and bound. Discrete event simulation. Linear programming. Dynamic programming.

COMP3131 Parsing and Translation **S2 L3T2**

Prerequisites: COMP2011. Excluded: 6.643, 6.664G.

This subject covers some of the common theories and techniques used for syntax-directed parsing and translation. These techniques are adequate for parsing many well-structured objects encountered in computing, but are not intended for natural language parsing.

Grammars: terminal symbols, non-terminal symbols, productions, phrase structure grammars. Chomsky classification, context-free grammars, finite state grammars, logic grammars. Parsing: LL(k) grammars, top-down parsing; LR(k) grammars, bottom-up parsing; parser generators. Translation: action symbols, translation grammars, syntax-directed translation, attributed-grammars, abstract syntax, unparsing. Lexical analysis: finite-state grammars, finite-state machines, regular expressions, lexical analyzer generators.

COMP3211 Computer Organization and Design **S1 L3T2**

Prerequisites: COMP2021 or ELEC2012 Excluded: 6.654G.

Topics will be chosen from: Advanced Design Strategies: combinational and sequential circuit design and realisation; synchronisation, communication and arbitration; register transfer specification (Modal). Arithmetic Design Strategies. Memory Organisation: physical and virtual address space: memory hierarchy; operating system and compiler support; memory mapping and caching. Communications Organisation: shared memory, memory mapping; network systems. Processor Design: the instruction pipeline; hardwired and micro-programmed control; instruction sets; RISC and object-based processor organisation. Error Detection/Correction and Fault Tolerance: testing and testability; faults, errors, and failures; coding theory; diagnosing and correcting errors.

COMP3221 Microprocessors and Interfacing **S2 L3T2**

Prerequisites: COMP2021. Excluded: 6.0318, 6.060G, 6.613, ELEC3020

The concept of a microprocessor system, busses, address spaces, memory devices, bus timing, bus standards, the VME bus, I/O device interfacing, polling, interrupts, DMA interfaces, the 68000 processor family, the C programming language, device drivers, the device driver software environment, other microprocessors, advanced topics. Laboratory work involves interfacing to and programming MC68000-series microprocessor-based systems.

COMP3231 Operating Systems **S1 L3T2**

Prerequisites: COMP2031. Excluded: 6.632, 6.663G, 6.672.

Services provided by operating systems. System calls and user commands (command languages, menus, etc). Virtual machines. Efficient techniques and methods of process management, memory management, input/output and communication handling. Performance evaluation and tuning. Protection and security.

COMP3311 Database Systems **S2 L3T2**

Prerequisites: COMP2011. Excluded: 6.005G, 6.633, 6.659G, 19.608.

The relational database model, object data bases, 4GL query languages, database design and implementation, deductive databases. Concurrency, optimisation, distribution. A major project involving both design and realisation is included.

COMP3321 Business Systems Organization **S1 L3T2**

Prerequisites: COMP2011 Excluded: 6.647, 6.661G.

Not offered in 1992.

Review of the organisation of accounting systems - journals, accruals, merchandising. The structure, design, development, and integration of various business systems selected from the following: general ledger; financial reporting; debtors, creditors; stock control; invoicing; purchasing and receiving; fixed assets; payroll. Systems for generating application systems and packages. User interfaces. File specifications and B-tree index files. Distributed commercial systems. The partial implementation of a business systems is undertaken as a group project.

COMP3331 Computer Networks and Applications **S2 L3T2**

Prerequisites: COMP2011, COMP2031. Excluded: 6.633, 6.659G.

History of digital communication and early computer networks. Circuit and packet switching. Digital data transmission. Error detection and recovery. Protocols for message transmission. Decomposition of network designs: the seven layer OSI model. Standards and standards organisations. The data link layer; character-oriented and bit-oriented channels; common channel systems, local area networks. Network configurations; the OSI network layer; internetworking: repeaters, bridges, gateways; Transport layer protocols: the OSI transport layer; the TCP protocol family. Other OSI layers: the session layer; the presentation layer. Data encoding, compression, encryption. Network management: security, privacy, integrity, synchronisation, recovery from failures. Studies of network applications, eg file transfer, electronic mail, remote procedure calls, remote program execution, distributed file systems,

distributed computing, electronic funds transfer, windowing systems.

COMP3411 Artificial Intelligence **S1 L2T3**

Prerequisites: COMP2011. Excluded: 6.666G.

Machine intelligence. Principles: knowledge representation, automated reasoning, machine learning. Tools: A1 programming languages, control methods, search strategies, pattern matching. Applications: computer vision, speech recognition, natural language processing, expert systems, game playing, computer-aided learning. Philosophical and psychological issues.

COMP3421 Computer Graphics **S1 L3T2**

Prerequisites: COMP2011. Excluded: 6.668G.

Graphics hardware: raster, random scan, and storage tube displays, graphical input devices. Scan conversion of lines and polygons. Basic 2D transformations, windowing, clipping, viewports, display segmentation. The user interface for graphics. Basic 3D transformations, perspective transformation, 3D clipping, hidden line and surface removal, shading, texture maps and lighting. Hierarchical modelling of objects, modelling curves and surfaces with splines and fractals. Existing graphics standards: X, GKS, PostScript, CGM, PHIGS, RenderMan.

COMP3511 Human-Computer Interaction **S1 L3T2**

Prerequisites: COMP2011. Excluded 6.006G.

Communication between computing systems and their users, with an emphasis on applications related to high-level query languages and searching techniques. Cognitive issues will figure prominently in the treatment. Topics include: theories and principles of interface design, interaction styles, interactive devices, interface and language testing, the null value problem, natural language systems.

COMP4011 Occasional Elective S1 (Computer Engineering) **S1 L3 T2**

Prerequisites: any 4 level 3 Computer Science subjects.

A program of advanced coursework offered by a new or visiting staff member in an area of computer science/engineering. Syllabus details will be available from the School Office before the start of session.

COMP4012 Occasional Elective S1 (Computer Engineering) **S2 L3 T2**

Prerequisites: any 4 level 3 Computer Science subjects.

A program of advanced coursework offered by a new or visiting staff member in an area of computer science/engineering. Syllabus details will be available from the School Office before the start of session.

COMP4121 Parallel Algorithms and Architectures **SS L3 T2**

Prerequisites: COMP3121 or COMP9101.

Analysis or algorithms: the classes P, NP, and NC. Sorting networks. Computational geometry. Graph algorithms. Parallel computational models: PRAM, linear processor array, Mesh Connected, Cube Connected, Perfect Shuffle. Complexity; programming paradigms for parallel computation. Parallel algorithms for merging, sorting, selection, searching and combinatorial problems. Vector architectures and algorithms: pipelining and chaining, multiple functional units, sparse operations, gather/scatter, data dependencies.

COMP4131 Programming Language Semantics **SS L3 T2**

Prerequisites: any 4 level 3 Computer Science subjects.

The main objective of this subject is the study of methods for specifying the semantics of programming languages, and the semantics of programs that can be expressed in those languages. One important method, known as Denotational Semantics, captures the meaning of a language by defining semantic functions that map the syntactic components of the language into a mathematical domain. Denotational semantics provides insight that is useful in the design of languages, for the implementation of translators for languages, e.g. for the implementation of compilers, and also wherever it is necessary to give a formal meaning to some notation that has a formal syntax. The subject will also discuss semantics that are useful to the users of a language, for example by programmers to show that a program correctly realizes its specification. Methods discussed here are axiomatic semantics, weakest pre-condition semantics and refinement.

Topics covered in this subject will include: concrete syntax, abstract syntax, the lambda calculus, semantic functions, denotations, recursion, axiomatic semantics, weakest pre-conditions, and refinement.

COMP4211 Advanced Architecture and Algorithms **SS L3 T2**

Prerequisite: COMP3211. Excluded: COMP9214.

Deterministic parallel systems: classification schemes, performance evaluation and interconnection schemes. Dataflow and other paradigms. Non-deterministic systems: stochastic computing, neural networks. Case studies: database machines, image processors, functional programming machines and paradigms, AI machines, fault tolerance, vector architectures and supercomputing.

COMP4215 VLSI Systems Architectures and Design **S1 L2 T3**

Prerequisites: COMP3221 or ELEC3020, ELEC4532. Excluded: COMP9215.

Review of electronics and technology. Integrated digital sybsystems. Analog functions in VLSI. Testing and testability. Integrated digital systems. VLSI design tools. Project work involves specification and simulation of a significant subsystem in the MODAL hardware description language, followed by fabrication and testing.

COMP4216 Distributed Operating Systems and Architecture **S2 L2 T3**

Prerequisites: COMP3211, COMP3231, COMP3331. Excluded: COMP9216.

Architectural Support: virtual addressing, caching, exception handling, communications; multiprocessor systems; capability-based architectures. Communication Models: IPC, RPC and Session models; broadcast, multicast; distributed virtual memory; typed versus untyped data. Naming and Security; Naming in distributed systems; Cryptographic authentication and capability-based protection schemes; Accounting and resource control. Distributed File Systems: File services, Sharing and cache consistency; transaction services; availability, scaling, replication, recoverability. Object-Orientation: weak, supportive and strong models; remote invocation versus server-based interaction; naming of operations; persistence models; inheritance models. Fault Tolerance: transaction processing systems; models of failure and tolerance; reliable broadcast protocols.

COMP4411 Artificial Intelligence: Knowledge-Based Systems **S1 L3 T2**

Prerequisite: COMP3411. Excluded: COMP9414, COMP9416.

Topics will be selected from Expert Systems (applications of expert systems; the expert system life cycle; knowledge representation; reasoning for expert systems; knowledge acquisition; knowledge maintenance; expert system project) and Machine Learning (learning as search; concept description languages; reinforcement learning; induction; learning theories; theory revision; learning project).

COMP4412 Artificial Intelligence: Interacting with the World **S2 L3 T2**

Prerequisite: COMP3411. Excluded: COMP9414, COMP9416.

Topics will be selected from Intelligent Robotics (image processing and computer vision; simulation; programming languages for robots; path and motion planning under constraints; design and control models; planning and learning; Robotics Project) and Natural Language Processing (overview of linguistics; grammars and languages; basic parsing techniques; semantic analysis and representation structures; cognitive modelling; natural language generation; natural language systems; natural language project).

COMP4914 Computing Science Honours **Full time**

COMP4913 Computing Science Honours **Part time**

Electrical Engineering

ELEC0802 Electrical Power Engineering **S2 L/T3**

Prerequisite: PHYS1002 or equivalent (PHYS2920 or 6.851 for students in Course 3140).

The course deals with the principles and practice of electrical power apparatus, particularly the transformer, the dc motor and the ac motor. It also covers some of the electronic power converters for power supplies and for control of electrical machinery. The course commences with the basic circuit theory and phasor algebra relevant to the analysis of the above systems and then proceeds to the consideration of distribution of electrical power. It then covers the operation, analyses and characteristics of transformers, dc motors, ac motors and a few semiconductor power converter circuits. Rating and thermal consideration electrical apparatus are also treated.

ELEC0805 Electronics for Measurement and Control **SS L2 T1**

The use of electronics in mechanical systems and the processing of signals by analog and digital techniques. Revision of basic circuit theory, operational amplifier circuits and filtering. Digital logic using integrated circuits. Microcomputers and Microprocessors. Techniques for A/D and D/A conversion, measurement system interfacing to microprocessors.

ELEC0931 Industrial Elective

ELEC0932 Industrial Elective

ELEC0933 Industrial Elective

Prerequisites for ELEC0931, ELEC0932, ELEC0933: Students must be in at least the third stage of part-time BE degree course and be in full-time approved employment or be pursuing an approved sandwich course. New enrolments in the part-time BE or sandwich course are not accepted, as those courses are no longer offered.

Each Industrial Elective represents one year of appropriate quality concurrent industrial experience for students in approved full-time employment. Students must submit evidence and a written report to the satisfaction of the Head of School. Some attendance at the University for verbal reporting may also be required.

A maximum of three such electives can be taken and they may be substituted for certain subjects in course 3640 requirements. The substitution is not available for work done during the first year of employment if this coincides with the first year of part-time enrolment. The period of employment claimed must precede the completion of the thesis ELEC4911. An Industrial Elective cannot be claimed for work submitted for credit as ELEC4911 Thesis. Details of the procedure for registering and the requirements to be met can be obtained from the School of Electrical Engineering.

ELEC1010 Introduction to Electrical Engineering **S1 L1 T.5**

Prerequisite:	*HSC Exam Score Range Required*
2 unit English (General) or	*53-100*
2 unit English or	*49-100*
3 unit English or	*1-50*
2 unit Cointemporary English	*60-100*

Introduction to the nature and scope of electrical engineering, including communications, computing, electrical energy, electronics and systems. Careers for electrical engineers in public and private enterprise. Organisation, verbal and written communication and research skills in engineering.

ELEC1011 Electrical Engineering 1 **S2 L3 T3**

Co-requisite: PHYS1969 or equivalent.

Passive electrical components. Electric circuit concepts and relationship to field theory. Kirchoff's laws. Node and mesh analysis of resistive networks. Network theorems. Controlled sources. Transient conditions. Sources of periodic signals. Power in DC and AC circuits. Circuit models of diodes and transistors. Transistor switching. Combinational logic principles and circuits. Diode and transistor logic implementations.

ELEC2010 Circuit Theory **S1 L2 T.5**

Prerequisites: ELEC1011, MATH1032. Co-requisite: MATH2620 or MATH2520.

Dynamic response of linear circuits: 1st and 2nd order circuits with DC sources, introduction to higher order circuits. Sinusoidal steady state operation: phasers, impedance and admittance; dynamic response of circuits driven by sinusoidal sources; linearity, network theorems; resonance, bandwidth, and quality factor. Two-port network: parameters, circuits as filters. Power in steady-state circuits; average and reactive power, power factor, power factor correction. Three-phase circuits: balanced and unbalanced steady-state operation; real and reactive power in balanced circuits, transient analysis. Operational amplifiers and ideal transformers.

ELEC2011 Systems Theory **S2 L2 T.5**

Prerequisites: ELEC2010, MATH2610 or MATH2510. Co-requisites: MATH3150, MATH2620, MATH2520.

Continuous and discrete signals and their transformations. Properties of continuous and discrete systems. Linear time

invariant systems. Low order differential and difference equations. Diagrammatic representations of systems. Impulse responses, step responses, convolution. Frequency responses, poles, zeros. Introduction to feedback, stability. Examples of systems will be taken from areas of circuits, analog and digital electronics, power and mechanical engineering, communications and control.

ELEC2012 Digital Circuits **S2 L2 T.5**

Prerequisite: ELEC1011.

Logic functions: truth tables, Boolean expressions. Boolean algebra: laws, standard forms, algebraic simplification. Logic Gates: symbols, timing diagrams, interconnections. Gate circuits: realisations of Boolean expressions. Gate-level design: prime implicants and covers, Karnaugh maps. MSI-level design: decoders, multiplexers, ROMs, PLAs. Introduction to sequential circuits: stop-watch, traffic light sequencer examples. Astable Bistable elements: clock circuits, RS, JK, D-type flip-flops. State machines: Moore/Mealy models, state diagram from circuit analysis. Synchronous sequential circuit design: state diagram, state transition table, excitation output specification, gate flip-flop design. Registers and memories: parallel and shift registers, multifunction registers, addressable register arrays. High-level design: register transfer language, control data paths, design examples.

ELEC2015 Electromagnetic Applications **L2 T.5**

Prerequisites: PHYS2979. Excluded: ELEC2013.

Rotating magnetic fields and electromagnetic principles of machines. Transformers. Transmission lines from circuit and electromagnetic viewpoints. Electromagnetic radiation and electromagnetic interference.

ELEC2016 Electrical Design and Practice **S1 L1 T1 S2 L1 T4**

Prerequisites: ELEC1011, ELEC1010, PHYS1969. Co-requisites: ELEC2010, ELEC2020, ELEC2012. Excluded: ELEC2110, ELEC2111, ELEC2014.

Concepts of product design: specification, design methodology, project management, costing for prototype production, testing. Electronic circuit design - device specifications, thermal dissipation, passive component choices, tolerances. Electronic circuit analysis and design using computer aids. Electronic circuit prototyping techniques: wirewrapping, PCB layouts (using computer aids), interconnection technologies, earthing. *Laboratory practice*: Experimental work on digital and analog devices and circuits. Group Project including design, production and test.

ELEC2020 Analog Electronics **S2 L2 T.5**

Prerequisites: ELEC2010, PHYS2989 or PHYS2859

Operating principles and terminal characteristics of PN diodes, bipolar and field effect transistors, and thyristors. Small signal models of devices, including h-parameter model. Analysis and design of low-frequency Class-A amplifiers, including choice of biasing method.

ELEC2130 Electrical Engineering – LAB2A **S1 T1**

Prerequisites: ELEC1011, PHYS1969. Co-requisite: ELEC2010. Excluded: ELEC2110.

Experiments in electric circuits. The use of the computer aided circuit analysis package SPICE. Laboratory Technique.

ELEC2131 Electrical Engineering – LAB2B **S2 T2**

Prerequisites: ELEC2130, ELEC2010, COMP2021. Co-requisite: ELEC2030. Excluded: ELEC2111.

Experimental work on digital and analogue circuits, devices and systems. Computer aided experimental work.

ELEC3010 Introduction to Electrical Energy **S1 L2 T.5**

Prerequisites: ELEC2015.

Introduction to energy systems: overview of electricity generation, transmission, distribution, storage and utilisation. Transformers: equivalent circuit, elimination of harmonics. Per-unit system. Thermal rating of equipment. Electrical machines: fundamentals and applications. Small electrical machines. Introduction to power electronics: single- and three-phase switching of electrical power.

ELEC3011 Integrated Electronics **S1 L2 T.5**

Prerequisite: ELEC2020.

Analysis and design of bipolar and field effect transistor amplifiers. Applications of negative feedback. Differential amplifiers. Properties and applications of operational amplifiers. Analysis and design of sinusoidal oscillators.

ELEC3012 Signals, Spectra and Filters **S1 L2 T.5**

Prerequisites: ELEC2011, MATH3150. Co-requisite: MATH2849, MATH2859.

Analysis and processing of continuous and discrete signals: frequency response, transfer functions, and convolution. Generalised Fourier analysis: autocorrelation, cross-correlation and power density spectra. Linear system relations, ideal filters and distortionless transmission. Random signal theory: modelling random signals, nonlinear devices, linear system identification using cross-correlation. Analogue filters: poles and zeros, stability, implementations with operational amplifiers and lumped elements. Sampled systems: sampling theorem, interpolation and reconstruction, aliasing and quantisation. Elementary digital filters: data smoothing by moving average and first order filters. Differentiators and integrators. The z-transform: transfer functions, poles and zeros, stability.

ELEC3013 Communication Systems 1 **S2 L2 T2**

Prerequisite: ELEC3012 or ELEC3032.

Overview of information acquisition, transmission and processing. Aims to enable students not specialising in this field to understand the communication problems they are likely to meet in their career, and to provide a background if they intend to specialise in communications. Topics: analogue to digital conversion (sampling, quantising, aliasing, pulse code modulation, delta modulation, time and frequency division multiplexing). Modulation and demodulation (amplitude, frequency and phase modulation, signal to noise ratio, noise figure, error probability, bandwidth, spectrum, intersymbol interference). Communication systems (radio wave propagation, antennas and arrays, modems, repeaters, equalisers, line coding).

ELEC3014 Systems and Control 1 **S2 L2 T2**

Prerequisite: ELEC3012 or ELEC3032.

Consolidation and extension of basic material on continuous-time and discrete-time systems, and the relationships between them. Includes dynamic systems modelling, block diagrams, signal flow graphs, frequency and time domain relationships, stability criteria, Nyquist diagrams

and root locus methods. Also includes introductory state space analysis.

ELEC3015 Electrical Energy S2 L2/T2

Prerequisite: ELEC3010.

Electrical energy supply systems: Principles of operation and planning. DC machines, induction machines and synchronous machines. Variable speed drives. Applications of power electronics. Lighting, heating, air-conditioning and refrigeration. Electrical equipment for hazardous atmospheres.

ELEC3016 Electronic Signal Processing S2 L2/T2

Prerequisites: ELEC3011 or ELEC3031, ELEC3012 or ELEC3032.

Electronic techniques for generation and shaping of wave-forms. Comparators and Schmitt triggers. Pulse and delay generators - monostables. Astable and relaxation oscillators. Active RC filters and switched capacitor filters. Signal sampling and multiplexing. A/D and D/A converters.

ELEC3020 Microprocessors and Interfacing S1 L2 T0.5

Prerequisite: ELEC2012. Excluded: COMP3221.

Concepts of a microprocessor system: address spaces, memory devices, bus timing and standards, the VME bus. Input/output interfacing: polling and interrupts. DMA interfaces. The 68000 family and assembly programming language. Other microprocessors.

ELEC3031 Integrated Electronics + Laboratory S2 L2 T2.5

Prerequisite: ELEC2020.

Analysis and design of bipolar and field effect transistor amplifiers. Applications of negative feedback. Differential amplifiers. Properties and applications of operational amplifiers. Analysis and design of sinusoidal oscillators. Includes the appropriate laboratory component from ELEC3110 Electrical Engineering Laboratory 3.

ELEC3032 Signals, Spectra and Filters + Laboratory S1 L2 T1.5

Prerequisites: ELEC2011, MATH3150. Co-requisites: MATH2849, MATH2859.

Analysis and processing of continuous and discrete signals: frequency response, transfer functions, and convolution. Generalised Fourier analysis: autocorrelation, cross-correlation and power density spectra. Linear system relations, ideal filters and distortionless transmission. Random signal theory: modelling random signals, nonlinear devices, linear system identification using cross-correlation. Analogue filters: poles and zeros, stability, implementations with operational amplifiers and lumped elements. Sampled systems: sampling theorem, interpolation and reconstruction, aliasing and quantisation. Elementary digital filters: data smoothing by moving average and first order filters. Differentiators and integrators. The z-transform: transfer functions, poles and zeros, stability. Includes the appropriate laboratory component from ELEC3110 Electrical Engineering laboratory 3.

ELEC3110 Electrical Engineering Laboratory 3 S1 T6

Prerequisite: ELEC2016. Co-requisites: ELEC3020, ELEC3010, ELEC3011, ELEC3012.

A programme of experiments and laboratory-based design exercises in electrical energy, electronic devices and circuits, signal processing and microprocessors.

ELEC3401 Reliability Engineering for Design and Development S2 L2 T2

Prerequisite: MATH2849 attempted. Co-requisite: MATH2859. Excluded: 6.044.

Part A: Quantified reliability, maintainability, availability achievement in design and development. Prediction of RAM. Redundancy design. Fault tree analysis. FMECA. Life cycle cost. RM programme management, including Design Review. Selection of components, materials and processes. Procurement specifications. *Part B:* Failure mechanisms. Environmental factors in design. Thermal design. Vibration and shock design. Developmental testing. Reliability growth programmes. Assessment of test results. Accelerated testing. Qualification testing.

ELEC3402 Introductory Physiology for Engineers S1 L2 T2

An introduction to biophysics and physiology for engineers. Cells, tissues and organ systems with emphasis on their functional and regulatory characteristics and their interaction. An introduction to computer models of physiological control systems demonstrating their value in understanding the dynamics of complex neural, hormonal and circulatory responses to changes in homeostasis.

ELEC4010 Introduction to Management for Electrical Engineers S1 L3 T1

Prerequisite: ELEC2016.

The purpose of this subject is to introduce students to key management concepts and techniques in the content of electrical engineering. Topics to be discussed will be taken from accounting, economics, finance, marketing, decision-making techniques, operations research, project and strategic management, human resources, industrial relations and law.

ELEC4011 Ethics and Electrical Engineering Practice S2 L1 T1

Prerequisite: ELEC4010.

An introduction to the ethical issues associated with electrical engineering practice. The role of the professional expert in society will be discussed and the nature of the decision making process will be examined. Social, political, environmental and economic considerations in decision making will be explored using case studies.

ELEC4042 Signal Processing SS L2 T3

Prerequisite: ELEC3012.

Analysis and processing of continuous-time (analog) and discrete-time (digital) signals and systems. Sampling and digital processing of analog signals, interpolation and decimation. Design of finite and infinite duration impulse response (FIR and IIR) digital filters: approximation, computer aided design and filter structures; implementation in hardware and software; quantization and finite wordlength effects. Programmable digital signal processors. Nonlinear filtering techniques. The discrete Fourier transform (DFT), faster Fourier transform (FFT) algorithms and applications. Processing and analysis of random signals and noise; mean square estimation of signals in noise. Wiener filters and linear prediction. Adaptive systems: least mean-square designs, adaptive filter structures and applications to equalization and echo and noise cancellation. Spectrum estimation.

ELEC4202 Power Systems **SS L2 T3**

Prerequisite: ELEC3015.

Review of basic concepts used in power systems analysis: phasers, complex power, systematic network analysis, three phase systems, the per-unit methodology. Some aspects of power systems analysis, including load flow and fault analysis. Distribution systems. An introduction to power system protection. Power systems planning: electricity pricing, demand side options, co-ordinated pricing and planning, practical tariffs.

ELEC4215 Industrial Electrical Systems **SS L2 T3**

Prerequisite: ELEC3015

The design, operation, maintenance and efficiency of large industrial electric power systems. Protection and detailed fault calculations. Choice and use of protective equipment, including circuit interrupters, surge diverters and personnel protection. Testing of equipment and relevance of Standards (including loading specifications, safety and general wiring procedures). Insulation systems, their design and practical limitations. High voltage testing techniques and their use in insulation assessment of high, medium and low voltage industrial systems.

ELEC4216 Electrical Drive Systems **SS L2 T3**

Prerequisite: ELEC3010.

Electrical Drive Systems. Elements of Drive Systems and their requirements for servo and industrial drive applications. Drive representation, quadrant operation, dynamic and regenerative braking. Transfer function representations of dc motor and converter and drive performance analysis. Performance analysis of induction motor drives with variable voltage, voltage source, current source and variable frequency supply. Performance analysis of synchronous and reluctance motors with variable frequency supply. Transducers in electric drive systems. Computer aided design.

ELEC4240 Power Electronics **SS L2 T3**

Prerequisites: ELEC2020, ELEC3010, MATH3150. Excluded: 6.212.

The course will be of interest to intending electronic specialists who want to know about techniques of designing high current electronic circuits using devices in the switching mode rather than in the linear mode as well as to power specialists who want to know of techniques of power conversion by other than electromechanical means. The course starts with coverage of the full spectrum of modern power semiconductor devices, their characteristics - both static and switching, their drive circuit design and protection techniques including the snubber. Topologies of power electronic circuits for applications in controlled rectification, inversion, dc-dc conversion and ac-ac conversion, their control techniques and characteristics will then be treated. Effects of power electronic circuits on supply systems will also be covered.

ELEC4303 Electromagnetic Wave Propagation **SS L2 T3**

Prerequisite: ELEC2015.

Fundamental concepts and analytical techniques of guided wave propagation. Transmission line theory, Smith Chart, impedance matching, waveguide theory, coaxial lines, rectangular and circular waveguides. Poynting theorem. Troposheric and ionospheric propagation. Basic antenna theory. Aperture antennas. Phase arrays.

ELEC4313 Optical Communications **SS L2 T3**

Prerequisite: ELEC4303.

Theory of multimode and single mode optical fibres. Measurements of fibre characterisation calculation of fibre bandwidth optical sources and transmitters. Optical detectors and receiver design. Power Budget calculation.

ELEC4323 Digital and Analog Communications **SS L2 T3**

Prerequisites: ELEC3013, MATH3150, MATH2859.

Theory and practice of modern digital and analog communications systems. Sampling, digital multiplexing, pulse shaping. Nysquist's criteria, error probability. Analog to digital convertion, quantisation and companding, pulse code modulation, delta modulation. Transmission media, line coding, digital carrier systems, signal space, optimun detection. Information theory, (channel capacity, source coding, compact codes, error control coding). Analog modulation: amplitude modulation, angle modulation. Multilevel transmission, minimum shift keying, matched filters, correlation receivers.

ELEC4333 Communications Systems 2 **SS L2 T3**

Prerequisites: ELEC3013, ELEC3016.

Modern communications systems from a systems point of view. Topics selected from: radar: Fundamentals of radio systems, CW radar, MTI and Pulse Doppler radar, tracking radar, synthetic aperture radar, electronic navigation aids, radio direction finding, VOR and dopper VOR, DME, hyperbolic systems of navigation aids, television systems: Monochrome and colour television systems, teletext, terrestrial and satellite TV transmission, the MAC transmission format and HDTV systems; satellite communications systems: satellite channel, antenna systems, effect of rainfall and atmospheric losses, receiver noise, link analysis, satellite transponders, FDMA, TDMA, CDMA, mobile satellite communications systems.

ELEC4351 Data Communication and Computer Networks **SS L3 T2**

Prerequisites: ELEC3013, ELEC3020.

Data communications. Error detection coding and synchronisation. Physical layer standards and modems. IEEE-488 instrument bus. Principles of data networks and queuing theory. HDLC data link layer. ISDN and X.25 packet switching. Local area networks. Contention and token passing systems. Laboratory work covers experiments on physical, data link and network layer protocols in a practical network.

ELEC4352 Data Networks 2 **SS L3 T2**

Prerequisite: ELEC4351.

Data transmission on telephone networks. Local area network interconnection. Analysis of protocols for data link, network and transport layers. TCP/IP protocols. Operating system views of communications; network protocol drivers, network servers.

ELEC4412 Systems and Control 2 **SS L2 T3**

Prerequisites: ELEC3012, ELEC3014.

This subject discusses the analysis and design of control systems using both classical and state-space design methods. The emphasis will be discussed where appropriate. The course covers: Process modelling by physical analysis. Experimental methods and systems identification. Classical PID control and discrete PID implementation. Classical frequency response and root locus design for continuous systems. Discrete and

continuous state space theory, including controllability, observability, solution of state equations and pole placement design by matrix and transfer function methods. Observers. Optimal control. Multivariable transfer function models. Decoupling control. Relative gain array. Nonlinear systems stability and design for algebraic non-linearities. Lyapsinov and Popov theorems.

ELEC4413 Digital Control **SS L2 T3**

Prerequisites: ELEC3014, MATH2849, MATH2859.

Covers the design and implementation of digital control systems. The topics covered include: identification of discrete-time model parameters; pole placement and lineal-quadratic controller design; observers; noise models and stochastic systems; minimum valiance controllers; Kalman filtering; LQG control; introduction to ideas of adaptive control and robustness. Aspects of implementation are constantly emphasized.

ELEC4432 Computer Control and Instrumentation **SS L2 T3**

Prerequisites: ELEC3014, ELEC3020, ELEC3016.

Design, evaluation and implementation of computer and microprocessor based control systems and instrumentation. The program is laboratory intensive. Topics covered include software systems for process control, the organisation of hardware systems for computer control, programmable logic controllers, robust implementation of digital controllers, smart sensors and instrumentation networks.

ELEC4483 Biomedical Engineering **SS L2 T3**

Prerequisites: ELEC3402, ELEC3014, ELEC3016.

Application of signals and systems theory to the analysis and computer modelling of dynamic properties of physiological systems. Topics include descriptions of typical biomedical signals, statistical properties of signals, optimal filtering of physiological signals, ARIMA stochastic models of time series, forecasting or prediction methods, estimation of transfer function - noise models using least squares procedures, identification of multivariable nonlinear systems, computer modelling of stochastic signals and dynamic systems, and physiological adaptive control processes. Several laboratory experiments will be run concerned with computer simulation and analysis of models of cardiac, respiratory and nervous systems.

ELEC4503 Advanced Electronic Circuits **SS L2 T3**

Prerequisites: ELEC2020, ELEC3011 (ELEC3016 recommended).

Electronic devices circuits and subsystems for use in communications and signal processing. The emphasis is on high performance applications which require an understanding of device behaviour and advance circuit design techniques. Topics include: high frequency models for bipolar and field effect devices, noise in systems, tuned amplifiers, power amplifiers, controlled gain amplifiers, AGC, multipliers, modulators and phase-locked loops.

ELEC4512 Semiconductor Devices **SS L2 T3**

Prerequisite: ELEC3011.

Principles of operation and circuit characteristics of a range of semiconductor devices including bipolar diodes and transistors, MOS devices and circuits, charge-coupled devices, solar cells, light-emitting diodes, and semiconductor lasers. The lectures are supplemented by experimental work with a selection of these devices.

ELEC4522 Microelectronics Design and Technology **SS L2 T3**

Prerequisites: ELEC3011, ELEC3016.

Review of technology for bipolar and MOS integrated circuits. Device models, layout rules, the relationship of parameters to processes. Analog circuit modules: current mirrors, compound transistors, differential pairs and multipliers. Operational amplifiers and voltage regulators. Bipolar logic: S&TTL and compound functions. MOS and CMOS logic. Analog MOS circuits, switched capacitor filters and other selected topics. The use of SPICE in circuit simulation. The laboratory program is aimed at understanding the internal design of some standard IC functions.

ELEC4532 Integrated Digital Systems **SS L2 T3**

Prerequisites: ELEC2012 or COMP2021

Integrated circuit logic families with emphasis on MOS technologies, structured chip design, custom and semi-custom approaches, system architecture, computer aided design, layout considerations, timing estimates, circuit failures, faults, fault modelling, testing, design for testability.

ELEC4540 Applied Photovoltaics **SS L2 T3**

The use of solar cells (photovoltaic devices) as electrical power supplies based on the direct conversion of sunlight into electricity. The emphasis is placed on applications including system design and construction, although the properties of sunlight, the operating principles of solar cells and the interaction between sunlight and the cells are also treated.

ELEC4903 Industrial Training

Students enrolled in courses 3640, 3725 and 3720 must complete a minimum of 60 days' industrial training. At least some of this must be obtained in Australia. Overseas employment must have prior approval. Students are required to submit to the School evidence from their employers confirming completion of the prescribed training and a report, typically 500 words long, summarising the work done and training received. Experience claimed as an industrial elective covers requirements for this subject.

ELEC4910 Thesis Part A

ELEC4911 Thesis Part B

This is done in the last two sessions of the BE degree course. for full-time students, six hours per week in the first session, and twelve hours per week in the second session are devoted to directed laboratory and research work on an approved subject under guidance of members of the lecturing staff. Part-time students may need to attend the University full-time in their final session or attend for one further part-time session, if facilities are not available for the thesis to be done at work. Generally, the thesis involves the design and construction of experimental apparatus together with laboratory tests. Each student is required to present a seminar, and a written thesis must be submitted on each project by the Tuesday of the fourteenth week of Session 1 or Session 2.

Environmental Engineering

Environmental Engineering is a course offered by the School of Civil Engineering.

Majors:- Two of the following Majors (other subject descriptions are to found elsewhere in the Handbook).

CIVL4017 Water Engineering **S2 L4T2**

Prerequisites: CIVL3402, CIVL3007.

Selection of 4 topics from:

Water Resources
The evaluation of water resources planning and management alternatives (the "rational" approach). Water and politics. Water and law.

Hydrology
Introduction to flood estimation. Runoff routing methods of estimating flood hydrographs - principles of methods, description of models, calibration, application of computer models on PC's and mainframe. Extreme flood estimation. Evapotranspiration.

Numerical Modelling of Free Surface Flow
An introduction to one-dimensional and two-dimensional numerical models of unsteady gradually varied canal, river and flood plain flows.

Public Health Engineering
Sewerage systems. Wastewater treatment plant design. Effluent disposal as related to the control of receiving water quality and effluent reuse. Water supply systems. Water treatment.

Advanced Hydraulics
Hydraulic modelling. Introduction to unsteady flow in open channels.

Coastal Engineering
Design of ocean outfalls. Ocean wave statistics. Shoaling of waves at a coastline. Introduction to coastal processes.

CEIC0030 Environmental Protection in the Process Industries **S2 L3T3**

Prerequisites: CIEC0010, CHEN3070, CEIC0020.

Selection of 3 topics from:

Environmental Pollutants
The characteristics of pollutants in air and water. Consequences of pollution by aqueous, gaseous and solid wastes; case histories. Standards and regulations; legislative aspects. Measurement, analysis and sampling - modern techniques of environmental chemical analysis.

Pollution Control Techniques
Water - primary, secondary and tertiary treatment. Air - removal of particles, chemicals and odours. Solid - disposal procedures. Noise - reduction techniques.

Water Pollution Control Engineering
Screening. Settling tank design. Coagulation and flocculation (colloid chemistry, double-layer theory and flocculation theory). Clarifier design.

Filtration technologies - deep bed filtration. Biological treatment plant design - trickling filters - activated sludge processes (and variants) - anaerobic digesters. Sludge processing and disposal.

Air Pollution Control
Case histories, statistics. Single component failure, failure rate data. Reliability theory, series, parallel and redundant systems. Hazard and operability studies. Quantitative risk assessment - hazard identification - failure frequency - consequence calculations (preliminary methods). Laboratory safety.

Laboratory for Environmental Analysis
14 hour laboratory unit developing techniques in modern environmental analysis.

Advanced Environmental Protection
This comprises a series of elective strands which build upon the core subject as follows:

1. Advanced treatment methods (water)
2. Advanced treatment methods (air)
3. Hazardous wastes
4. Computer-aided risk assessment
5. Advanced laboratory
6. Occupational Health Laboratory

GEOG9110 Soil Erosion and Conservation **S L2T4**

Climatic, vegetational, geomorphic and pedologic controls of erosion. Physical processes of sediment transport and deposition. Conservational measures for the prevention of erosion including constructional and management practices. Methods of assessing soil loss risk and erosion hazard evaluation.

CIVL4027 Geotechnical and Transport Engineering **S2 L3T3**

Prerequisites: CIVL3402, CIVL3804.

Four topics selected from:

Soil engineering. Rock engineering. Foundation engineering. Geotechnical engineering. Advanced pavement design. Theoretical soil mechanics. Concrete technology.

Theory of land use/transport interaction - travel demand and transport supply. Economic social and environmental assessment. Analysis of impacts of transport activity: accidents, noise, air pollution, intrusion and energy consumption.

Fuel Technology

Fuel Technology is a department within the School of Chemical Engineering and Industrial Chemistry.

FUEL0020 Fuels and Energy **S2 L2 T2**

A servicing subject for students in Electrical Engineering which deals with sources and properties of fuels and energy, energy use patterns, principles of combustion, combustion calculation, the technology of boilers and other fuel plant, thermodynamic cycles, new and emerging energy technologies, including solar, wind and nuclear energy.

Geography

GEOG1031 Environmental Processes **S1 L2 T2**

Excluded: GEOG1051, GENS4240.

Essential and continuing links between components of the physical environment. Movement of energy and matter in the physical environment, including consideration of Earth's energy balance, the hydrological cycle, nutrient cycles in vegetation and soil, imbalances leading to land degradation and instability, to and movement of materials.

GEOG2021 Introduction to Remote Sensing **S2 L2 T2**

Prerequisite: Successful completion of a Year 1 program in Applied Science, Science or Arts or equivalent as approved by the Head of School.

Principles and technical aspects of remote sensing. Forms of available imagery, their utility and facilities for interpretation. Basic airphoto interpretation techniques relevant to environmental assessment. Introduction to principles of the electromagnetic spectrum, photometry and radiometry. Sensor types, image formation and end products associated with selected satellite programs, including Landsat. Land-cover and land-use interpretation procedures in visual image analysis. Basic procedures in machine-assisted image enhancement.

GEOG2032 Geomorphology **S2 L2 T3**

Prerequisites: GEOG1031 or GEOG1051 or GEOL1201.

Hillslope materials, processes and form; models of slope and landscape evolution. Fluvial geomorphology including water movement and sediment transport in river channels, hydraulic geometry, channel patterns, river types, flood plain formation, alluvial fans, river channel changes. Erosional and depositional landforms in coastal, arid, humid and glacial environments. Field work in fluvial and hillslope geomorphology, and laboratories on field measurements of geomorphic processes, sediment analyses and airphotograph interpretation.

GEOG3011 Pedology **S2 L2 T3**

Prerequisites: GEOG1031 or GEOG1051 and one of CHEN1101 or CHEM1401 or both GEOL1101 and GEOL1201 or both BIOS1011 or BIOS1021.

Methodology of pedogenic studies and the application of these studies to the understanding of soil-landform relationships. Soil physical and chemical properties and their interrelationships, emphasizing clay-mineral structure and behaviour, soil solution chemistry, soil water movement and the application of these properties to elements of soil mechanics. Soil properties in natural, rural and urban landscapes, including assessment of soil fertility, swelling characteristics, dispersibility, erodibility and aggregate stability. Laboratory analysis of soil physical and chemical characteristics with emphasis on properties associated with land capability assessment. Statistical analysis of soil data and its application to mapping. The use of soil micromorphological and mineralogical studies in pedology.

GEOG3021 Biogeography **S1 L2 T3**

Prerequisites: GEOG1031 or GEOG1051 or both BIOS1011 and BIOS1021.

Distribution of taxa. Floras of the Southern Hemisphere with particular reference to Australia. Endemic, discontinuous and relict taxa. Dispersal and migration of species. Origin, evolution and geological history of Angiosperms. The development of the Australian biogeographic element. Study of the recent past to understand present distributions of taxa. The role of humans and climatic change on Australian vegetation. Detection of pattern and association and their causes. Classification, ordination and mapping of vegetation. Ecology of selected Australian vegetation types. Management of vegetation in different climate regimes.

GEOG3032 Remote Sensing Applications **S2 L2 T2**

Prerequisite: GEOG2021 or SURV8711.

Spectral characteristics of natural phenomena and image formation. Ground truthing, collection and calibration. Introduction to computer classification procedures. Multitemporal sampling procedures, image to image registration and map to image registration. Major applications of remote sensing in the investigation of renewable and non-renewable resources to include: soils, geology, hydrology, vegetation, agriculture, rangelands, urban analysis, regional planning, transportation and route location and hazard monitoring.

GEOG3042 Environmental Impact Assessment **S2 L2 T2**

Prerequisites: GEOG1031 or GEOG1051 or by permission from Head of School.

Rationale and basic objectives; standardized types of environmental impact assessment EIA, including matrix approach, adopted methods of EIA in Australia. Frequently used assessment and predictive techniques for meteorological, hydrological, biological, socio-economic impacts. Techniques of impact evaluation in terms of socio-economic criteria. Environmental decision making and planning under conditions of uncertainty. Case studies exemplifying procedures, techniques and issues. Trends, changes and possible future developments in EIA. Practical exercises representing components of typical EIAs.

GEOG3051 Soils and Landforms **S1 L2 T2**

Prerequisite: GEOG3011 or GEOG2032 or GEOG2081 or by permission from Head of School.

Organization of soil material: stratigraphic layers versus profiles. Models of soil formation zonal, leaching and landscape approaches. Australian and international soil classification systems. Soil development on hillslopes: texture contrast soils. Floodplain landforms: river terraces and chrono-sequences. Lithoand chrono-stratigraphic use of soils in residual aeolian, fluviatile and coastal deposits.

GEOG3062 Environmental Change **S2 L2 T2**

Prerequisite: Successful completion of a Year 2 Programme in Applied Science, Science, or Arts or equivalent as approved by the Head of School.

The nature of environmental change on the land, oceans, biosphere and atmosphere. Evolution of the continents, oceans, life and atmosphere. Techniques for environmental reconstruction and chronology building. Quaternary climatic change and modelling. Human impact on the atmosphere and climatic consequences.

GEOG3211 Australian Environment and Natural Resources **S1 L2 T2**

Prerequisite: GEOG2032 or GEOG1051.

Continental and regional patterns of land, water and energy resources in Australia and its territorial waters, and natural factors affecting their development, including climate, soils and

terrain; problems of limited surface and underground water resources and of conflicting demands, exemplified through particular basin studies; comparable reviews of energy, minerals and forest resources, human resources and development.

Applied Geology

GEOL5100 Geology for Civil and Environmental Engineers **S1 L2 T1**

An introduction to mineralogy, petrology, structural geology, stratigraphy and geomorphology. Weathering of rocks and development of soils. The role of the geologist in civil and environmental engineering.

Industrial Chemistry

Industrial Chemistry is a department within the School of Chemical Engineering and Industrial Chemistry.

INDC4120 Chemistry of the Industrial Environment **S1 L2 T1**

Prerequisites: CHEM1101, CHEM1201

Soil chemistry. Occupational diseases. Smogs and acid rain. Toxic elements and compounds. Toxic waste disposal. Industrial accidents. Atmospheric structure and chemistry. Greenhouse warming. The Ozone hole. Nuclear energy. Alternative energy sources. Water analysis. Air analysis. Occupational health.

Law

LAWS3410 Environmental Law **SS Hpw4 C3**

Statutory and common law regulation of access to, and use and management of, natural resources, and the theories and policies underlying such regulation. The focus is upon land, water and air, involving a detailed treatment of pollution and land use control, attempting to draw out the techniques (for example, licensing and standards setting) which are common to attempts at legal regulation of resources. Emphasis is on the law as it operates in practice. Students are encouraged to take an interest in ongoing environmental debates and to carry out fieldwork. Specific attention to the part played by the exercise of political and administrative discretion in this field, the tension which exists between the various levels of government and the potential role of public participation in the decision-making process.

Manufacturing Management

Manufacturing Management is a course offered by the School of Mechanical and Manufacturing Engineering.

MANF1100 Workshop Technology **SS L1 T2**

The implementation of design and its interaction with manufacturing equipment and processes. Manufacturing capabilities and tolerancing. Approximately 30 hours of practical training including welding, fitting and machining. Students who have done Industrial Arts for the HSC, have an appropriate trade or certificate course qualification, or are suitably employed, may qualify for exemption from this subject.

MANF1110 Manufacturing Technology **S2 L/T3**

Co-requisites: MECH1300, MECH1100, MECH1400.

Description of the processes classified as: forming from liquid or solid, material removal, material joining. Elementary mechanics of forming and cutting processes. Analysis of the primary functions of machine tool structures and their operation. Relationship between product design and manufacture processes. Elementary functional analysis of product designs, including linear loop equations, limits and fits, dimensional accuracy of processes and alternate design and manufacturing strategies.

MANF3200 Product Design and Manufacturing Technology **S L/T 4**

Prerequisites: MECH2100, MECH2400. Co-requisite: MANF3410. Excluded: 18.403.

Design of products so that they can be manufactured economically. Material on: geometric analysis of product designs and the technology and economics of manufacturing, assembly, storage and transportation processes provides a basis for rational process selection and the refinement of product design to suit the chosen manufacturing methods.

MANF3300 Design of Manufacturing Facilities 1 **S2 L/T 4**

Prerequisites: MANF3200, MANF3410, MATH2839. Co-requisite: MANF3500. Excluded: 18.303.

The design of workplace elements in which operations such as assembly, measurement and loading/unloading are performed by a human operator or robot. Material on: documentation of manufacturing processes, characteristics of human operators and robots, workplace and methods design, measurement of workplace element characteristics.

MANF3400 Engineering Economics **S1 L/T 2**

Prerequisite: MECH1500. Excluded: 18.603.

An analytic framework for decision making from an economic viewpoint which included: cost information, engineering and investment decision, cost/benefit analysis, replacement analysis, capital recovery models, breakeven analysis and decision trees.

MANF3410 Quality Systems 1 **S1 L/T 4**

Prerequisites: MANF1110, MATH2839, MECH3000. Excluded: 18.003, MANF4429.

An introduction to the role of national and international standards in manufacturing, the principle and technology underlying dimensional metrology. The design and analysis of

experiments to investigate the performance of manufacturing processes and introductory statistical process control.

MANF3500 Computers in Manufacturing 1 **S2 L/T 4**

Prerequisites: MANF1110, MECH1500, ELEC0805. Excluded: 18.224.

The selection and use of computer-controlled devices such as robots, machines and vehicles in manufacturing systems: components of computerized systems. Control of devices by PLCs and computers is also examined.

MANF3600 Information and Decision Making Technology 1 **S1 L/T 4 S2 L/T 2**

Prerequisites: MECH1500, MATH2839. Excluded: MANF3609, MANF4610, MANF9620, MANF9629.

An introduction to the quantitative aspects of decision making and relevant computing tools including: decision theory, data modelling and data base management systems, operations research, spreadsheets, fourth generation languages and decision support systems.

MANF3800 Introduction to Numerical Methods **S2 L/T 1.5**

Prerequisites: MECH1500, MATH2009. Excluded: 18.003.

An introduction to the processes, data structures and numerical algorithms required for the solution of engineering problems including: numerical solution of equations, sets of simultaneous equations interpolation, differentation and integration.

MANF4010 Manufacturing Systems Design **S2 L/T4**

Students will work in project teams to perform a complete manufacturing system design, involving activities such as: selection of a product for manufacture, engineering and industrial design, design for manufacture, process selection, tolerance optimization, manufacturing system system design, including selection of production elements, workplace design, factory layout, production control system, detailed budget, containing discounted cash flow analysis, projected position and income statements.

Prominent engineers will give lectures on their experiences. topics covered formally will include: steps in starting up a company, statutory requirements, finance, feasibility analysis, manufacturing goal setting, industrial design, import replacement, the economic environment of manufacturing.

MANF4300 Design of Manufacturing Facilities 2 **S2 L/T4**

Prerequisite: MANF3300.

Introduction to plant layout design; strategies and criteria for locating a manufacturing facility; process locations, safety aspects. Materials handling system: automatic guided vehicles, conveyor systems, robots. Storage and retrieval systems: palletization, warehousing, containers, overhead cranes, forklifts, robots. Simulation of various systems: computerized manufacturing facilities planning, including simulation and associated data acquisition and manipulation.

MANF4400 Engineering Management **S1 L/T2**

Prerequisite: MANF3400. Excluded: 18.603

Engineering and management, summary of macro- and micro-economic issues from an engineering management perspective, management science models, marketing management, the legal environment of business, industrial relations, engineering project management, quality assurance and total quality management, entrepreneurship and management of technical change and innovation.

MANF4410 Quality Systems 2 **S1 L/T2**

Prerequisites: MANF3410. Excluded: MANF4429, MANF9410.

Management and philosophies of quality systems; quality planning in design and manufacture; selection of quality systems and statistical process control; total quality - quality circles and zero defects; accreditation for quality; economic selection of quality systems; preparation and use of quality manuals - national and international standards; legal aspects of product design and quality; some experiments and analyses for statistical process control; case studies/project.

MANF4420 Management of Manufacturing Systems **S1 L/T6 S2 L/T2**

Prerequisites: MANF3400, MANF3410, MANF3600. Excluded: MANF4429.

Nature and scope of manufacturing management, key bases for competition, Porter's model, manufacturing performance factors and their strategic significance; meaning of waste, value added and total quality; design for manufacture and the market; basic dynamics of materials flow in an organization. Demand forecasting and master planning, role of inventory, production smoothing. Production control, bottlenecks and capacity constraining resources, product and layout rationalization, mechanics of scheduling. Purchasing, vendor selection, vendor performance monitoring; physical distribution, warehouse location and operations. Maintenance management: planning and control, total preventative maintenance. Role and fit of packaged approaches: MRP, JIT, OPT.

MANF4500 Computers in Manufacturing 2 **S1 L/T2**

Prerequisite: MANF3500.

Introduction to computer integrated manufacture (CIM): what is CIM, skills required when designing and implementing CIM, unsolved problems in CIM. Integration: CAD, CAM, CAD/CAM integration technology, MAP/TOP. Flexible Manufacturing Systems (FMS): FMS system architecture, material handling and storage systems in FMS, auxiliary devices in FMS, FMS operation control. Project on cmputer integration with data aquisition and control.

MANF4600 Information and Decision Making Technology 2 **S1 L/T4**

Prerequisites: MECH1500, MATH2839. Excluded: MANF3609, MANF4610, MANF9620, MANF9629.

Combinatorial optimization; integer and dynamic programming; branch and bound technique; elementary multiple-criteria decision analysis; goal programming; examples from production planning and scheduling. Data, information and knowledge; problem decomposition; techniques for knowledge representation; rule-based systems; examples from manufacturing process planning, scheduling, and diagnostic maintenance. Intelligent DSS: deductive databases; integration of algorithmic and knowledge-based problem solving approaches; examples from process planning and scheduling. More advanced simulation topics; discrete event simulation languages; factory simulation packages; simulation model and experimental design. Organizational issues; distributed vs centralized decision making, knowledge bases and data bases; goal integration; importance of common

data and procedural semantics for coordinated decision making; examples from CIM environments.

MANF4610 Operations Research **F L2 T1**

Prerequisites: MECH1500, MATH2009, MATH2839. Excluded: 6.646.

The formulating and optimisation of mathematical models. The development of decision rules. Some techniques of operations research such as mathematical programming, queuing theory, inventory models, replacement and reliability models; simulation. These techniques applied to situations drawn from industrial fields, eg production planning and inventory control. Practical problems of data collection, problem formulation and analysis.

Servicing Subjects

These are subjects taught within courses offered by other schools and faculties.

MANF0400 Production Management **F L2 T1**

Prerequisites: MATH2021, MATH2841.

Engineering economy: Economic objectives of the firm. *Economic measure of performance:* net present value, annual equivalent value and the DCF rate of return (including the incremental rate of return) and their application in the selection and replacement of processes and equipment. *The use of human and physical resources*: Methods engineering, ergonomics, motion and time study, financial incentives, applications to machine controlled processes, work sampling and data collection. Plant location, factory layout. Production and quality control: Control of jobbing, repetitive batch and continuous production. Manufacturing organisations, functions, inter-relationships and information flow. Sampling techniques in quality control, control charts. Introduction to inventory control: Analysis of some engineering planning decisions. Introduction to operational research: The formation and optimisation of mathematical models of industrial processes. The development of decision rules. Some techniques of operational research and applications, eg mathematical programming, queuing theory, inventory models, simulation.

MANF0401 Production Management A **S1 L3**

Prerequisites: MATH2021, MATH2841 or MATH1011, MATH1021, FIBR2201.

Use of human and physical resources: Methods engineering, ergonomics, motion and time study, financial incentives, applications to machine controlled processes, work sampling and data collection. Plant location, factory layout. *Production and quality control:* Control of jobbing, repetitive batch and continuous production. Manufacturing organisations, functions, inter-relationships and information flow. Sampling techniques in quality control, control charts. *Introduction to inventory* control: Analysis of some engineering planning decisions.

MANF0402 Production Management B **S2 L3**

Prerequisites: MANF0401.

Engineering economy: Economic objectives of the firm. Economic measure of performance: net present value, annual equivalent value and the DCF rate of return (including the incremental rate of return) and their application in the selection and replacement of processes and equipment. *Introduction to operational research:* Formation and optimisation of mathematical models of industrial processes. Development of decision rules. Some techniques of operational research and applications, eg mathematical programming, queuing theory, inventory models, simulation.

MANF0410 Industrial Management **S1 L/T5**

Prerequisites: MATH2120, MATH2849, MATH2859.

This subject is intended primarily for Electrical Engineering students.

Engineering economy: economic objectives of the firm. *Economic measures of performance:* net present value, annual equivalent value and the DCF rate of return (including the incremental rate of return) and their application in the selection and replacement of processes and equipment. *Introduction to operational research*: The formation and optimisation of mathematical models of industrial processes. The development of decision rules. Some techniques of operational research and applications, eg mathematical programming, queuing theory, inventory models, simulation, critical path networks. *The use of human and physical resources:* Methods engineering, ergonomics, motion and time study, financial incentives, applications to machine controlled processes, work sampling and data collection. Plant location, factory layout. Production and quality control: Control of jobbing, repetitive batch and continuous production. Manufacturing organisations, functions, inter-relationships and information flow. Sampling techniques in quality control, control charts. *Introduction to inventory control:* Analysis of some engineering planning decisions.

MANF0600 Operations Research

Introduction to operational research: The formation and optimisation of mathematical models of industrial processes. The development of decision rules. Some techniques of operational research and applications, eg mathematical programming, queuing theory, inventory models, simulation.

Mathematics

MATH1032 Mathematics 1 **F L4 T2**

Prerequisite:	*HSC Exam Score Range Required†*
2 unit Mathematics or*	*67-100*
2 and 3 unit Mathematics or	*100-150*
3 and 4 unit Mathematics or	*100-200*

**This refers to the 2 unit Mathematics subject which is related to the 3 unit Mathematics subject. It does not refer to the subjects Mathematics in Society or Mathematics in Practice.*

†These numbers may vary from year to year.

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

MATH1042 Higher Mathematics 1 **F L4 T2**

Prerequisite:	*HSC Exam Score Range Required†*
2 and 3 unit Mathematics	*145-150*
or	
3 and 4 unit Mathematics	*186-200*

**This refers to the 2 unit Mathematics subject which is related to the 3 unit Mathematics subject. It does not refer to the subjects Mathematics in Society or Mathematics in Practice.*

†These numbers may vary from year to year.

As for MATH1032 Mathematics 1, but in greater depth.

MATH1081 Discrete Mathematics **S1 L4 T2**

Co-requisite: MATH1032 or MATH1042.

Role of proof in mathematics, logical reasoning and implication, different types of proofs. Sets, algebras of sets, operations on sets. Mathematical logic, truth tables, syntax, induction. Graphs and directed graphs, basic graph algorithms. Counting, combinatorial identities, binomial and multinomial theorems. Binary operations and their properties, groups and semigroups, ordered structures. Recursion relations. Application to network theory, assignment problems and population growth.

MATH1090 Discrete Mathematics for Electrical Engineers **S1 L2T1**

Co-requisites: MATH1032 or MATH1042. Excluded: MATH1081

The role of proof in mathematics, logical reasoning and implication, different types of proofs. Sets, algebra of sets, operation on sets, mathematical logic, truth tables, syntax, induction. Recursion, recursive logic, recurrence relations.

MATH2009 Engineering Mathematics 2 **F L2 T2**

Prerequisite: MATH1032.

Differential equations, use of Laplace transforms, solutions by series; partial differential equations and their solution for selected physical problems, use of Fourier series; introduction to numerical methods; matrices and their application to theory of linear equations, eigenvalues and their numerical evaluation; vector algebra and solid geometry; multiple integrals; introduction to vector field theory.

MATH2100 Applied Mathematics 2 – Vector Calculus **S1 or S2 L1.5 T.5**

Prerequisite: MATH1032 Excluded: MATH2110.

Properties of vectors and vector fields; divergence, gradient, curl of a vector; line, surface, and volume integrals. Gauss and Stokes' theorems. Curvilinear co-ordinates.

MATH2110 Higher Applied Mathematics 2 – Vector Analysis **S1 L2 T.5**

Prerequisite: MATH1042 or MATH1032 CR. Excluded: MATH2100.

As for MATH2100 but in greater depth.

MATH2120 Applied Mathematics 2 Mathematical Methods for Differential Equations **S1 or S2 L1.5 T.5**

Prerequisite: MATH1032. Excluded: MATH2130.

Introduction to qualitative and quantitative methods for ordinary and partial differential equations. The following topics will be treated by example. Ordinary differential equations: linear with constant coefficients, first order systems, singularities, boundary-value problems, eigenfunctions, Fourier series. Partial differential equations: characteristics, classification, wave equation, heat equation, Laplace equations, separation of variables methods.

MATH2130 Higher Applied Mathematics 2 – Mathematical Methods for Differential Equations **S2 L2 T.5**

Prerequisite: MATH1042 or MATH1032 CR. Excluded: MATH.2120.

As for MATH2120 but in greater depth.

MATH2200 Applied Mathematics 2 Discrete Dynamical Systems **S2 L1.5 T.5**

Prerequisite: MATH1032. Co-requisite: MATH2501, Excluded: 10.2215.

The study of dynamical systems whose states change at discrete points in time. Difference equations, general properties. Linear systems, stability, oscillations, z-transforms. Nonlinear systems, critical points, periodic cycles, chaotic behaviour. Applications selected from engineering, biological, social and economic contexts.

MATH2220 Applied Mathematics 2 – Continuous Dynamical Systems **S2 L1.5 T.5**

Prerequisite: MATH1032. Excluded: 10.2216.

The study of continuous dynamical systems. One-dimenional systems, kinematic waves, applications include traffic flow and waves in fluids. An introduction to the modelling of physical, biological and ecological systems, stability, oscillations and resonance.

MATH2400 Pure Mathematics 2 – Finite Mathematics **S1 L1.5 T.5**

Prerequisite: MATH1032 or MATH1042.

Positional number systems, floating-point arithmetic, rational arithmetic, congruences. Euclid's algorithm, continued fractions, Chinese remainder theorem, Fermat's theorem, applications to computer arithmetic. Polynomial arithmetic, division algorithm, factorization, interpolation, finite field. Codes, error-correcting codes, public-key cryptography.

MATH2501 Pure Mathematics 2 – Linear Algebra **F L1.5 T1 or S1 or S2 L3 T2**

Prerequisite: MATH1032 or MATH1042 or Excluded MATH2601.

Vector spaces, linear transformations, change of basis, inner products, orthogonalization, reflections and QR factorizations, Eigenvalues and eigenvectors, diagonalization Jordan forms and functions of matrices. Applications to linear systems of differential equations, quadratics, rotations, Laplace transforms.

MATH2510 Pure Mathematics 2 – Real Analysis **S1 or S2 L1.5 T1**

Prerequisite: MATH1032 or MATH1042 or Excluded MATH2610.

Multiple integrals, partial differentiation. Analysis of real valued functions of one and several variables.

MATH2520 Pure Mathematics 2 – Complex Analysis **S1 or S2 L1.5 T1**

Prerequisite: MATH1032 or MATH1042 or Excluded MATH2620.

Analytic functions, Taylor and Laurent series, integrals. Cauchy's theorem, residues, evaluation of certain real integrals.

MATH2601 Higher Pure Mathematics 2 – Linear Algebra **S2 L4 T.5**

Prerequisite: MATH1042 or MATH1032 CR. Excluded MATH2501, MATH3500.

As for MATH2510, but in greater depth, and with additional material on unitary, self-adjoint and normal transformations.

MATH2610 Higher Pure Mathematics 2 – Real Analysis **S1 L2 T.5**

Prerequisite: MATH1042 or MATH1032 CR. Excluded MATH2510.

As for MATH2510 Pure Mathematics 2 Real Analysis but in greater depth.

MATH2620 Higher Pure Mathematics 2 – Complex Analysis **S1 L2 T.5**

Prerequisite: MATH1042 or MATH1032. Excluded MATH2520.

As for MATH2520 Pure Mathematics 2 Complex Analysis, but in greater depth.

MATH2801 Theory of Statistics 2 – Probability and Random Variables **S1 L3 T1**

Prerequisite: MATH1032 or MATH1042 or MATH1021 (CR). Excluded: MATH2901, MATH2819, MATH2841, BIO2041

Probability, random variables, standard discrete and continuous distributions, multivariate distributions, transformations, random sampling, sampling distributions, limit theorems.

MATH2810 Theory of Statistics 2 – Statistical Computing and Simulation **S1 L1.5 T.5**

Prerequisite: MATH1032 or MATH1042 or MATH1021(CR). Co-requisite: MATH2801.

Introduction to APL, random variables, univariate transformation, simulation of random variables, APL programming, integer value random variables, random walks – theory and simulation, introduction to Markov chains.

MATH2821 Theory of Statistics 2 – Basic Inference **S2 L3 T1**

Prerequisite: MATH2801. Excluded: MATH2921, MATH2819, MATH2841, BIO2041.

Point estimation: general theory, estimation by moments, maximum likelihood, interval estimation with general theory and application, hypothesis testing using Neyman Pearson theory, linear regression and prediction, analysis of variance.

MATH2829 Statistics SU **S1 L2.5 T.5**

Prerequisite: MATH1032 or MATH1042.

Introduction to probability theory, random variables and distribution functions, sampling distributions, including those of t, chi^2 and F. Estimation procedures, including confidence interval estimation with an emphasis on least squares and surveying problems, and computer based exercises.

MATH2830 Theory of Statistics 2 – Nonparametric Statistical Inference **S2 L1.5 T.5**

Prerequisite: MATH2801. Co-requisite: MATH2821.

Order statistics, exact and approximate distributions, multinomial distributions, goodness of fit, contingency tables, one-sample and two-sample estimation and inference problems.

MATH2839 Statistics SM **F L1.5 T.5**

Prerequisite: MATH1032 or MATH1042.

Introduction to probability theory, with finite, discrete and continuous sample spaces. Random variables: the standard elementary distributions including the binomial, Poisson and normal distributions. Sampling distributions: with emphasis on those derived from the normal distribution: t, chi^2 and F. Estimation of parameters: the methods of moments and maximum likelihood and confidence interval estimation. The standard test of statistical hypotheses, and, where appropriate, the powers of such tests. An introduction to regression and the bivariate normal distribution.

MATH2841 Statistics SS **F L1.5 T.5**

Prerequisite: MATH1032 or MATH1021(CR). Excluded: MATH2801, MATH2821, MATH2901, MATH2921, MATH2819, BIOS2041.

An introduction to the theory of probability, with finite, discrete and continuous sample spaces. The standard elementary univariate distributions: binomial, Poisson and normal, an introduction to multivariate distributions. Standard sampling distributions, including those of X^2, t and F. Estimation by moments and maximum likelihood (including sampling variance formulae, and regression); confidence interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction to experimental design; fixed, random and mixed models.

MATH2849 Statistics SE1 **S1 or S2 L1.5 T.5**

Prerequisite: MATH1032 or MATH1042. Excluded: 10.361.

Introduction to probability theory, random variables and distribution functions; the binomial, Poisson and normal distributions in particular. Standard sampling distributions including those of X^2 and t.

MATH2859 Statistics SE2 **S1 or S2 L1.5 T.5**

Prerequisite: MATH2849.

Estimation by moments and maximum likelihood; confidence interval estimation. The standard tests of significance with a discussion of power where appropriate.

An introduction to linear regression, auto-regression. Probability limit, law of large numbers and central limit theorem. Multivariate normal distribution. Stochastic processes in discrete and continuous time; Poisson and Gaussian processes.

MATH2869 Statistics SC **S1 or S2 L1.5 T.5**

Introduction to probability. Random variables. Elementary distribution. Statistical inference. Point estimation. Confidence intervals.

MATH2901 Higher Theory of Statistics 2 – Probability and Random Variables **S1 L3 T1**

Prerequisite: MATH1032 or MATH1042. Excluded: MATH2801, MATH2819, MATH2841, BIOS2041.

As for MATH2801 but in greater depth.

MATH2910 Higher Theory of Statistics 2 – Statistical Computing and Simulation **S1 L1.5 T.5**

Prerequisite: MATH1032 or MATH1042. Co-requisite: MATH2901.

As for MATH2810 but in greater depth.

MATH2921 Higher Theory of Statistics 2 – Basic Inference **S2 L3 T1**

Prerequisite: MATH2901. Excluded: MATH2821, MATH2819, MATH2841, BIOS2041.

As for MATH2821 but in greater depth.

MATH2930 Higher Theory of Statistics 2 – Nonparametric Statistical Inference **S2 L1.5 T.5**

Prerequisite: MATH2901. Co-requisite: MATH2921.

As for MATH2830 but in greater depth.

MATH3101 Applied Mathematics 3 – Numerical Analysis **S1 L3 T1**

Prerequisite: At least two level 11 mathematics units, including any course prerequisites. Excluded: MATH3141, 10.222A

Analysis of some common numerical methods. Iterative methods for solving nonlinear equations; interpolation using polynomials, splines and trigonometric functions; least-squares approximation and orthogonal function; numerical differentiation and intergration: extrapolation; finite difference methods for initial value problems for ordinary differential equations; iterative techniques for large systems of linear equations.

MATH3141 Electrical Engineering – Mathematics 3 Numerical and Mathematical Methods **S2 L2.5 T1**

Prerequisites: MATH2501, MATH2510, MATH2100. Excluded: MATH2120, MATH2130, MATH3101, 10.222A.

Numerical and Mathematical Methods for Electrical Engineering. Numerical Methods: Solution of linear and non-linear algebraic equations, interpolation and extrapolation, numerical quadrature, solution of ordinary differential equations, computational methods for matrix eigenvalues and eigenvectors. Mathematical Methods for Partial Differential Equations: Separation of variables methods, generalized Fourier series, Bessel functions, Legendre polynomials.

MATH3150 Electrical Engineering Mathematics 3 – Transform Methods **S2 L1.5 T.5**

Prerequisites: MATH2100, MATH2520. Excluded: 10.033, 10.2921.

The mathematics of signals and linear systems. General Fourier series. Fourier, Laplace and related transforms. Delta-distributions and others and their transforms. Discrete Fourier and Z-transforms. Applications to spectral analysis, autocorrelation, uncertainty and sampling, linear analog and digital filters, partial differential equations.

MATH3181 Applied Mathematics 3 – Optimal Control **S2 L3 T1**

Prerequisites: A total of 2 level II mathematics units which must include either MATH2100 or MATH2510. Excluded: 10.222M.

An introduction to the optimal control of dynamical systems. Mathematical descriptions of dynamical systems. Stability, controlability, and observability. Optimal control. Calculus of variations. Dynamic programming.

Examples and applications are selected from biological, economical and physical systems.

Materials Science and Engineering

MATS1002 Microstructural Analysis **S1 L1T2**

Specimen preparation techniques. Principles of optical micriscopy. Quantitative microscopy and sterology. Electron microscopy. Microcmical analysis.

MATS1042 Crystallography and X-Ray Diffraction **S2 L2 T2**

Introduction to crystallography, crystal structure, Bravais lattices, Miller indices. Miller-Bravais indices. Production, absorption and diffration of X-rays. Powder and single crystal X-ray methods. Stereographic projections. Applications of diffraction methods to solid solutions and solubility limit. Thermal Abalysis, stress measurement, X-ray fluorescence spectroscopy chemical analysis.

MATS1062 Mechanical Properties of Materials **S1 L2 T2**

Prerequisite: 5.0011. Co-requisite: 4.412A.

Mechanical properties of solids. Nature and significance of mechanical properties. Mechanical testing; the tension test, hardness testing and impact testing. Stress-strain-time relationships. Analysis of stress and strain, stress and strain transformation relationships, Mohr's circle, elastic stress-strain relationships, application to various types of loading and metal working processes. Failure and yeilding criteria. Influence of stress state, temperature, strain rate and environment on mechanical behaviour.

MATS1072 Physics of Materials **S2 L2 T1**

Pre-requisite: PHYS1002.

Interatomic bonding in solid materials. Types of interatomic bonds, metallic, covalent, ionic. Introductory quantum mechanics in one dimension, free electron theory, effects of periodic potential, density of states curves. Effect of electron to atom ratio on conductivity and crystal structure; semiconductors; instrinsic, extrinstic. Exchange energy; ferromagnetism, antiferromagnetism. Elementary perturbation theory, covalent bond; crystal structures, properties. Ionic bond, crystal structures, force models, properties.

MATS1083 Non-ferrous Alloys **S2 L1 T2**

Metallography of non-ferrous alloys. Structure/property relationships in non-ferrous alloys. Hardening mechanisms. Metallography and properties of copper, aluminium, nickel, magnesium, lead, tin and titanium based alloys.

MATS1253 Ferrous Alloys **S1 L1 T2**

Ferrous alloys. Iron-carbon Phase equilibrium diagrams. Microstructure and properties of plain carbon steels. Austenite decomposition under equilibrium and non-equilibrium conditions. Dilatometry. Heat treatment of steels. Surface hardening treatments. Microstructure and properties of ordinary cast irons, including grey, white, mottled, malleable and ductile irons.

MATS1263 Alloy Steels **S2 L1 T1**

Alloy steels. Ternary equilibria involving iron and carbon. Metallography and properties of alloy steels. Effects of alloying elements on austenite formation and decomposition under equilibrium and non-equilibrium conditions. Heat treatment of alloy steels. Metallography and properties of alloy cast irons.

MATS4363 Origins of Microstructure
Units 1, 2, 3, 4

Unit 1 Phase equilibria S1 L1 T1
Phase rule. Two-component systems: free energy-composition and temperature-composition diagrams, solubility limits, compound formation, invariants. Three-component systems: isothermal sections and liquidus projections. Solidifaction and crystallization; cooling curves, crystallization paths.

Unit 2 Diffusion S1 L1 T1
Fick's first and second laws. Solutions for short and long times by analytical and numerical methods. Boundary conditions for solid-fluid and solid-solid interfaces. Diffusion couples. Atomic level diffusion theory.

Unit 3 Metallography and phase equilibrium laboratory S1 T3
Determination of equilibrium phase diagrams. Solidification processes in moulds Metallography of non-ferrous alloys.

Unit 4 Phase transformations S2 L2 T1
Solidification: single phase, eutectic and near-eutectic, pertectic. Diffusional transformations: precipitation, ripening, cooperative transformations, TTT and CCT curves. Diffusionless transformations: crystallography, nucleation and growth modes.

MATS9323 Mechanical Behaviour of Materials (Units 1,2,3)

Unit 1 Deformation S1 L2
Atomic and molecular description of deformation. Introduction to dislocation theory and its application to mechanical properties. Chain dynamics under stress.

Unit 2 Fractographic Analysis S2 L1 T1
Classification of macroscopic and microscopic fracture mechanisms. Initiation and propagation of ductile, brittle, fatigue, creep, stress corrosion, and corrosion fatigue fractures. Effect of material defects, design deficiencies and incorrect processing on the origin and cause of fracture. Analysis of various modes of fracture using fractographic techniques involving optical microscopy and scanning and transmission electron microscopy.

Unit 3 Deformation and Strengthening Mechanisms S2 L1 T1
Strengthening mechanisms, creep, fracture, grain size dependence of strength. Introduction to generation of deformation and recrystallization textures. Measurements of age-hardening, activation energy of strain ageing.

MATS9520 Engineering Materials L2 L/T1
Microstructure and structure-property relationships of the main types of engineering materials (Metals, Ceramics, Polymers and Composites). Micromechanisms of elastic and plastic deformation. Fracture mechanisms for ductile, brittle, creep and fatigue modes of failure in service; corrosion. Metal forming by casting and wrought processes. Phase Equilibria of alloys; microstructural control by thermomechanical processing and application to commerical engineering materials. Laboratory and tutorial work includes experiments on cast and recrystallised structures, ferrous and non-ferrous microstructures and fracture and failure analysis.

MATS9530 Materials Engineering S1 or S2 L2 T1
Materials used in Mechanical Engineering and related fields (Manufacturing Engineering Management, Aerospace Engineering, Naval Architecture) are discussed with emphasis on the dependence of properties and performance on microstructure. Aspcets of materials selection during the design of engineering components which affect the service performance in applications where failure can occur by brittle fracture, corrosion, creep or fatigue, will also be discussed.

MATS9640 Materials Science and Engineering for Electrical Engineers S2 L3 T1
Metallic, ceramic, organic, polymeric and composite materials and their technology for electrical engineering applications. Structures and structure property relations, phase equilibria and their effect on mechanical, electrical, magnetic , thermal and chemical properties. The shaping, treating and joining of materials. Aqueous and gaseous corrosion. Metallic glasses, superconductors, fast ion conductors. The role of materials science in the development of electrical energy systems.

Mechanical Engineering

Mechanical Engineering is a course offered by the School of Mechanical and Manufacturing Engineering.

MECH1000 Professional Studies 1 S1 L/T1

Prerequisite:	*HSC Exam Score Range Required*
2 unit English (General) or	*53-100*
2 unit English	*49-100*
3 unit English or	*1-50*
2 unit Contemporary English	*60-100*

Excluded 5.061.

NOTE: If these prerequisites are not met, other remedial English studies can be taken concurrently.

To assess abilities in written expression; to develop a consciousness of the importance of written, pictorial and oral expression in engineering life; to begin to develop these skills, emphasising the significance of logical structure; to begin to develop an awareness of the professional attitude.

MECH1100 Mechanical Engineering Design 1 S1 L/T S2 L/T2

Co-requisite: MECH1000.

Introduction to hardware. Studies of a range of engineering components, considering: what they do, how they do it, how they were made, the range of possible forms for each item, why each item has its particular form. Design philosophy. Design as the formulation and implementation of practical ways of fulfilling needs, including: recognising the need, generalising the question, considering a range of solutions, selecting a short-list, analysing the selected range, making a final choice. Commercial philosophy. Impetus for design, market competition, significance of innovation, intellectual property, financing, manufacturing, marketing, etc.

MECH1110 Graphical Analysis and Communication **S2 L1 T2**

Excluded: MECH0160, MECH1110, MECH0130.

Descriptive geometry as the basis of analysis and synthesis of spatial relationships: points, lines, plans, solids, intersections. Orthographic and other projection systems. Engineering drawing as a means of definition and communication, selection of views, construction of drawings, conventions, dimensions and tolerancing. Introduction to computer-based drafting systems.

MECH1300 Engineering Mechanics 1 **S1 or S2 L2 T2**

Prerequisite:	*HSC Exam Score Range Required*
Either	
2 unit Science (Physics) or	*53-100*
3 unit Science or	*90-150*
4 unit Science multistrand	*1-50*
or	
2 unit Industrial Arts (Engineering Science) or	*53-100*
3 unit Industrial Arts (Engineering Science)	*1-50*

Excluded MECH0330, MECH0360

Note: Students who wish to enrol in this subject in courses other than the full-time courses in Aerospace Engineering, Electrical Engineering, Manufacturing Management, Mechanical Engineering and Naval Architecture can make up for the lack of the prerequisite by work taken in Physics in the first half of the first year.

Equilibrium. Friction. Systems of multiforce members, co-plantar and three-dimensional. Mass centre; centroid. Fluid statics. Plane particle kinematics: rectilinear, curvilinear and relative motion. Plane particle kinetics: equations of motion; work, power, energy; impulse, momentum, impact.

MECH1400 Mechanics of Solids 1 **S1 or S2 L2 T1**

Co-requisite: MECH1300.

Stress and strain. Bars under axial loading. Stresses and deformation due to bending. Strain energy. Flexibility and stiffness. Stress and deformation due to torsion. Helical springs.

MECH1500 Computing 1 M **S2 L/T3**

Introduction: history, applications, hardware, software, a model of a computer system, editors, operating systems. Program design and development: programming objectives, data structures, algorithms, symbolic names, translation of algorithms, steps in programming, programming style, syntax charts, errors and debugging. Data: data types, declarations, input output, file control. Programming constructs: arithmetic expressions, assignment, relational and logical expressions, selection, iteration, intrinsic functions, statement functions, subprograms, common, communication. Applications using existing programs: sorting, word processing, graphics and plotting, simultaneous linear algebraic equations. The computer language employed in this subject is FORTRAN.

MECH2000 Professional Studies 2 4 contact hours total

Prerequisite: MECH1000.

To introduce the student to the engineering working environment. To get the student curious about the engineering environment. To give further practice in report writing. Preparation for Industrial Training; Industrial Training, report on Industrial Training.

MECH2100 Mechanical Engineering Design 2 **F L1 T2**

Prerequisites: MECH1300, MECH1100, MECH1400, MECH1110, MANF1110. Co-requisites: MECH1000, MECH2300, MECH2400, MECH2600, MECH2700, MATS9520

Design of basic engineering elements and simple systems. Selection and specification of materials and manufacturing processes for engineering items. Communication by means of engineering drawings (including tolerances) of manufacturing information for simple structures and assemblies. Application of standards and trade literature to design. Simple design-and-make project to meet a published specification and to demonstrate the product's performance.

MECH2300 Engineering Mechanics 2A **S1 or S2 L2 T1**

Prerequisites: MECH1300, PHYS1002 or PHYS1919, MATH1032 or MATH1042.

Kinetics of systems of particles; plane steady mass flow. Plane kinematics and kinetics of rigid bodies: moment of inertia; motion relative to translating and rotating frames of reference; equations of motion; work and energy, impulse and momentum. Virtual work for static and dynamic systems. Kinematics and kinetics of simple mechanisms.

MECH2310 Engineering Mechanics 2B **S1 or S2 L/T2**

Co-requisite: MECH2300.

Differential equations of motion. Transverse vibrations of beams. Whirling of shafts. Single degree-of-freedom systems: free, forced, undamped and damped vibrations. Transmissibility.

MECH2400 Mechanics of Solids 2 **F L1.5 T2**

Prerequisites: MECH1400, MATH1032 or MATH1042.

Mechanical properties of materials: tensile and compressive behaviour; hardness; testing machines. Analysis of stress and strain at a point (2D, 3D, Mohr's Circles); generalised Hooke's Law; modulus of rigidity; bulk modulus; interdependence of elastic moduli; strain energy (total, volumetric and distortion); yield criteria; combined loads in beams; fatigue, stress concentrations, Miner's Rule; membrane stresses; bending of composite beams; bending and unsymmetrical beams; direct shear stresses in beams, shear centre; elastic and inelastic buckling of columns.

MECH2600 Fluid Mechanics 1 **F L1 T1**

Prerequisites: MECH1300, PHYS1002 or PHYS1919, MATH1032 or MATH1042. Co-requisite: MECH2300.

Units. Fluid properties; fluid statics. Flow fields; unsteady and compressible flow. Bernoulli's equation. Momentum equations. Ideal flow. Flow measurement. Dimensional analysis: similitude; dimensionless numbers; methods of analysis. Steady one dimensional flow in ducts: laminar and turbulent; pressure loss; friction factor; losses in bends and fittings. Elementary boundary layer flow; skin friction and drag. Pumps and turbines.

MECH2700 Thermodynamics 1 **F L1 T1**

Prerequisites: MECH1300, PHYS1002 or PHYS1919 MATH1032 or MATH1042.

Work, energy, power. Units. Systems, states and processes. Control mass and volume. Fluid properties: extensive; intensive. Equation of state. Tables of properties. First law of thermodynamics. Non-flow processes: reversible; irreversible.

Flow processes: energy equation; enthalpy. Ideal processes and cycles. Reversibility. The second law of thermodynamics. Entropy. Isentropic processes. Cycles for engines and heat pumps. Energy conversion efficiency. Reciprocating pumps; compressors; engines. Energy analysis; P-V diagrams. Heat transfer.

MECH3000 Professional Studies 3 **S2 L/T2**

Prerequisites: MECH2000, MECH3010. Co-requisite: MECH3200.

Technical report writing (linked with Engineering Experimentation). Oral reports on Industrial Training 1. Professional ethics, responsibility, liability and intellectual property. Preparation for Industrial Training 2.

MECH3010 Industrial Training 1 **S1**

Practical work in industry at the process or shop floor level to gain experience of people, industrial problems and relations, and process equipment. (Report submitted in Session 1 detailing involvement and experience gained prior to Year 3.)

For details contact Mr. G. Crawford, Industrial Training Officer.

MECH3100 Mechanical Engineering Design 3 **F L2 T1**

Prerequisite: MECH2100. Co-requisites: MECH3300, MECH3400.

Mathematical modelling in design with applications. More advanced design analyses, component and assembly design and drawing with individual and group projects of an interdisciplinary nature.

MECH3200 Engineering Experimentation **F L/T1.5**

Prerequisites: MECH1110, MECH2400, MECH2600, MECH2700, ELEC0805. Excluded: 5.034.

Scientific method, engineering method; report writing; error analysis; principles of transducers; dynamic response of instruments; digital data acquisition; interfacing transducers to computers; computer control of experiments; signal processing.

MECH3211 Linear Systems Analysis **S1 L2 T1**

Prerequisites: MECH1300, MATH2009.

Models of physical systems: differential equations for physical systems including mechanical, electrical, hydraulic, thermal and pneumatic systems; linearisation. System analysis techniques: solution by Laplace transform method. Transfer functions and block diagrams. System response: response of first and second order systems to impulse step, ramp, sinusoidal and periodic inputs; higher order system response; system stability, applications.

MECH3212 Principles of Control of Mechanical Systems **S1 L2 T1**

Prerequisite: MECH3211.

Introduction to modern systems analysis. Review of modelling; nonlinear systems. Digital and analogue representations. Stability; regulation; control and optimal control. Instrumentation; actuators; interfaces; control computers; programmable logic controllers. Implementation; various case studies, including microprocessor applications.

MECH3300 Engineering Mechanics 3 **S2 L/T2**

Prerequisites: MECH2300, MATH2009.

Kinematics of gear tooth profiles; standard and non-standard gear proportions. Gear trains; epicyclic gears. Static and dynamic balancing of rotating and reciprocating mass systems.

Three-dimensional kinematics and kinetics of a rigid body: co-ordinate transformations, general screw motion, angular momentum, inertia tensor, kinetic energy, Euler's equations of motion, planetary and satellite motions, gyroscope.

MECH3310 Vibration Analysis **S2 L/T2**

Prerequisites: MECH2310, MATH2009.

Lagrange's equations of motion. Linear vibrations of multi-degree-of-freedom systems; normal modes; simple applications. Finite elements for structural dynamics; mass matrix; natural frequency and normal mode determinations; convergence; engineering applications.

MECH3400 Mechanics of Solids 3 **S1 L3 T1**

Prerequisites: MECH2400, MATH2009.

Deflections of beams and structures. Statically indeterminate beams and structures. Introduction to theory of elasticity; stress, strain, torsion. Membrane analogy. Finite element stress analysis. Basic concepts; structural stiffness method; bar, triangular and rectangular finite elements.

MECH3500 Computing 2M **S1 L/T2**

Prerequisites: MECH1500. Exluded: MECH4509.

Techniques for writing, debugging and documenting elegant, portable, robust and reliable programs quickly and economically. Material on the programming environment, programming style, numerical precision, storage management, database processing and program libraries. The computer languages employed in this subject are FORTRAN and C.

MECH3600 Fluid Mechanics 2 **S1 L/T2**

Prerequisites: MECH2300, MECH2600, MECH2700, MATH2009 Excluded: 5.630, 5.653, 5.663.

Dimensional Analysis, dynamic similarity, turbomachines; incompressible, inviscid flow; compressible flow.

MECH3701 Thermodynamics 2 **S1 L/T2**

Prerequisites: MECH2300, MECH2600, MECH2700. Excluded: 5.623, 5.624, 5.636.

Availability - open and closed systems; general thermodynamic relations; kinetic theory of gases; non-reactive ideal gas mixtures; high-temperature gas properties; combustion.

MECH3702 Heat Transfer **S2 L/T2**

Prerequisites: MECH3600, MECH3701. Excluded: 5.636.

Basic concepts of heat transfer, units, dimensions; conduction, convection, radiation, boiling and condensation; heat exchangers.

MECH3800 Numerical Methods **S2 L2 T1**

Prerequisites: MECH1500, MATH2009.

Numerical methods for solution of non-linear equations, linear and non-linear systems, ordinary and partial differential equations.

MECH4000 Thesis **F T6**

Co-requisite: MECH4001.

To be taken in year of completion of course.

For students in the BE degree courses in the School of Mechanical and Manufacturing Engineering.

MECH4001 Professional Studies 4 **S2 L/T2**

Prerequisites: MECH3000. Corequisite: MECH4000, MECH4002. Excluded: MECH4019.

Development of skills in the use of various media of communication. Presenting oral and written reports. Conference organization and participation. Group projects in communications.

MECH4002 The Engineer in Society **S2 L/T2**

Prerequisite: MANF4400. Co-requisite: MECH4001.

Reading, instruction and project work concerned with the organisational, environmental and social aspects of engineering.

The subject is intended to integrate a student's prior and current studies over the range of scientific, technological and contextual areas and general education. Students will undertake socially directed projects in large groups and follow them up with more reflective individual tasks.

This subject satisfies the requirements of Category C of the General Education Program.

MECH4010 Industrial Training 2 **S1**

Practical work in industry at the professional level to gain experience in design, development, investigation or management control systems areas in collaboration with professional engineers. (Report submitted in Session 1 detailing responsibilities and experience gained in vacation period between Years 3 and 4.)
For details contact Mr. G. Crawford, Industrial Training Officer.

MECH4020 Group Engineering Project S1 L/T6 or F L/T3

Group approach. Subject integrates the engineering science and creativity aspects of previous years. Students work in groups on an engineering project selected via the School's Program structure in conjunction with industry. Aspects of the project include, where appropriate, a basic assessment of the market development of the design and other engineering features, consideration of environmental and safety impacts, procedures for manufacture and/or construction and the industrial design (presentation and packaging of the completed item). Management skills are to be promoted with students' participation in a manner similar to those used in industry teams. Industry participation is to be used where possible in assessment.

MECH4110 Design Project **F L1 T2**

Prerequisite: MECH3100.

Creative design and development leading to the detail design and possible building and testing of systems and devices to satisfy specified objectives of set projects.

MECH4120 Design Technology **SS L2 T1**

Prerequisite: MECH2100.

Aspects of mechanical engineering technology which form the basis for machinery design including: performance matching; hydraulic power components and circuits. Fluid couplings and torque converters; power flow analysis in multi-path machinery, and other selected topics.

MECH4130 Computer-Aided Engineering Design **SS L2 T1**

Prerequisite: MECH2100. Excluded MANF3819, MANF9630.

Mathematical modelling and analysis of component and system designs using the computer as a tool to optimise and investigate design solutions. Use of available algorithms and computer packages.

MECH4301 Plane Mechanism Kinematics S1 or S2 L2 T1

Prerequisites: MECH2300. Excluded: MECH9301.

Algebraic displacement, velocity and acceleration analyses of simple and complex planar mechanisms. Instantaneous kinematics: centrodes; inflection and Bresse circles; acceleration centre; Euler-Savary equation; cubic of stationary curvature; centring point curve. Coupler curves and their properties; curve cognates. Constraint and freedom; mobility; velocity closure of a loop; special configurations; singularities. Various methods of synthesis.

MECH4310 Advanced Vibration Analysis **SS L2 T1**

Prerequisites: MECH3310, MECH3400. Excluded: MECH9310.

Introduction to experimental vibration analysis using Fast Fourier Transform (FFT) techniques. Typical sources of vibration in machines. Analysis of continuous systems via classical and finite element techniques. Experimental modal analysis. Torsional vibrations including geared shaft systems.

MECH4321 Engineering Noise 1 **SS L2 T1**

Excluded: MECH9321.

Acoustic plane wave equation, standing waves, energy density, intensity, decibel scales. Human response, annoyance and damage criteria. Transmission between media, absorbing materials. Mufflers. Three dimensional wave equation. Transmission in ducts. Room acoustics.

MECH4322 Engineering Noise 2 **SS L2 T1**

Prerequisite: MECH4321. Excluded MECH9322.

Noise measurement, microphones, frequency analysis, transient and average measurement. Frequency weightings. Flow noise, noise from jets, fans, propellers. Noise of machines, modal response, damping.

MECH4361 Lubrication **SS L/T3**

Prerequisites: MECH2600, MATH2009. Excluded: MECH9361.

History of lubrication, types of bearings and bearing operation, nature of surfaces and their contact, modes of lubrication, properties of lubricants, viscous flow in pipes and channels, measurement of viscosity, infinitely long and short bearing approximations, one-dimensional analysis of short bearing, other slider bearing geometries, the effect of end leakage, hydrostatic or externally pressurised bearings, squeeze films.

MECH4400 General Mechanics of Solids **SS L2 T1**

Prerequisite: MECH3400. Excluded: 18.413.

Inelastic behaviour of bars, beams, shafts and columns. Thick cylinders and composite cylinders loaded by internal and external pressures; rotating discs; contact stresses. Elementary concepts of fracture mechanics; stress intensity factor; fracture toughness; crack propagation.

MECH4410 Engineering Applications of Finite Elements **SS L2 T1**

Prerequisite: MECH3400. Excluded MECH9410, AERO4400.

Introduction to finite element and associated graphics packages.

Principles of mesh design and validation. Specification of boundary conditions and use of symmetry. Solid modelling and use of mesh generators. Estimation of the cost of the solution.

Assessment of the accuracy of the results. Convergence. Applications using commercial finite element programs.

MECH4420 Plates and Shells **SS L2 T1**

Prerequisite: MECH3400. Excluded: MECH9421.

Bending of rectangular and circular plates under normal loading; thermal stresses. Shells; membrane stresses, bending stresses, discontinuities at junction of ends; design of pressure vessels.

MECH4430 Theory of Elasticity **SS L2 T1**

Prerequisites: MECH2300, MECH3400.

Mathematical foundations; analysis of stress; deformation and strain; equilibrium, motion and flow; fundamental laws of continuum mechanics; linear elasticity; viscoelasticity; applications.

MECH4440 Theory of Plasticity **SS L2 T1**

Prerequisite: MECH3400 or MANF3219.

Analysis of stress, strain, strain rate; plastic stress strain relations with description of experimental verification. Application of plasticity theory to a selection of problems including metal working processes such as extrusion and rolling and metallic friction and wear.

MECH4450 Structural Instability **S1 L1.5 T0.5**

Prerequisite: MECH3400.

Buckling of perfect and imperfect columns; bending and buckling of thin flat plates; local instability and crippling of thin-walled columns. Buckling of monocoque cylinders and curved panels. Stiffened panels. Tension field beams.

MECH4500 Computing 3M **S1 L/T2**

Prerequisite: MECH3500.

Computer environments; PC and mainframe. User and machine interfacing with terminal controls, menus, mouse and I/O hardware. Use of graphics and special packages, e.g., spreadsheets for man/machine interaction. Communications protocol, serial and parallel transmission, interrupts polling and general housekeeping routines. Use of C language and comparison with other high level languages.

MECH4600 Viscous Flow Theory **F L/T1.5**

Prerequisites: MECH2600, MECH2700, MATH2009.

Review of vector analysis and Cartesian tensors. Kinematics of fluid motion. Reynold's transport theorem. Stress in fluid motion. Cauchy's equation. Constitutive equations. Couple stresses. Dynamics of fluid motion. Navier-Stokes equations. Linear and angular momentum equations. Inviscid motion. Thermodynamics of fluid motion. Energy equation. Energy transfer equation. Dissipation function. Enthalpy and entropy. Crocco's, Bjerkne's and Kelvin's theorems. Turbulent motion. Time smoothing. Time smoothed equations of fluid motion. Vortex transport equation. Creeping flow. Similarity.

MECH4610 Hydraulic Transients **SS L2 T1**

Prerequisites: MECH3600, MATH2009.

Mass oscillations in surge systems with various types of surge tanks. Stability of surge systems, comparison with experiment. Allievi's theory of water hammer, fast and slow closures, waterhammer in pumping systems, circle diagrams.

MECH4700 Turbomachines and Engines **SS L/T3**

Prerequisites: MECH3600, MECH3701.

Definition of a turbomachine, classes and characteristic of turbomachines, sizing using dimensional analysis. Thermodynamics of axial machines. Blade element analysis of axial stage, cascade data, design of a fan. Centrifugal machines, slip factor, design of a centrifugal pump. Review of air-standard cycles in relation to real engine cycles for reciprocating engines and gas turbines. Engine control. Engine flow process. Fuel preparation, combustion and combustion chambers. Fuel air and computer generated engine cycles for reciprocating engines and gas turbines. Heat transfer calculations in engines. Turbomachinery in engines. Introduction to component matching in turbocharged reciprocating engines and gas turbines. Control of emissions from engines.

MECH4710 Convection Heat Transfer **SS L2 T1**

Prerequisite: MECH3701. Excluded: MECH9710.

Introduction: review of the mechanisms of heat transfer. Governing equations for convection: continuity, Navier-Stokes, energy. Boundary layer equations for forced and natural convection. Boundary conditions. Approximate analytical solution methods: momentum and energy integral equations. Polhausen technique. Similarity formulation. Solution by conversion to initial value problem. Finite difference methods: Finite difference approximations of partial differential equations. Consistency, stability and convergence. Application to the boundary layer and the full equations of motion and energy.

MECH4720 Solar Energy **SS L2 T1**

Prerequisites: MECH3600, MECH3709, MATH2001. Excluded: MECH9720.

Ambient energy systems. Photovoltaic systems. Solar radiation characteristics. Solar radiation measurement, data sources. Beam and diffuse components on inclined and tracking surfaces. Solar collector performance measurement. Heat transfer processes in solar collectors. Evaluation of long-term performance, heat tables, F chart and detailed simulation. Solar air heating systems, utilisability/unutilisability methods for passive space heating systems.

MECH4730 Multiphase Flow **SS L2 T1**

Prerequisites: MECH3600, MECH3701, MATH2009

Nature of multiphase flow. Gas-liquid, gas-solid, liquid-solid two phase and two-component flows. Three-phase flows. Vertical and horizontal flows. Flow patterns. Correlations. Pressure drop in two-phase flows. Isothermal flows. Flows with heat transfer. Hydraulic and pneumatic transportation of solid materials in pipelines.

MECH4740 Thermal Power Plants **SS L2 T1**

Prerequisites: MECH2600, MECH2700. Excluded: MECH9740.

Energy sources, power plant thermodynamics. Fuel, combustion processes and equipment. Boilers, turbines and condensers. Heat exchangers, pumps, water supply and treatment systems. Air circulating and heating systems. Station operation and performance. Economics of electric power production. Environmental impacts of power plants. Alternative sources of energy.

MECH4751 Refrigeration and Air Conditioning S1 L/T3

Prerequisite: MECH3702.

Psychrometry and air conditioning calculations; heating and cooling load calculations; refrigerants; vapour compression refrigeration; multipressure systems; air conditioning systems; components of refrigeration and air conditioning systems; air distribution; refrigeration and air conditioning controls.

MECH4800 Optimal Engineering Strategies S1 L2 T1

Prerequisites: MECH2300, MATH2009. Co-requisite: MECH2100.

Optimization: a selection of techniques and their applications from the calculus of variations, geometric programming, network analysis, linear programming, non-linear programming, etc. Strategies for design and analysis: system structure; variable classification; procedure generation; recycle optimisation; the adjacency matrix.

Servicing Subjects

These are subjects taught within courses offered by other schools and faculties.

MECH0130 Engineering Drawing and Descriptive Geometry S1 or S2 L1 T3

Graphic communication. First and third angle orthographic projection and isometric projection. Descriptive geometry fundamentals and their application to engineering problems with special emphasis on visualisation of problems and development of methods for their solution. Australian standard engineering drawing practice. Applications involving detail and assembly drawings, functional dimensioning and tolerancing.

MECH0160 Introductory Engineering Design and Drawing Practice S1 L/T2

Excluded MECH1110, MECH0130

This subject is intended specifically for Electrical Engineering students, and is to be taken in conjunction with MECH1300.

Introduction to engineering design: Engineering method, problem identification, creative thinking, mathematical modelling; computer-aided design; materials and processes; communication of ideas; the place of engineering in society.

Introduction to drawing practice: Graphic communication. First and third angle orthographic projection. Descriptive geometry fundamentals. Mechanical drawing practice and interpretation. Pictorial views. Theory of computer-aided drafting. Electrical drawing practice.

MECH0330 Engineering Mechanics SS L2 T2

Prerequisites: As for MECH1300 Engineering Mechanics 1.
Exclusions: MECH1300, MECH0360

Composition and resolution of forces, laws of equilibrium. Friction. Statics of rigid bars, pin-jointed frames and beams. Simple states of stress. Statics of fluids. Rectilinear motion, curvilinear motion using rectangular and natural co-ordinates. Simple rotation. Equations of motion. Work, energy and power. Impulse and momentum.

MECH0360 Introductory Engineering Mechanics

This subject is intended specifically for Electrical Engineering students, and is to be taken in conjunction with MECH0160.

Prerequisite:	*HSC Exam Score Range Required.*
Either	
2 unit Science (Physics) or	*53-100*
3 unit Science or	*90-150*
4 unit Science multistrand	*1-50*
or	
2 unit Industrial Arts (Engineering Science) or	*53-100*
3 unit Industrial Arts (Engineering Science)	*1-50*

Excluded: MECH0330, MECH1300

Equilibrium. Friction. Systems of multiforce members, co-planar and three-dimensional. Mass centre; centroid. Fluid statics. Plane particle kinematics: rectilinear, curvilinear and relative motion. Plane particle kinetics: equations of motion; work, power, energy; impulse, momentum, impact.

MECH0440 Engineering Statics S1 or S2 L2 T1

Prerequisites: As for MECH1300 Engineering Mechanics 1. Excluded: MECH1300, MECH0330., MECH0360

Composition and resolution of forces, laws of equilibrium. Friction. Statics of rigid bars, pin-jointed frames and beams. Simple states of stress. Statics of fluids.

MECH0760 Mechanical Engineering SS L3 T1

Prerequisites: PHYS1969, MATH2100, MATH2120 or equivalent.

This subject is intended specifically for Electrical Engineering students.

Properties of matter. Laws of Thermodynamics for non-flow and flow processes, entropy, efficiency and availability. Air standard and vapour power cycles. Combined cycles and cogeneration. Manometers, Bernoulli, linear and angular momentum equations. Flow measurement. Turbomachinery velocity diagrams. Incompressible and compressible flow in adiabatic ducts. Conduction, convection and radiation heat transfer with applications.

Naval Architecture

Naval Architecture is a course offered by the School of Mechanical and Manufacturing Engineering.

NAVL3100 Principles of Ship Design 1 S2 L2 T1

Development of ship and ship building. Ocean environment. Trading environment. Ship operations. Ship types. Freeboard. Tonnage. Mathematics of ship design: optimisation techniques. Mathematical modelling.

NAVL3400 Ship Structures 1 F L1.5 T0.5

Prerequisites: MECH2400, MATH2009, MATS9520

Ship structural loading and response. Bending of the hull girder – deterministic aspects. Statistical prediction of wave loads and whole girder response. Basic concepts in finite element analysis – extended beam theory. Applications of extended beam theory – hull girder analysis. Frame analysis and applications in ship structures. Ultimate strength of beams and frames. Laterally loaded grillages and stiffened panels – elastic and ultimate strength analysis.

NAVL3600 Ship Hydrostatics **F L2 T0.5**

Prerequisites: MECH1300, MECH1500, MATH1032, PHYS1919

Basic concepts and integration methods. Hydrostatic particulars and approximate formulae. Intact stability, cross curves and righting arm, stability at small angles and free surface effects, the wall-sided formula, flooding and water tight subdivision. Damaged stability. Launching calculations and docking. Representation of hull surfaces for computer applications. Analysis of hull hydrostatics and stability by an integrated computer package.

NAVL3610 Ship Hydrodynamics **F L2 T0.5**

Prerequisites: MECH2300, MECH2310, MECH2600, MATH2009,

Kinematics of irrotational flow and equations of continuity for an incompressible fluid. Stream function and use of distributed singularities to generate arbitrary body shapes. Airfoils and hydrofoils. Added mass for simple two dimensional shapes. Plane progressive water waves in both deep water and in water of finite depth. Motion of a spar buoy and derivation of coefficients in equation of motion. Linearised uncoupled motion of a ship. Coupled heave and pitch motion of a ship. Ocean waves and their properties.

NAVL4000 Ship Management Economics **S2 L1.5 T0.5**

Prerequisite: MATH2009.

Basic concepts and definitions. Interest relationships. Present worth. Average annual cost. Capitalised cost. Rate of return. Depreciation and taxation. Economic criteria. Voyage analysis. Probability in economic studies. Sensitivity analysis in economic studies. Introduction to dynamic programming. Replacement analysis of equipment, ships and shipyards.

NAVL4100 Principles of Ship Design 2 **S1 L3 T1 S2 L1.5 T0.5**

Prerequisite: NAVL3100.

Techniques of ship design. Blocking out a ship's dimensions. Weight equation. Estimation: weights, capacity, freeboard and stability. Preliminary powering and selection of main engine. Lines plan. General arrangements. Design for construction. Classification rules: scantling development, structural arrangement. Safety and protection of ships. Cargo handling arrangements. Ship building methods. Modular construction. Quality control and ship production. Contract, tendering and specification. Shipyard layout. Shipyard management. Cost estimation.

NAVL4110 Ship Design Project **S1 T3 S2 T4**

Prerequisites: NAVL3600, NAVL3610, NAVL3100. Co-requisites: NAVL4000, NAVL4100.

Each student is required to perform the following design tasks and submit the results: **1.** Rationale, specifications, weights, inboard profile. **2.** Power, capacities, freeboard, trim, stability, stern gear. **3.** Sectional area curve, lines drawing, prelim midship section. **4.** Hydrostatics, floodable length and stability curves. **5.** Powering, propeller, systems-schematic drawing, detailed capacity. **6.** Section modulus calculation, bulkhead, midship section, module concept. **7.** Final weights, capacity drawing, operational data, and evaluation. **8.** Specification.

NAVL4400 Ship Structures 2 **F L1.5 T0.5**

Prerequisites: MECH3400, NAVL3400.

Plate bending – elastic and ultimate strength analysis. Orthotropic plate bending and applications. Buckling and ultimate strength of columns. Buckling and ultimate strength of plates. Buckling of stiffened panels. Ultimate strength of stiffened panels. Ship structural materials, fatigue, fracture. Geometric stress concentration. Welded connections. Pressure hulls. Ultimate strength of hull girder. Structural optimisation methods. Automated and computer aided design.

NAVL4700 Ship Propulsion and Systems **F L/T4**

Prerequisites: NAVL3600, NAVL3610.

Ship resistance. Problems of modelling. Froude's Method and improvements. Laboratory tests. Viscous resistance, wave resistance, and other components of drag. Propulsion. Propeller terminology and momentum theory. Experiments. Design and selection of propellers. Cavitation and vibration. Manoeuvring. Theory of ship manoeuvrability. Linearized equations of motion. Determination of coefficients and trials. Rudder design. Marine Engineering systems. Steam, diesel, gas turbines, turbo- and diesel-electric, nuclear propulsion. Systems for fuel, transmission, electricity, pumps, compressors, purifiers, piping systems and automation.

Physiology and Pharmacology

PHPH2112 Physiology 1 **F L2 T4**

**Prerequisites: BIOS1011 and BIOS1021; CHEM1112 and CHEM1113 or CHEM1114; MATH1032 or MATH1042 or MATH1011 and MATH1021. Excluded: PHPH2122. Co-requisite: BIOC2312.*

In exceptional cases Chemistry 1T will be accepted as a prerequisite in the absence of Physics 1 with the permission of the Head of School.

Introduction to fundamental physiological principles, dealing first with basic cellular function in terms of chemical and physical principles, and, second, with the operation of the various specialised systems in the body, for example, the cardiovascular system, whose function it is to transport materials to and from the tissues of the body; the respiratory system which must maintain the exchange of oxygen and carbon dioxide between the atmosphere and the blood; the gastrointestinal system which enables food materials to be modified by digestion and absorbed into the circulation; the kidney which is involved in the regulation of body fluid and electrolyte balance and with the excretion of the waste products of metabolism; the endocrine system which releases chemical messengers, called hormones, that are carried in the blood stream to regulate a great variety of body functions, eg metabolism and reproductive activity; the nervous system which by means of very rapidly propagated electrical impulses is responsible for all our movements, sensations, memories, emotions and consciousness itself. A substantial series of practical class experiments on these different areas of physiology is included in the course. This subject is taken by students enrolled in any of the Physiology program.

survey techniques for urban and rural properties; the status of roads in NSW, strata plan surveys, identification surveys, consents for MHWM, railways, rivers, kerbs in Sydney. The role of coordinates in cadastral surveying.

SURV6721 Project Management 3 **S2 L1.5 T.5**

Co-requisite: SURV5721.

Project teams in a corporation. Psychology of professionals. Qualifications of a project manager. Decision making process in project management: authority, power, interaction, leadership, assignments. Human resource management: small group behaviour, learning curve, management of teams in professional practice, professional liabilities and responsibilities. Short term field planning. Logistics of field work. Case studies in the application of project management to surveying projects.

SURV6811 Land Economics and Valuation **S2 L2 T1**

The surveyor's role in the economic use of land. Variation of land use and land value. Temporal change in land use due to supply and demand, and its effect on land development and urbanisation. Location theory. public measures for directing land use. introduction to valuation; factors affecting value of land, valuation principles and practice.

SURV7051 Survey Camp 3 **S1 T7**

Prerequisites: all Year 3 subjects.

Two weeks survey camp for projects selected from areas of cadastral, engineering and geodetic surveying, followed by (one hour per week) computations, plan and report preparation at the School of Surveying.

SURV7311 Offshore Surveying **S1 L2 T1**

Introduction to offshore and hydrographic surveying. Charts. Law of the sea. Datums at sea, tides, chart datum. Review of visual fixing. Electronic position fixing. Satellite positioning techniques: navigation and kinematic GPS. Platform positioning. Elements of hydrographic surveying. Echo sounding, side scan sonar. Seafloor mapping. Applications and case histories.

SURV7511 Photogrammetry and Mapping 2 **S1 L2 T1**

Prerequisite: SURV 6511.

Aerial triangulation; semi and analytical methods, block adjustment by models and bundles, control requirements for block adjustment. Differential rectification; orthophotos. Map production; map compilation by photogrammetric techniques, map production processes. Project planning. Non-topographic methods of photogrammetry.

SURV7521 Remote Sensing and Resources Surveys **S1 L2 T1**

Land resource inventory surveys: general procedures. Remote sensing and its application to resource surveys. Variations of electromagnetic energy. Sensing systems. Elements of image interpretation. Computer assisted image analysis procedures. Sampling methods. Elementary statistics applied to areal sampling. Land classification systems. Reliability of class boundaries. Integrated resource surveys: concepts and specifications. Thematic and parametric surveys.

SURV7531 Spatial Information Systems 1 **S1 L2 T1**

Overview and background of Spatial Information Systems. Explanation of definitions and terminology; LIS, GIS, MPC. Management and institutional issues; land information as maps and records; existing systems; problems. Technological issues; digital maps and data base management; data acquisition; data storage; editing; raster and vector representations; topology. Modelling and analysis.

SURV7711 Land Management and Development Project **S1 L1 T1 S2 L1 T1**

Co-requisite: SURV7811.

Design project for a residential neighbourhood development, illustrating the interactions between a registered surveyor, design engineer and town planner. Critical site analysis, including environmental and physical constraints and the use of thematic land use maps. Structure plan design and presentation showing the broader cultural aims of the development. Plan of detailed lot layout; considerations of access, grades, building locations and environmental protection. Preparation of engineering design and plans to local government specifications and standards.

SURV7811 Land Subdivision and Development **S1 L2 T1**

Subdivision and development control in New South Wales. Administration of subdivision and development under Local Government and environmental planning and assessment legislation; procedures and legal controls. Statutory requirements for land development and subdivision of land, particularly as they apply to broad-acre subdivisions.

SURV8001 Project **S1 T1 S2 T8**

Prerequisite: all Year 3 subjects.

The project is undertaken in the final year of the BSurv Course with one hour per week in the first session and 8 hours per week in the second session. Students must undertake surveying projects or research tasks in the field or laboratory on a topic approved by the Head of School, under the guidance of academic staff. Each student is required to submit a written report in prescribed format by a specific date at the end of the second session.

SURV8011 Project Surveying **S2 L2.5 T0.5**

Co-requisites: SURV5011.

Selected topics from: monitoring of deformations and settlement of terrain, structures and machines; design and optimization of precise engineering networks; high precision distance measurement; 3-D measuring systems; computer controlled surveying; length transducers; alignment surveys; interferometer applications; collimation and auto-collimation techniques; optical tooling; principal and use of gyrotheodolite; electronic tiltmeters; inertial surveys.

SURV8221 Advanced Geodesy **S2 L2 T1**

Prerequisite: SURV 5221.

Selected topics from: space technologies including GPS for high precision positioning; satellite altimetry analysis; gravimetric geodesy; 4-D geodesy; inertial positioning technology; methods of kinematic positioning.

SURV8531 Spatial Information Systems 2 **S2 L2 T1**

Management of Land Information Systems; system lifecycle; development; costs and benefits; examples in Australia and overseas. Data management; combination of attribute and graphical data; continuous mapping; indexing; computer considerations; standards for cartography, software, hardware and communications. Future developments. Modelling and analysis with a GIS software system.

SURV8711 Professional Practice **S2 T2**
Students must complete 60 days of approved professional practice prior to the commencement of this subject. Professional practice is to be taken during the vacation periods. Students are required to provide evidence of this practice in a special log-book (available from the School). A detailed report must be submitted and a seminar must be presented summarising the work done and the experience gained during the professional practice period. Students are required to perform several practical surveying tasks (including instrument adjustment, levelling, traversing and resection) which will be examined.

Servicing Subjects

These are subjects taught within courses offered by other schools and faculties.

SURV0411 Surveying for Builders **S1 L1 T1.5 C2**
A compulsory subject. Prerequisites: nil.

Introduction. Chaining, methods of measurement, corrections, chain surveys. Level, differential levelling, booking. Contours, volumes of earthworks. Theodolite, methods of reading angles, applications in building. Traversing, setting out.

SURV0441 Surveying for Engineers **S2 L2 T2.5**
Principles of surveying; co-ordinate systems, levelling, linear and angular measurement. Traversing, tacheometry and electronic distance measurement. Areas and Volumes. Horizontal and vertical curves. Control, underground and construction surveys. Outline of photogrammetry.

SURV0491 Survey Camp
A one-week field camp for students studying SURV0441 Surveying for Engineers.

SURV0580 Mining Surveying **S1 L2 T1**
Prerequisite: SURV0441.

Revision of traverse, set out and levelling (14 hours field work).

Surface surveys. Map projections, the Integrated Survey Grid (I.S.G.). Electronic Distance Measurement. Correlation of surface surveys with I.S.G. Subsidence. Shaft plumbing. Transfer of height and coordinates. Transfer of azimuth. Gyrotheodolite. Underground mapping. Dip, fault and three dimensional coordinate calculations. Borehole surveying.

SURV0752 Remote Sensing Techniques and Applications **S1 L3 T1**
The physics of various remote sensing techniques; interpretation of conventional aerial photography in exploration; Infra-red remote sensing techniques; side-looking airborne radar; theory and applications of Landsat imagery; interpretation of Landsat photographic products. Major applications of remote sensing in the investigation of renewable and non-renewable resources to include: soils, geology, hydrology, vegetation, agriculture, rangelands, urban analysis, regional planning, transportation and route location and hazard monitoring.

SURV0901 Introduction to Mapping **S1 L1 T.5**
Mapping: map types, map reading, scale, relief, depiction of features, cartography and photogrammetry. *Remote Sensing:* cameras and other sensors. Landsat images and applications. *Cadastral surveying*: land titles, surveys, easements and covenants.

Graduate Study

Course Outlines

Faculty of Engineering Enrolment Procedures

All students re-enrolling in 1992 or enrolling in graduate courses should obtain a copy of the free leaflet *Re-Enrolling 1992* available from School Offices and the Admissions Office. This booklet provides detailed information on enrolment procedures and fees, enrolment timetables by Faculty and course, enrolment in miscellaneous subjects, locations and hours of Cashiers and late enrolments.

Graduate School of Engineering

The Graduate School of Engineering is concerned with the co-ordination and development of the graduate activities of the Faculty and provides opportunities for well-qualified graduates to engage in advanced studies and research.

The Faculty awards nine higher degrees as follows: Research – Doctor of Philosophy, Master of Engineering and Master of Surveying; Course Work Masters – Master of Biomedical Engineering, Master of Computer Science, Master of Engineering Science (available in a number of areas of specialisation), Master of Environmental Engineering Science, Master of Information Science and Master of Surveying Science. In addition, the degrees of Doctor of Science and Master of Science may be awarded for research conducted in, or in association with, the Faculty of Engineering.

The administration of the various awards including admission, progress and assessment of all higher degree and diploma candidates is conducted by the Higher Degree Committee of the Faculty under the general supervision of the Faculty of Engineering.

Conditions governing the award of higher degrees and graduate diplomas are set out later in this handbook in **Conditions for the Award of Higher Degrees.** However, conditions for the award of the degree of Doctor of Science may be found in the University Calendar.

The Faculty consists of the Schools of Civil Engineering, Computer Science and Engineering, Electrical Engineering, Mechanical and Manufacturing Engineering, Surveying and the Centres for Biomedical Engineering, and Wastewater Treatment. The Faculty is also closely associated with the following which are joint enterprises of the Faculties of Engineering and Applied Science: Centre for Groundwater Management and Hydrogeology, and Centre for Remote Sensing.

The Faculty is also actively involved with the following research centres: The Special Research Centre for Photovoltaic Devices and Systems, the Cooperative Research Centre for Aerospace Structures and the Cooperative Research Centre for Waste Management and Pollution Control.

The **School of Civil Engineering** consists of five departments: Geotechnical Engineering (foundation engineering, soil mechanics, rock mechanics, concrete technology, and pavement engineering); Engineering Construction and Management (civil engineering systems, engineering economy, project planning and management and civil engineering construction); Structural Engineering (structural analysis and design, solid mechanics, bridge engineering, concrete structures and numerical methods); Transport Engineering (planning, design, and operation of transport systems, statistical analysis, land use and transport modelling,

economic evaluations and environmental impact studies); Water Engineering (hydraulics, hydrology, water resources, waste management and public health engineering). The **Centre for Wastewater Treatment** is also located within the School. In addition to extensive laboratory facilities on the Kensington campus, the School operates laboratories at King Street, Randwick and King Street, Manly Vale. The latter complex houses the School's Water Research Laboratory and the associated Water Reference Library. The School also uses the Fowlers Gap Arid Zone Research Station for construction camps and data collection for arid zone hydrology.

The **School of Computer Science and Engineering** is grouped around the following activity areas: Artificial Intelligence, Formal Methods and Software Engineering, Computer Architectcure and VLSI Design, Information Science, Algorithms and Programming Techniques, Networks and Operating Systems and Human-Computer Interaction.

The **School of Electrical Engineering** comprises four departments: Communications (all aspects of theory, applied electronics and engineering relating to communication systems such as telephones, broadcasting and television); Electric Power (electrical machines and generation, distribution and utilisation of electric energy); Electronics (electronic circuits, devices, micro-electronics and application of electronics to such areas as solar power generation); Systems and Control (development of theories for the control of complex systems and the application of these theories including computer simulation).

The **School of Mechanical and Manufacturing Engineering** consists of five ***Disciplines,*** which underpin the fundamental areas of the profession and six ***Directed Programs*** of industry-oriented cross-disciplinary activity.

The ***Disciplines*** are: ***Applied Mechanics*** (engineering, mechanics and mechanics of solids); **Design** (conceptual design, machine systems design, optimization and failure-analysis); ***Fluid and Thermal Engineering*** (energy utilisation and power generation, refrigeration and air conditioning, gas and liquid handling); ***Industrial Technology and Management*** (economic analysis, production planning and control, product and process design, methods engineering and operations research); ***Mechatronics*** (interface between mechanical engineering and electronic engineering).

The ***Directed Programs*** are: Manufacturing and Automation; Mechanical Building Services; Maintenance Engineering; Energy and Power Systems; Vehicle and Transport Systems; Machine Systems Design.

The **School of Surveying** areas of study: Satellite Surveying (position determination techniques using satellite signals); Geodetic Surveying (determining the mathematical model of the earth, and its gravity field, and the practice of surveying on the earth's surface); Hydrographic Surveying (mapping the seabed and waterways for navigation and offshore resource management); Engineering Surveying (the precise surveying for engineering projects); Cadastral Surveying (knowledge of the laws and practices relating for survey of property boundaries); Land Management and Development (environmental assessment for resource management and change of land use); Land Information Management (the use of computer-based information systems of spatially related data for planning purposes); Photogrammetry and Remote Sensing (the use of photographs and remotely sensed images for mapping and resource surveys).

The **Centre for Biomedical Engineering** is an interdisciplinary unit which promotes and co-ordinates biomedical engineering studies and research being conducted by various schools and departments within the University and its teaching hospitals. Biomedical engineering involves the application of engineering techniques to biomedical problems with particular emphasis on clinical medicine.

The **Centre for Groundwater Management and Hydrogeology** was established early in 1987 as a research and training unit within the Faculties of Applied Science and Engineering. Its general aims are to research the groundwater problems of strategic national importance and to co-ordinate and develop postgraduate courses and continuing education programs, and to liaise with industry.

The **Centre for Photovoltaic Devices and Systems** was established in 1991 under the Commonwealth Special Research Centres Scheme. Its function is to carry out research into improved performance, lower cost photovoltaic solar cells and develop a co-ordinated set of activities in the photovoltaic systems area. The Centre is housed in the School of Electrical Engineering.

The **Centre for Remote Sensing** is a joint enterprise of the Faculties of Applied Science, and Engineering which promotes and co-ordinates remote sensing studies and research being conducted by various schools within the University. Remote sensing is the science of obtaining information about the earth's surface (in particular) using electro-magnetic imaging systems mounted on aircraft and space platforms.

The **Centre for Wastewater Treatment** was established with a grant provided by the Australian Water Advisory Council. The Centre conducts research in the field of wastewater treatment and offers short courses and a consultancy service for industry.

The Faculty is also closely associated with two of the 15 Cooperative Research Centres established under the Commonwealth Government's program of Cooperative Research Centres (CRCs) in 1991.

The **CRC for Aerospace Structures** provides an Australian focus for the generation of advanced aerospace technologies which fosters the development of an efficient and internationally competitive Australian aerospace industry. (Contact person: Mr J.R. Page, School of Mechanical and Manufacturing Engineering.)

The **CRC for Waste Management and Pollution Control** is developing new approaches which aim to lessen the threat to the environment caused by urban, industrial and agricultural wastes and in the process establish the basis for an environmental management industry. (Contact person: Professor D.H. Pilgrim, School of Civil Engineering).

English Language Requirements

Applicants whose first language is not English or who have not undertaken a previous degree where English was the primary language of instruction are required to provide proof of their competence by presenting acceptable results from one of the following tests or by satisfying the course authority as to their level of proficiency.

	Minimum Acceptable Score
1.The Test of English as a Foreign Language (TOEFL)	550
2. International English Language Testing Service (IELTS)	5.5
3 .Combined Universities Language Test (CULT)	65%
4. Indonesia-Australia Language Foundation (IALF)*	Cat 1 or 2

*Cat 3 may be accepted if current English program available.

Research Degrees

Doctor of Philosophy
PhD

This degree is awarded for a thesis considered to be a substantially original contribution to the subject concerned. The degree is becoming a prerequisite for research appointments in government and industrial research and development laboratories. Research for this degree may be taken at, or externally to, the University. However the Faculty recommends that periods of residency at the University totalling at least six months be included in the candidate's research program.

Admission Guidelines: A candidate for registration for the degree of Doctor of Philosophy should hold an honours degree from the University of New South Wales or an honours degree of equivalent standing from another approved university. See also *English Language Requirements* as detailed earlier under *Graduate School of Engineering.* Applications for admission should be made to the Registrar on the prescribed form at least one calendar month before the commencement of the session in which registration is to begin.

Period of Candidature: The normal period is six academic sessions (full-time) and eight academic sessions (part-time) from the date of enrolment. In special cases the minimum period of registration may be reduced by up to two academic sessions. The maximum period of registration is ten academic sessions (full-time) and twelve academic sessions (part-time). In special cases an extension of these times may be granted.

Master of Engineering/Master of Science/ Master of Surveying
ME/MSc/MSurv

These are research degrees in which a thesis embodies the result of an original investigation, or design, or engineering surveying development. Candidates for the award of the degree of ME and MSurv may be required to carry out a program of advanced study.

Admission Guidelines: A candidate for registration for the degree of Master of Engineering, Master of Science or Master of Surveying should hold a Bachelor's degree from the University of New South Wales or from another approved university. See also *English Language Requirements* as detailed earlier under *Graduate School of Engineering.* Applications for admission should be made to the Registrar on the prescribed form at least one calendar month before the commencement of the session in which registration is to begin.

Period of Candidature: The normal period is four academic sessions (full-time) and six academic sessions (part-time) from the date of enrolment. In special cases the minimum period of registration may be reduced by up to two academic sessions. The maximum period of registration is six academic sessions (full-time) and ten academic sessions (part-time). In special cases extensions may be granted.

Research degrees may be undertaken in the Faculty of Engineering as follows:

Degree	School/Course	Course Code
PhD	Civil Engineering	1630
	Electrical Engineering	1640
	Computer Science and Engineering	1650
	Mechanical and Manufacturing Engineering	1662
	Surveying	1680
	Biomedical Engineering	1710
ME	Civil Engineering	2650
	Electrical Engineering	2660
	Computer Science and Engineering	2665
	Mechanical and Manufacturing Engineering	2692
MSurv	Surveying	2720
MSc	Civil Engineering	2750
	Electrical Engineering	2760
	Mechanical and Manufacturing Engineering	2781
	Biomedical Engineering	2795

Course Work Masters Degrees

Master of Engineering Science/ Master of Environmental Engineering Science/ Master of Surveying Science
MEngSc/MEnvEngSc/MSurvSc

The Master of Environmental Engineering Science allows for a degree to be taken in a specific area of specialisation. The Master of Engineering Science and Master of Surveying Science are Faculty-wide degrees allowing for flexibility of choice between formal course work and research. The schools in the Faculty have developed recommended programs of study leading to specialisation in certain areas.

Candidates who enrolled from 1990 are required to complete a program totalling 30 credits*. Those who first enrolled prior to 1990 including those who are upgrading from a Graduate Diploma must complete 36 credits. A degree may be awarded for formal course work only or for the completion of formal course work and a report on a project depending on the program being offered. The number of credits for a project reports varies amongst schools and centres and between departments within schools and are 9, 12, 15 or 18.

Candidates may undertake interdisciplinary studies and, subject to approval, are able to take subjects from any school in the Faculty, other faculties of the University and other universities or institutions. By means of this system, programs of studies best suited to the needs of the candidates may be selected.

Before enrolment an applicant should submit an intended program for approval by the school or division offering the majority of the credits to ensure that the prerequisite background held is adequate for all subjects including those taken in other schools or institutions.

Admission Guidelines: An acceptable qualification is a degree at Honours level, or at Pass level to a superior standard in a four-year course in an approved discipline. The latter is defined

*See definition of 'credit' under Graduate Subjects later in this section.

as an average of 65% over the last two years of a full-time course (or last three stages of a part-time course) taken in minimum time. If the degree concerned is not in an acceptable discipline, or was of less than four years full-time study, a bridging or qualifying program is required. This is normally arranged by enrolment in the appropriate graduate diploma with the possibility of transferring to the Masters program after completion of requirements prescribed by the Faculty. See also *English Language Requirements* as detailed earlier under *Graduate School of Engineering.*

Applicants for admissions to a course of study leading to the award of a Masters degree by course work should apply to the Registrar on the prescribed form at least two calendar months before the commencement of the session in which registration is to begin. It may be necessary to limit entry to some formal courses because of available resources. In such cases, an application may be provisionally accepted 'subject to a place being available'. When a firm offer is made, it is subject to acceptance within one month.

Period of Candidature: The normal period is two academic sessions (full-time) or four academic sessions (part-time) from the date of enrolment. The maximum period of candidature is four academic sessions (full-time) and eight academic sessions (part-time). In special cases an extension of time may be granted. A candidate is not permitted to continue in a course if the credit value of the subjects failed totals more than six.

Master of Biomedical Engineering
MBiomedE

This degree is primarily obtained through course work but includes a project report conducted in either a hospital or other institution. The course of study offers scope for original research into the application of engineering principles and technology to medical problems. Candidates must complete a program totalling 60 credits, 40 of which must be for the study of subjects at graduate level.

Admission Guidelines: An acceptable qualification is a degree at Honours level, or at Pass level to a superior standard in a four-year course in an approved discipline. The latter is defined as an average of 65% over the last two years of a full-time course (or last three stages of a part-time course) taken in minimum time. If the degree concerned is not in an acceptable discipline, or was of less than four years full-time study, a bridging or qualifying program is usually required. This is normally arranged by enrolment in the appropriate graduate diploma with the possibility of transfering to the Masters program after completion of requirements prescribed by the Faculty. See also *English Language Requirements* as detailed earlier under *Graduate School of Engineering.*

Applicants for admission to a course of study leading to the award of a course work Masters degree should apply to the Registrar on the prescribed form at least two calendar months before the commencement of the session in which registration is to begin.

Period of Candidature: The normal period is four academic sessions (full-time) or six academic sessions (part-time) from the date of enrolment. The maximum period of candidature is eight academic sessions (full-time) and ten academic sessions (part-time). In special cases extensions may be granted.

Master of Information Science/ Master of Computer Science
MInfSc/MCompSc

These degrees allow for flexibility of choice between formal coursework and research.

Candidates are required to complete a program totalling 36 and 48 credits* for formal coursework for the MInfSc, MCompSc degrees respectively. Alternatively, a degree may be awarded for the completion of formal coursework and a report on a project. The number of credits for a project report is 18.

Candidates may undertake interdisciplinary studies after having met the requirements of the specialisation and, subject to approval, are able to take subjects from any school in the Faculty, other faculties of the University and other universities or institutions. By means of this system, programs of studies best suited to the needs of the candidate may be selected.

Admission Guidelines: An acceptable qualification is a degree at Honours level, or at Pass level to a superior standard in a four-year course in an approved discipline. The latter is defined as an average of 65% over the last two years of a full-time course (or last three stages of a part-time course) taken in minimum time. Candidates for admission are selected on merit. If the degree concerned is not in an acceptable discipline, or was of less than four years full-time study, a bridging or qualifying program may be required. This is normally arranged by enrolment in the appropriate graduate diploma with the possibility of transferring to the Masters program after completion of requirements prescribed by the Faculty. See also *English Language Requirements* as detailed earlier under *Graduate School of Engineering.*

In the case of the degree of MCompSc, students who consider that they have an extensive knowledge of computing may request exemption of 12 credits of coursework.

Applicants for admission to a course of study leading to the award of a coursework Masters degree should apply to the Registrar on the prescribed form at least two calendar months before the commencement of the session in which registration is to begin. It may be necessary to limit entry to some formal courses because of availability of resources. In such cases, an application may be provisionally accepted 'subject to a place being available'. When a firm offer is made, it is subject to acceptance within one month.

Period of Candidature: The normal period for the degrees are three sessions full time for the degree of MInfSc and 4 sessions full time for the degree of MCompSc if the full 48 credits are required. The maximum period of candidature is six academic sessions for both degrees. In special cases an extension of time may be granted. A candidate is not permitted to continue in a course if the credit value of the subjects failed totals more than six.

*See definition of 'credit' under Graduate Subjects later in this section.

Courses of Study

Courses of study leading to the award of course work Masters degrees may be undertaken in the Faculty as follows:

Degree	School/Course	Course Code
MEngSc	Electrical Engineering	8501
	Industrial Engineering	8531
	Mechanical Engineering	8541

Degree	School/Course	Course Code
	Remote Sensing	8641
	Civil Engineering	8612
	Waste Management	8612 (Internal) 8614 (External)
	Surveying	8640
MCompSc	Computer Science and Engineering	8680
MEnvEngSc	Civil Engineering	8615
MInfSc	Computer Science and Engineering	8508
MSurvSc	Surveying	8651
MBiomedE	Biomedical Engineering	8660

The program in Remote Sensing is offered in both the Faculty of Engineering and the Faculty of Applied Science. Entry into either Faculty depends upon the background of the applicant and the orientation of the proposed program.

The following courses are contributed to by the Faculty of Engineering and further details may be found in the Faculty of Applied Science Handbook: *Master of Applied Science in Arid Lands Management* (course code **8025**), *Master of Safety Science* (course **8671**) and *Master of Engineering Science in Industrial Safety* (course code **8675**).

Subject Identification Scheme

The first digit in the numeric suffix of all subject identifiers for subjects offered by the schools and centres in the Faculty of Engineering indicates the level of the subject and the value '9' in this position is reserved for graduate subjects.

Course Work Programs

Detailed information is available from the schools offering the courses.

8501 Electrical Engineering

Master of Engineering Science MEngSc

- Candidates may commence in Session 1 or Session 2 and must possess an appropriate level of knowledge for the program subjects chosen.
- All candidates elect to study in at least one of the specific programs offered by the School of Electrical Engineering: each Program Co-ordinator will advise if applicants are adequately qualified to undertake the proposed subjects and must approve the chosen program.

All candidates must register in one of the following major areas and in at least one of its programs:

Major Area

Communications

Program Co-ordinator:
Dr R.A. Zakarevicius

Programs:
1. Communication Electronics
2. Digital Communication and Systems
3. Microwave and Optical Communications
4. Signal Processing

Electric Power

Program Co-ordinator:
Dr T.R. Blackburn

Programs:
1. Power Systems Engineering
2. Electrical Power Technology

Electronics

Program Co-ordinator:
Dr R.S. Huang

Programs
1. Solid State Devices
2. Microelectronics

Systems and Control

Program Co-ordinator:
Professor N.W. Rees

Programs:
1. Digital Systems and Control
2. Cybernetic Engineering and Advanced Robotics
3. Biomedical Engineering (see co-ordinator)

Programs listed would normally consist of 12 or 18 credits of course work and correspondingly a 12 or 18 credit project. However, other appropriate programs or subjects in the same major area or other areas may be substituted for the project allowing completion of the 30 credits by course work only.

Specialist Programs

Communications

1. Communication Electronics

- Normally 12 credits of course work and an 18 credit project.
- One of the five elective subjects may be chosen from outside this program.

Compulsory subject		Credits
ELEC9340	Communication Electronics	3
Elective subjects		
COMP9221	Microprocessor Systems	3
ELEC9353	Microwave Circuits: Theory and Techniques	3
ELEC9354	Microwave and Optical Devices	3
ELEC9338	Television Systems	3
ELEC9341	Signal Processing 1 – Fundamental Methods	3

		Credits
ELEC9343	Principles of Digital Communications	3
ELEC9403	Real Time Computing and Control	3
ELEC9503	Integrated Circuit Design	3
COMP9215	VLSI System Architecture and Design	3

2. Digital Communication and Systems

- Normally 12 credits of coursework and an 18 credit project.
- At least three subjects must be taken from the following list and the remaining subjects from other graduate programs within the Department and School.

ELEC9336	Digital Communication Networks	3
ELEC9337	Data Networks 2	3
ELEC9338	Television Systems	3
ELEC9343	Principles of Digital Communications	3
ELEC9347	Digital Modulation	3

3. Microwave and Optical Communications

- Normally 12 credits of course work and an 18 credit project.
- One of the three elective subjects may be chosen from outside this program.

Compulsory subjects

ELEC9350	Theory of Optical Fibres and Optical Signal Processing	3
ELEC9351	Propagation and Transmission of Electromagnetic Waves	3
ELEC9354	Microwave and Optical Devices	3

Elective subjects

ELEC9352	Antenna Design and Applications	3
ELEC9353	Microwave Circuits: Theory and Techniques	3
ELEC9355	Optical Communications Systems	3

4. Signal Processing

- Normally 12 credits of course work and an 18 credit project.
- One of the four elective subjects may be chosen from outside the program.

Compulsory subjects

ELEC9341	Signal Processing 1 – Fundamental Methods	3
ELEC9342	Signal Processing 2 – Advanced Techniques	3

Elective subjects

ELEC9340	Communications Electronics	3
ELEC9343	Principles of Digital Communications	3
ELEC9350	Theory of Optical Fibres and Optical Signal Processing	3
ELEC9370	Digital Image Processing Systems	3
MATH5054	Advanced Mathematics for Electrical Engineers	3

Electric Power

- Normally 12 or 18 credits of coursework and an 18 or 12 credit project as appropriate. A program in another area offered by the School may be substituted for the project.
- At least three subjects should be chosen from one of the two programs below (items 1 and 2), with the remainder from the other program or from the list of relevant subjects in item 3.

1. Power Systems Engineering

		Credits
ELEC4202	Power Engineering 1	3
ELEC9201	Power System Planning and Economics	3
ELEC9202	Power System Operation, Control and Planning	3
ELEC9222	Power Engineering Seminars (Occasional Elective)	3
ELEC4215	Power Engineering Utilization and Equipment	3
ELEC9221	Protection of Power Equipment (Occasional Elective)	3

2. Electrical Power Technology

ELEC4202	Power Engineering 1	3
ELEC4215	Power Engineering Utilization and Equipment	3
ELEC9215	Fields and Materials	3
ELEC9214	Power System Equipment	3
ELEC9222	Power Engineering Seminars (Occasional Elective)	3
ELEC9221	Protection of Power Equipment (Occasional Elective)	3

3. Relevant Subjects from other areas and disciplines

Relevant coursework subjects from other areas and disciplines are listed below. A limited number of credits from this group may be taken as part of an Electric Power program. Subject to the approval of the Postgraduate Advisor, a limited number of other elective subjects offered in the School of Electrical Engineering may also be included in the program.

ELEC4216	Electrical Drive Systems	3
ELEC4240	Power Electronics	3
ELEC9221	Microprocessor Systems	3
ELEC9504	Solar Energy Conversion	3
ELEC9505	Solar Cells	3
ELEC9401	Computer Control Systems 1	3
ELEC9351	Propagation and Transmission of EM Radiation	3
MECH9740	Power Plant Engineering	3
MECH9741	Energy Conservation and Systems Design	3
MECH9742	Power Production Assessment	3
MANF9400	Industrial Management	3
MANF9660	Energy Modelling, Optimization and Accounting	3
SAFE9213	Introduction to Safety Engineering M	3

Electronics

- Normally 12 or 18 credits coursework and correspondingly 18 or 12 credit project.

There are no compulsory subjects, but at least 3 subjects should be chosen from one of the programs shown below.

- The remaining three subjects may be chosen from the alternative program list or outside these lists.

1. Solid State Devices

		Credits
ELEC9354	Microwave and Optical Devices	3
ELEC9501	Advanced Semiconductor Devices	3
ELEC9502	Integrated Circuit Technology	3
ELEC9504	Solar Energy Conversion	3
ELEC9505	Solar Cells – Operating Principles, Technology and System Applications	3

2. Microelectronics

COMP9215	VLSI Systems Architecture Design	3
ELEC9340	Communication Electronics	3
ELEC9501	Advanced Semiconductor Devices	3
ELEC9502	Integrated Circuit Technology	3
ELEC9503	Integrated Circuit Design	3

Additional elective subjects for both programs:

COMP9221	Microprocessor Systems	3
ELEC4532	Integrated Digital Systems	3
ELEC9341	Signal Processing 1 – Fundamental Methods	3
ELEC9342	Signal Processing 2 – Advanced Techniques	3
ELEC9343	Principles of Digital Communications	3
ELEC9353	Microwave Circuits: Theory and Techniques	3

Systems and Control

1. Digital Systems and Control

- Normally 18 credits of course work and a 12 credit project.

Compulsory subjects

ELEC9401	Computer Control Systems 1	3
ELEC9402	Computer Control Systems 2	3
ELEC9403	Real Time Computing and Control	3
ELEC9404	Topics in Digital Control	3

Elective subjects

COMP9221	Microprocessor Systems	3
ELEC9342	Signal Processing 2 – Advanced Techniques	3
ELEC9405	Advanced Control Topics	3
ELEC9410	Robotics, Automation and Productivity Technology	3
ELEC9415	Optimization and Optimal Control	3
ELEC9416	Non-Linear Systems and Simulation	3

2. Cybernetic Engineering and Advanced Robotics

- Normally 9 credits of course work and a 12 credit project.
- Remaining 9 credits may be taken from the elective list or other programs and subjects.

Compulsory subjects

ELEC9407	Cybernetic Engineering	3
ELEC9409	Cybernetic, Machine and Robot Vision	3
ELEC9410	Robotics, Automation and Productivity Technology	3

Elective subjects

COMP9221	Microprocessor Systems	3
ELEC9342	Signal Processing 2 – Advanced Techniques	3
ELEC9370	Digital Image Processing Systems	3
ELEC9403	Real Time Computing and Control	3
ELEC9405	Human Movement Control Systems	3

8508
Computer Science and Engineering

Master of Information Science
MInfSc

Candidates are required to complete a program totalling at least 36 credits and this may be taken in one of two ways:

i. *Major Project Option* –
18 credits of coursework and an
18 credit Project, or

ii. *Coursework Option* –
36 credits all of which will be associated with subjects although 6 credits will relate to a minor project or design.

The typical duration of the course is three sessions full-time or five sessions part-time.

i. Major Project Option

Compulsory Subjects

		Credits
At least one of:		
COMP9314	Advanced Data Base Management 1	3
COMP9315	Advanced Data Base Management 2	3
and		
COMP9511	Human Interface Computing 1	3
COMP9514	Advanced Decision Theory for Information Science	3
Students will take at least one of:		
LIBS0817	Information Storage and Retrieval	3
COMP9614	Linguistics	3
Students will take at least one of:		
GEOG9240	Geographic Information Systems	3
SURV9604	Land Information Systems	3
REMO9580	Design Analysis in Remote Sensing	3

It is necessary that subjects of at least three credits be taken in one of the areas of expert systems, knowledge-based systems, artificial intelligence, or decision support systems.

ii. Coursework Option

Compulsory subjects:
At least one subject from each of the above subject groupings plus:

COMP9311	Introduction to Data Base Systems (For students with limited knowledge of Data Bases)	3
COMP9596	Advanced Topics in Information Science	6
ELEC9336	Digital Communication Networks 1	3

The remaining three subjects may be chosen from subjects offered in the specialisations:
Computer Science/Computer Engineering
Digital Communications and Systems
Signal Processing
Cybernetic Engineering and Advanced Robotics

It could also be appropriate to select subjects dealing with behavioural aspects of judgement and choose from the programs offered by other schools.

8531
Industrial Engineering

8541
Mechanical Engineering

Master of Engineering Science
MEngSc

A major field of study is required to be nominated and two-thirds of the 30 credits required for the degree must be taken in that major field. (Examples of major fields are applied mechanics, fluid mechanics, manufacturing management, mechatronics and design. Consult School Advisers for further details.)

All candidates take a 12 credit project on a topic in their major field.

Formal lecture subjects are not restricted to the School of Mechanical and Manufacturing Engineering, Faculty of Engineering or this University, but two-thirds of all credits must be taken at the University of New South Wales.

In consultation with their School Adviser, candidates at enrolment put together a program which is based on these requirements, but which may be modified from time to time in the light of changes in availability of subjects. These requirements also apply to a number of specialist courses which are offered by the School of Mechanical and Manufacturing Engineering and which are described below. Some of these specialist programs may not run if the resources are not available. The structure of the programs is currently under review.

Specialist Programs

1. Computer Integrated Manufacturing

12 credits of core subjects:		Credits
MANF9400	Industrial Management	3
MANF9520	Computer Aided Manufacturing	3
MANF9541	Computer Aided Design for Manufacturing	3
MANF9460	Computer Integrated Manufacturing	3

and 12 credit project

MANF9010	Research project	

The remaining six credits may be selected from:

MECH9221	Industrial Robotics	3
MECH9410	Finite Element Applications	3
ELEC9403	Real Time Computing and Control	3
ELEC9409	Robot Vision	3
ELEC9410	Robotics, Automation and Productivity Technology	3
ACCT9062	Accounting for Engineers	3
MANF9410	Inspection and Quality Control	3
MANF9500	Computer Aided Programming for Numerical Control	3
MANF9601	Economic Decisions in Industrial Management	3
MANF9340	Flexible Manufacturing Systems	3
MANF9542	Computer Aided Design for Manufacture 2	3

2. Industrial Management

3 credits of core subjects:

MANF9400	Industrial Management	3
MANF9040	Industrial Management Seminar	0

and 12 credit project

MANF9010	Research project	

At least 6 credits selected from the following list of priority subjects:

ACCT9062	Accounting for Engineers	3
MANF9640	Decision Support Systems	3
	Methods Engineering	4
MANF9620	Operations Research 1	6

and the remaining 9 credits may be selected from the following:

MECH4509	Computing Science for Mechanical Engineers	2
ACCT9062	Acccounting for Engineers	3
IROB5701	Industrial Relations A	3
MANF9811	Industrial Experimentation 1	3
MANF9650	Decision Support Systems	3
MANF9410	Inspection and Quality Control	3
MANF9320	Ergonomics	3
MANF9310	Factory Design and Layout	3
MANF9210	Value Analysis and Engineering	3
MANF9620	Operations Research 1	6
MANF9610	Decision Theory for Industrial Management	3
MANF9601	Economic Decisions in Industrial Management	3
MANF9440	Management of Distribution Systems	2
MANF9420	Production and Inventory Control	2

Before enrolling in the program, a student should have had one year's relevant industrial experience and have access to industry for his/her project topic.

3. Operations Research

Prerequisites:

i. 2 years of University level Mathematics

ii. minimum 28 hours University level course in Probability and Statistics (or enrolment in MATH2839 Statistics SM or equivalent as a co-requisite)

iii. minimum 40 hours University level course in Engineering Economic Analysis (or enrolment in MANF9601 Economic Decisions in Industrial Management as a co-requisite)

iv. competence in computer programming (or enrolment in MECH1500 Computing IM as a co-requisite).

9 credits of core subjects:

ACCT9062	Accounting for Engineers	3
MANF9620	Operations Research 1	6

		Credits
MANF9049	Operations Research Seminar	0
and 12 credit project		
MANF9010	Research project	

The remaining 9 credits may be selected from:

MANF9400	Industrial Management	3
MANF9650	Decision Support Systems	3
MANF9320	Ergonomics	3
MANF9310	Factory Design and Layout	3
MANF9300	Methods Engineering	4
MANF9210	Value Analysis Engineering	3
MANF9450	Management Simulation	3
MANF9610	Decision Theory for Industrial Management	3
MANF9660	Energy Modelling, Optimisation and Energy Accounting	3
MANF9601	Economic Decisions in Industrial Management	3
MANF9330	Simulations in Operations Research	2
MANF9420	Production and Inventory Control	2
MANF9840	Linear Programming	2
MANF9850	Nonlinear Programming	2
MANF9630	Large Scale Optimization in Industry	3
MANF9870	Dynamic Programming	2

4. Refrigeration and Air Conditioning

12 credits of core subjects:

MECH9751	Refrigeration and Air Conditioning 1	3
MECH9752	Refrigeration and Air Conditioning 2	3
MECH9753	Refrigeration and Air Conditioning Design 1	3
MECH9754	Refrigeration and Air Conditioning Design 2	3

and 12 credit project

MECH9010	Research project	

The remaining 6 credits may be selected from:

MECH9710	Numerical Fluid Dynamics and Heat Transfer	3
MECH9321	Acoustic Noise 1	2
MECH9322	Acoustic Noise 2	2
MECH9741	Energy Conservation and System Design	3
MECH9730	Two Phase Flow and Heat Transfer	3
MECH9720	Solar Thermal Energy Design	3
MECH9711	Analysis of Heat Transfer	4
MECH9757	Ambient Energy Air Conditioning	2
SAFE9232	Introduction to Occupational Health and Safety Law	3
SAFE9583	Ventilation	3

or such other subjects (based on availability) as may be approved by the Head of School.

5. Industrial Automation

9 credits of core subjects must be selected from:

MECH9201	Digital Fundamentals for Mechanical Engineers	3
MECH9202	Microprocessor Fundamentals	3
MECH9203	Industrial Applications for Microprocessors	3
MECH9221	Industrial Robots	3
MECH9222	Artificially Intelligent Machines	3
MANF9500	Computer Aided Programming for Numerical Control	3

and 12 credit Project

MECH9010	Research Project	

The remaining 9 credits may be selected from the above list or from other subjects as approved by the Head of School.

6. Advanced Analysis for Design

12 credits of core subjects:

MECH9410	Finite Element Applications	3
MECH9421	Stress Analysis for Mechanical Engineering Design 1	3
MECH9400	Mechanics of Fracture and Fatigue	3
MANF9320	Ergonomics	3

and 12 credit project

MECH9010	Research Project	

The remaining 6 credits may be selected from:

MECH4120	Design Technology	2
MECH4130	Computer Aided Engineering Design (or MANF9630)	2
MECH9460	Experimental Stress Analysis	3
CIVL9731	Project Management (or CIVL9732)	3
CIVL9732	Advanced Project Management Theory (or CIVL9731)	3
MANF9210	Value Analysis Engineering	3
MANF9601	Economic Decisions in Industrial Management	3
MANF9630	Large Scale Optimisation in Industry (or MECH4130)	3

or other subjects approved by the Head of School.

8612
Civil Engineering

Master of Engineering Science
MEngSc

The School of Civil Engineering offers a large number of graduate subjects which allow the flexibility of many combinations to provide relevant groupings both in an academic and professional sense. The main technical groupings are:

- engineering construction and management
- geotechnical engineering
- structural engineering
- transport engineering
- water engineering

All candidates are required to undertake a project with the other credits being obtained from formal course work. Full details of preferred programs in the various specialist areas are available from the School.

8612 Internal
8614 External
Waste Management

Master of Engineering Science
MEngSc

8085
Waste Management

Master of Applied Science
MAppSc

Candidates are required to complete a course totalling at least 30 credits, made up of compulsory subjects, elective subjects and a project. The degree may be obtained internally on a full time (normally 2 sessions) or part time (normally 4 sessions) basis. An external course program is also offered (normally over 4 sessions) to students outside Sydney with resource material posted to students and evaluation made on written assignments and examinations.

Candidates are enrolled as MEngSc or MAppSc degree students depending on their previous qualifications, experience and course content.

Internal Program

Compulsory Subjects		**Credits**
CIVL9872	Solid Waste Management	3
CIVL9881	Hazardous Waste Management	3
CIVL9884	Environmental Engineering Science 1	3
CIVL9886	Environmental Engineering Science	3
FUEL5880	Unit Operations in Wastewater Sludge and Solids Management	3

Project (MEngSc)		
CIVL9909		9

Project (MAppSc)		
GEOL9504		9

Elective Subjects
(2 of the following for MEngSc, 3 for GradDip)

CIVL9887	Advanced Topics in Waste Management	3
CIVL9857	Sewage Treatment and Disposal	3
GEOL9020	Geopollution Management	3
MINE1524	Mining Conservation	3
MINE5355	Mine Fill Technology	2
FUEL5920	Atmospheric Pollution Control	3
CIVL9870	Hydraulics and Design of Water and Wastewater Treatment Plants	3
GEOL9011	Hydrology G	3
GEOL9060	Environmental Geology	3
SAFE9543*	Management of Dangerous Materials	3
SAFE9242	Human Behaviour and Safety Science	3
CEIC5630	Industrial Water and Wastewater Engineering	3
GEOG3042	Environmental Impact Assessment	3

External Program

CIVL8855	Water and Wastewater Analysis and Quality Requirements	3
CIVL8857	Sewage Treatment and Disposal	3
CIVL8884	Environmental Engineering Science 1	3
FUEL5881	Unit Operations in Wastewater, Sludge and Solids Management	3
CIVL8872	Solid Waste Management	3
CIVL8881	Hazardous Waste Management	3
GEOL9320	Geopollution Management	3

Project		
CIVL8909		9

Project		
CIVL8803		3

Notes: MEngSc students undertake a 9 credit project to make 30 credits and GradDip students complete a 3 credit project to make 24 credits.

Civil subjects starting with 8 are the external equivalents of the internal subjects starting with a 9.

* Subject to approval of course coordinator.

8615
Civil Engineering

Master of Environmental Engineering Science
MEnvEngSc

Candidates are required to complete a program totalling 30 credits. The program is made up of compulsory subjects, selective subjects and a 9 credit project.

Compulsory Subjects		**Credits**
CIVL9884	Environmental Engineering Science 1	3
CIVL9885	Environmental Engineering Science 2	3
CIVL9888	Environmental Management	3
CIVL9889	Environmental Law and Economics	3
CIVL9909	Project	9

Elective Subject Groupings

Waste Management (Liquids)

CIVL9851	Unit Operations in Public Health Engineering	3
CIVL9857	Sewage Treatment	3
CIVL9858	Water Quality Management	3
CEIC5630	Industrial Water and Wastewater Engineering	3

Waste Management (Solids)

CIVL9872	Solid Waste Management	3
CIVL9881	Hazardous Waste Treatment	3
CIVL9887	Advanced Topics in Waste Management	3
SAFE9543	Management of Dangerous Materials	3

Water Engineering

CIVL9858	Water Quality Management	3
CIVL9875	Hydrological Processes	3
CIVL9876	Applied Hydrological Modelling	3
CIVL9880	Groundwater Modelling	3
CIVL9835	Coastal Engineering 1	3
CIVL9836	Coastal Engineering 2	3

Geotechnical Engineering

GEOL9030	Geological Engineering	3
GEOL9060	Environmental Geology	3
GEOL9080	Groundwater Geophysics	3

		Credits
GEOL9320	Geopollution Management	3
CIVL9788	Site Investigation	3

Transport Engineering

CIVL9420	Transport and the Environment	3
CIVL9407	Transport Systems Design (Non-Urban)	3
CIVL9408	Transport Systems Design (Urban)	3

Management

CIVL9702	Project Planning and Control	3
CIVL9704	Quantitative Engineering Management	3
CIVL9705	Engineering Management Practice	3
CIVL9706	Management of People	3
CIVL9710	Engineering Risk Management	3
CIVL9731	Project Management	3

Land and River Management

GEOG9310	River Management
GEOG9320	Soil Degradation and Conservation
GEOG9300	Vegetation Management

Subjects offered within the MEngSc degree program are also available to students enrolled for a MEnvEngSc degree, subject to the approval of the course coordinator.

8641
Remote Sensing

Master of Engineering Science
MEngSc

Candidates are required to complete a course totalling at least 30 credits, made up of compulsory subjects, elective subjects and a project. Compulsory subjects not offered in a particular year may be substituted by an equivalent subject, approved by the appropriate Head of School. The degree will normally comprise one year of full-time study (two sessions of 15 credits) or two years of part-time study.

Compulsory subjects		Credits
GEOG9150	Remote Sensing Applications	3
SURV9600	Principles of Remote Sensing	3
SURV9605	Ground Investigations for Remote Sensing	3
REMO9580	Image Analysis in Remote Sensing	3
Project in Remote Sensing†		12

†The subject number for these subjects varies according to the school in which the candidate is enrolled.

Elective subjects

Candidates may include additional subjects selected from the following listed elective subjects, or from other relevant subjects offered within the University, as approved by the appropriate Head of Schools.

REMO9581	Microwave Remote Sensing	3
ELEC9370	Digital Image Processing Systems	3
ELEC9408	Computer Display Systems and Interactive Instrumentation	3
COMP1011	Computing 1A	4
COMP1021	Computing 1A	3
	Remote Sensing in Applied Geology	2
GEOG9210	Computer Mapping and Data Display	3
GEOG9240	Geographic Information Systems	3
SURV9602	Remote Sensing Procedures	3
SURV9213	Physical Meteorology	3
SURV9604	Land Information Systems	3

8651
Surveying

Master of Surveying Science
MSurvSc

Programs of study leading to the degree of MSurvSc are offered by the School of Surveying in a range of topics including:

- advanced surveying
- geodesy
- photogrammetry
- land development and management
- land and geographic information systems

Candidates are allowed a wide choice in selecting programs. Subjects can be selected to suit individual student needs and typical programs can be supplied by the School on request. The program of study must total at least 30 credits. One credit is normally equal to attendance for one hour per week for one session but some senior undergraduate subjects may be taken for partial credit towards the degree. The program normally includes a Project of 12 credits. Examples of suitable external subjects are electronic computing, statistics, oceanography, and a range of others.

8651
Surveying

Master of Surveying Science
MSurvSc in Land and Geographic Information Systems

Candidates are required to complete a course totalling at least 30 credits made up of compulsory subjects, elective subjects and a project. Compulsory subjects not offered in a particular year may be substituted by an equivalent subject approved by the appropriate Head of School. The course normally comprises one year of full-time study or two years of part-time study.

Compulsory subjects

COMP9311	Data Base Systems	3
GEOG9240	Geographic Informations Systems	3
SURV9532	Computer-Assisted Mapping	3
SURV9604	Land Information Systems	3

Elective subjects

GEOG9150	Remote Sensing Applications	3
GEOG9210	Computer Mapping and Data Display	3
GEOG9250	Special Topic in Geography	3
REMO9580	Image Analysis in Remote Sensing	3
LIBS0815	Economics of Information Systems	3
LIBS0817	Information Storage and Retrieval Systems	6
ELEC9336	Digital Communication Networks 1	3
SURV9107	Special Topic in Surveying B	3

		Credits
SURV9608	Cadastral Systems	3
Project		12

The Masters degree program in Land and Geographic Systems is offered in both the Faculty of Engineering and the Faculty of Applied Science. Entry into either Faculty depends on the background of the applicant and the orientation of the proposed program.

8660
Biomedical Engineering

Master of Biomedical Engineering
MBiomedE

The program of study must total 60 credits and include at least 40 credits at graduate level.

Strand A subjects are directed to candidates with an engineering/physical sciences background and Strand B to those with a medical/biological sciences background. Selection of subjects is not limited to those listed below: relevant approved subjects from other areas may be undertaken. A research project is compulsory and may be undertaken concurrently with other subjects. An 18 credit Project Report is the normal requirement.

Session 1 (March-June)			**Credits**
PHPH2112	Physiology (1 full year) (Strand A)	C	12
ANAT2111	Introductory Anatomy (Strand A)	HR	6
BIOM9101	Mathematical Modelling for Biomedical Engineers (Strand B)	C	4
BIOM9501	Computing for Biomedical Engineers (Strand B)	HR	4
ELEC9411	Introductory Physiology for Engineers[1.]		3
BIOM9028	Radiation Physics		3
BIOM9040	Analogue Electronics for Biomedical Engineers		4
BIOM9060	Biomedical Systems Analysis		3
BIOM9510	Introductory Biomechanics		3
BIOM9551	Biomechanics of Physical Rehabilitation[2.]		3
BIOM9561	Mechanical Properties of Biomaterials[2.]		3
BIOM9601	Biomedical Applications of Microcomputers 1[3.]		3
BIOM9621	Biological Signal Analysis		3
BIOM9701	Dynamics of the Cardiovascular System		3

Session 2 (July-November)			
PHPH2112	Physiology 1 (continued)		
BIOM9010	Biomedical Engineering Practice	C	2
BIOM9012	Biomedical Statistics		4
BIOM9027	Medical Imaging		4
BIOM9050	Microprocessors and Circuit Design for Biomedical Engineers[4.]		4
BIOM9311	Mass Transfer in Medicine		4
BIOM9321	Physiological Fluid Mechanics		4
BIOM9332	Biocompatibility		3
BIOM9541	Mechanics of the Human Body[2.]		3
BIOM9602	Biomedical Applications of Microcomputers 2[6.]		3
BIOM9603	Image and Flow Cytometry		3
BIOM9611	Medical Instrumentation[5.]		3
SAFE9533	Electrical Safety		3
BIOM9018	Project Report[7.]	C	18
BIOM9030	Project Report[7.]		30

C Compulsory
HR Highly recommended.

1. For part-time students, ONLY, who are unable to do PHPH2112
2. These three electives vary according to Session in which offered. Only one is offered per year. *Prerequisite for BIOM9541 and BIOM9551: ANAT2111 or equivalent.*
3. *Prerequisite: BIOM9050 or equivalent. ANAT2111.*
4. *Prerequisites: BIOM9501 and BIOM9040 or equivalents.*
5. *Prerequisite: BIOM9040 or equivalent.*
6. Subject follows on from BIOM9601.
7. Research project may be done concurrently with course work during the other Sessions. An 18-credit Project Report is the normal requirement.

8680
Computer Science and Engineering

*Master of Computer Science
MCompSc

Candidates are required to complete a course totalling at least 48 credits but those who consider that they have extensive knowledge of computing may request exemption from 12 credits of Level 1 subjects.

The program of study may be taken in one of two ways:

Project Option

- 18 credit project COMP9918
- 12 credits from Level 1 subjects
- at least 9 credits from Level 2 subjects
- remaining subjects to be chosen from Computer Science Level 3 electives

or

Coursework Option

- 12 credit Level 1 subjects
- 12 credits from Level 2 subjects
- 12 credits from Computer Science Level 3 subjects
- remaining subjects to be chosen from Computer Science or other specialisations subject to approval

Level 1 Subjects

COMP9021	Introduction to Computer Science
COMP9022	Digital System Structures
COMP9023	Concurrent and Functional Programming
COMP9024	Data Structures, File Systems and Data Bases

Level 2 Subjects

COMP9101	Design and Analysis of Algorithms
COMP9102	Compiling Techniques and Programming Languages
COMP9211	Computer Organisation and Design
COMP9221	Microprocessor Systems
COMP9415	Computer Graphics

COMP9231 Integrated Digital Systems
COMP9416 Expert Systems and Deductive Data Bases
COMP9331 Computer Networks and Applications
COMP9201 Operating Systems

Level 3 Subjects
COMP9215 VLSI Systems Architecture and Design
COMP9214 Computer Organisation and Architecture
COMP9414 Artificial Intelligence
COMP9114 Formal Specification
COMP9216 Parallel and Distributed Systems
COMP9115 Programming Languages: Fundamental Concepts

* Note that the Course Structure is currently under review.

Graduate Diplomas

Courses of study leading to the award of a Graduate Diploma in the Faculty of Engineering provide graduates with opportunities to extend their professional knowledge. In most cases, candidates may choose from a range of subjects in the special area of their choice. There are also opportunities to select subjects from other professional areas in which candidates may be interested.

Before enrolment, an applicant should submit an intended program for approval by the school or centre offering the majority of the credits. Candidates must complete a program totalling 24 credits except for Biomedical Engineering which requires 30 and the Graduate Diploma specialisation in Computer Science which requires 36. In the latter case, an exemption may be granted from 12 of these credits. In most cases 12 credits may be derived from approved undergraduate subjects and the program may contain subjects from other schools of the Faculty, other faculties of the University and other universities or institutions subject to meeting the prerequisite requirements. If an applicant nominates a course of study taken from the list below, at least half of the credits should come from the subjects taken in that area. The exceptions to this requirement are for the Information Science and Computer Science Graduate Diploma specialisations where all subjects are taken from a prescribed program of study.

It should be noted that some candidates who have partially completed or who have completed the requirements but not taken out the diploma may be considered for upgrading to the relevant Master program with advanced standing. Since the policy on upgrading varies between different schools and centres, further enquiries should be made with the school or centre concerned.

Admission Guidelines: An applicant for admission to a graduate diploma course should be a graduate of the University of New South Wales or other approved university or have other qualifications as may be approved by the Faculty of Engineering. Applicants should apply to the Registrar on the prescribed form at least two calendar months before the commencement of the session in which registration is to begin.

It may be necessary to limit entry because of available resources. In such cases, an application may be provisionally accepted 'subject to a place being available'. When a firm offer is made, it is subject to acceptance within one month.

Period of Candidature: The normal period is two academic sessions (full-time) or four academic sessions (part-time) from the date of enrolment with the exception of the Computer Science Graduate Diploma specialisation where the normal period is three academic sessions (full-time) or six academic sessions (part-time). The maximum period of candidature is four academic sessions (full-time) and six academic sessions (part-time). In special cases extensions may be granted. A candidate is not permitted to continue in a course if the credit value of the subjects failed totals more than six.

Courses of study leading to the award of a graduate diploma may be undertaken in the Faculty of Engineering as follows:

School/Course	Course Code
Graduate Diploma in Engineering:	
Biomedical Engineering	5462
Civil Engineering	5459
Waste Management*	5459\ (Internal) 5498 (External)
Electrical Engineering	5458
Computer Science	5452
Information Science	5453
Computer Education	5464
Industrial Engineering	5455
Mechanical Engineering	5456
Graduate Diploma in Remote Sensing**	5496
Graduate Diploma in Surveying	5491

*The Graduate Diploma in Waste Management is offered in both the Faculty of Engineering and the Faculty of Applied Science. Entry into either Faculty depends upon the background of the applicant and the orientation of the proposed program. Graduate Diploma is available as an external course program to students living outside Sydney, with course material posted to students and evaluation made on written assignments and examinations.
**The Graduate Diploma in Remote Sensing is offered in both the Faculty of Engineering and the Faculty of Applied Science. Entry into either Faculty depends upon the background of the applicant and the orientation of the proposed program.

Further details of the recommended programs of study may be obtained from the course authorities concerned.

Subjects available in the Faculty of Engineering are listed at the end of this section. However, not all electives are offered in any particular year. Subjects available by tape correspondence as well as all subject descriptions, appear later in this handbook.

Graduate Subjects

The subjects which may be available for a candidate proceeding to the award of the degree of Master of Biomedical Engineering, Master of Computer Science, Master of Engineering Science, Master of Environmental Engineering

Science, Master of Information Science, Master of Surveying Science and Graduate Diploma are listed below. Not all electives are necessarily offered in any particular year.

Under the credit system in operation in the Faculty, one credit is normally equal to one hour's attendance per week for one session. The qualification 'normally' is required because of the varying ways in which credits are distributed for course work, design, critical review or research in the different schools.

Many graduate subjects assume that students have prior, or preliminary, knowledge of the area of study. It is the responsibility of students to acquaint themselves with this level of assumed prior knowledge and take steps, if necessary, to obtain it. This may, for example, involve a course of preparatory reading before commencing the subject.

In some cases the assumed level of knowledge for a specific subject is indicated in this Handbook by the statement of assumed knowledge. This is intended as a guide to the assumed prior knowledge and often uses the description of other subjects in the Handbook (graduate and undergraduate) to indicate the content and level which the lecturer will assume. Students who are in doubt as to the adequacy of their preparation should contact the lecturer concerned and discuss the matter. The lecturer in charge of a subject has the authority to decide whether or not the student has the appropriate level of assumed knowledge.

Civil Engineering

Department of Transport Engineering

		Credits
CIVL9402	Transport, Environment, Community	3
CIVL9403	Theory of Land Use Transport Interaction	3
CIVL9405	Urban Transport Planning Practice	3
CIVL9407	Transport System Design Non-Urban	3
CIVL9408	Transport System Design Urban	3
CIVL9410	Highway Engineering Practice	3
CIVL9412	Economics for Transportation Studies	3
CIVL9414	Transport Systems Part 1	3
CIVL9415	Transport Systems Part 2	3
CIVL9416	Traffic Engineering	6
CIVL9417	Transport and Traffic Flow Theory	6
CIVL9418	Statistics for Transport Studies Part 1	3
CIVL9419	Statistics for Transport Studies Part 2	3
CIVL9420	Special Topic in Transport Engineering	3

Department of Engineering Construction and Management

CIVL9701	Economic Decision Making in Engineering	3
CIVL9702	Project Planning and Control	3
CIVL9704	Quantitative Engineering Management	3
CIVL9705	Engineering Management Practice	3
CIVL9706	Management of People	3
CIVL9710	Engineering Risk Management	3
CIVL9714	Special Topic in Engineering Management	3
CIVL9723	Construction Design	3
CIVL9724	Construction Engineering and Technology	3
CIVL9725	Engineering Financial Management	3
CIVL9726	Legal Studies and Professional Practice	3
CIVL9727	Construction Planning and Estimating	6
CIVL9728	Special Topic in Construction	3
CIVL9731	Project Management	3
CIVL9732	Masonry Construction Design and Materials	3

Department of Geotechnical Engineering

CIVL9753	Soil Engineering	3
CIVL9776	Rock Mechanics	3
CIVL9777	Numerical Methods in Geomechanics	3
CIVL9781	Advanced Concrete Technology	3
CIVL9783	Pavement Materials	3
CIVL9784	Pavement Design	3
CIVL9785	Pavement Evaluation and Maintenance	3
CIVL9786	Industrial and Heavy Duty Pavements	3
CIVL9788	Site Investigations	3
CIVL9790	Stability of Slopes	3
CIVL9791	Foundation Engineering 1	3
CIVL9792	Foundation Engineering 2	3
CIVL9793	Geomechanics	3

Department of Structural Engineering

CIVL9802	Elastic Stability 1	3
CIVL9803	Elastic Stability 2	3
CIVL9804	Vibration of Structures 1	3
CIVL9805	Vibration of Structures 2	3
CIVL9806	Prestressed Concrete 1	3
CIVL9807	Prestressed Concrete 2	3
CIVL9809	Reinforced Concrete 1	3
CIVL9810	Reinforced Concrete 2	3
CIVL9814	Analysis of Plates and Shells	3
CIVL9817	Experimental Structural Analysis	3
CIVL9818	Bridge Design 1	3
CIVL9819	Bridge Design 2	3
CIVL9820	Structural Analysis and Finite Elements 1 (SAFE 1)	3
CIVL9821	Structural Analysis and Finite Elements 2 (SAFE 2)	3
CIVL9822	Steel Structures 1	3
CIVL9823	Steel Structures 2	3

Department of Water Engineering

CIVL9830	Hydromechanics	3
CIVL9831	Closed Conduit Flow	3
CIVL9832	Pipe Network and Transients	3
CIVL9833	Free Surface Flow	3
CIVL9835	Coastal Engineering 1	3
CIVL9836	Coastal Engineering 2	3
CIVL9847	Water Resources Policy	3
CIVL9848	Water Resource System Design	3
CIVL9849	Irrigation	3
CIVL9851	Unit Operations in Public Health Engineering	3
CIVL9852	Water Distribution and Sewage Collection	3
CIVL9855	Water and Wastewater Analysis and Quality Requirements	3

		Credits
CIVL9856	Water Treatment*	3
CIVL9857	Sewage Treatment and Disposal*	3
CIVL9858	Water Quality Management	3
CIVL9860	Investigation of Groundwater Resources 1	3
CIVL9861	Investigation of Groundwater Resources 2	3
CIVL9862	Fluvial Hydraulics	3
CIVL9863	Estuarine Hydraulics	3
CIVL9868	Public Health Science	3
CIVL9870	Hydraulics and Design of Water and Wastewater Treatment Plants	3
CIVL9871	Water Supply and Sanitation in Developing Countries	3
CIVL9872	Solid Waste Management	3
CIVL9875	Hydrological Processes	3
CIVL9876	Applied Hydrological Modelling	3
CIVL9877	Flood Design 1	3
CIVL9878	Flood Design 2	3
CIVL9880	Groundwater Modelling	3
CIVL9881	Hazardous Waste Management	3
CIVL9884	Environmental Engineering Science 1	3
CIVL9885	Environmental Engineering Science 2	3
CIVL9886	Environmental Engineering Science 3	3
CIVL9887	Advanced Topics in Waste Management	3
CIVL9888	Environmental Management and Economics	3
CIVL9889	Legislative Aspects of the Environment	3

Other Subjects

CIVL9901	Special Topic in Civil Engineering	3
CIVL9902	Special Topic in Civil Engineering	3
CIVL9909	Project	9
CIVL9915	Project Report	15

*Students specialising in Public Health Engineering normally study BIOT7100 Biological Principles and BIOT7030 Biotechnology in the School of Biotechnology.

Computer Science and Engineering

		Credits
COMP9021	Introduction to Computer Science	3
COMP9022	Digital System Structures	3
COMP9023	Concurrent and Functional Programming	3
COMP9024	Data Structures, File Systems and Data Bases	3
COMP9101	Design and Analysis of Algorithms	3
COMP9102	Compiling Techniques and Programming Languages	3
COMP9114	Formal Specification	3
COMP9115	Programming Languages Fundamental Concepts	3
COMP9201	Operating Systems	3
COMP9211	Computer Organisation and Design	3
COMP9214	Computer Architectures	3
COMP9215	VLSI System Design	3
COMP9216	Parallel and Distributed Computing Systems	3
COMP9221	Microprocessor Systems	3
COMP9231	Integrated Digital Systems	3
COMP9311	Data Base Systems	3
COMP9314	Advanced Data Base Management 1	3
COMP9331	Computer Networks and Applications	3
COMP9315	Advanced Data Base Management 2	3
COMP9414	Artificial Intelligence	3
COMP9415	Computer Graphics	3
COMP9416	Expert Systems and Deductive Data Base	3
COMP9511	Human-Computer Interaction	3
COMP9514	Advanced Decision Theory for Information Science	3
COMP9596	Advanced Topics in Information Information Science	6
COMP9614	Linguistics	3
COMP9918	Project	18

Electrical Engineering

Department of Communications

		Credits
ELEC9330	Special Topic	3
ELEC9370	Digital Image Processing Systems	3
ELEC9350	Theory of Optical Fibres and Optical Signal Processing	3
ELEC9352	Antenna Design and Applications	3
ELEC9351	Propagation and Transmission of Electromagnetic Waves	3
ELEC9353	Microwave Circuits: Theory and Techniques	3
ELEC9354	Microwave and Optical Devices	3
ELEC9336	Digital Communication Networks 1	3
ELEC9337	Data Networks 2	3
ELEC9338	Television Systems	3
ELEC9340	Communication Electronics	3
ELEC9341	Signal Processing 1- Fundamental Methods	3
		3
ELEC9342	Signal Processing 2- Advanced Techniques	3
		3
ELEC9343	Principles of Digital Communications	3
ELEC9347	Digital Modulation	3
ELEC9355	Optical Communication Systems	3

Department of Electric Power Engineering

ELEC9201	Power System Planning and Economics	3
ELEC9202	Power System Operation,Control and Protection	3
ELEC9211	High Voltage Technology	3
ELEC9212	Partial Discharges in Electrical Insulation	3
ELEC9213	Insulation Performance in Electrical Plant	3
		3
ELEC9214	Power System Equipment	3
ELEC9215	Fields and Materials	3
ELEC9203	Power Systems Analysis	3
ELEC9221	Special Topic in Power	3
ELEC9222	Special Topic in Power	3

		Credits
Department of Electronics		
ELEC9506	Special Topic in Electronics	3
ELEC9501	Advanced Semiconductor Devices	3
ELEC9502	Integrated Circuit Technology	3
ELEC9503	Integrated Circuit Design	3
ELEC9504	Solar Energy Conversion	3
ELEC9505	Solar Cells - Operating Principles, Technology and System Applications	3
Department of Systems and Control		
ELEC9401	Computer Control Systems 1	3
ELEC9402	Computer Control Systems 2	3
ELEC9403	Real Time Computing and Control	3
ELEC9404	Topics in Digital Control	3
ELEC9405	Advanced Control Topics	3
ELEC9407	Cybernetic Engineering	3
ELEC9409	Cybernetic, Machine and Robot Vision	
ELEC9410	Robotics, Automation and Productivity Technology	3
ELEC9412	Biological Signal Analysis	3
ELEC9415	Optimization and Optimal Control	3
ELEC9416	Non-linear Systems and Simulation	3
Other subjects		
MATH5054	Advanced Mathematics for Electrical Engineers	3
Project		
ELEC9912	Project Report	12
ELEC9918	Project Report	18

Mechanical and Manufacturing Engineering

		Credits
MECH9010	Project	12
MECH9201	Digital Logic Fundamentals for Mechanical Engineers	3
MECH9202	Microprocessor Fundamentals for Mechanical Engineers‡	3
MECH9203	Industrial Applications of Microprocessors	
MECH9204	Elements of Industrial Automation‡	3
MECH9205	The Analysis and Use of Integrated CAD/CAM Systems	3
MECH9211& MECH9212	Control and Modelling of Mechanical Systems 1,2‡	3,3
MECH9221	Industrial Robotics	3
MECH9222	Artificially Intelligent Machines	3
MECH9301& MECH9302	Advanced Mechanism Analysis and Synthesis 1, 2	3,3
MECH9310	Advanced Vibration Analysis	3
MECH9320	Random Vibrations	2
MECH9321& MECH9322	Acoustic Noise 1,2	2,2
MECH9361& MECH9862	Lubrication Theory and Design 1,2	2,2
MECH9400	Mechanics of Fracture and Fatigue	3
MECH9410	Finite Element Applications	3
MECH9421& MECH9422	Stress Analysis for Mechanical Engineering Design 1,2	3,3
MECH9460	Experimental Stress Analysis	3
MECH9620	Computational Fluid Dynamics	3
MECH9631& MECH9632	Gasdynamics 1,2	2,2
MECH9710	Numerical Fluid Dynamics and Heat Transfer	3
MECH9711	Analysis of Heat Transfer*	4
MECH9720	Solar Thermal Energy Design	3
MECH9730	Two Phase Flow and Heat Transfer*	4
MECH9740	Power Plant Engineering	3
	Design	3
MECH9742	Power Production Assessment	3
MECH9751& MECH9752	Refrigeration and Air Conditioning 1, 2*	3,3
MECH9753& MECH9754	Refrigeration and Air Conditioning Design 1, 2	3,3
MECH9755	Refrigeration and Air Conditioning Applications	3
MECH9756	Refrigeration and Air Conditioning Experimentation	3
MECH9757	Ambient Energy Air Conditioning	2
MEch9761& MECH9762	Intrnal Combustion Engines 1, 2	3,3
MECH9800	Ordinary Differential Equations in Mathematical Engineering	3
MECH9900- MECH9910	Special Topics in Mechanical Engineering	2,2
MECH9920- MECH9930	Special Topic in Mechanical Engineering	3,3
MANF9010	Research Project	12
MANF9019	Project†	9
MANF9029	Project Report †	18
MANF9039	Thesis†	36
MANF9040	Industrial Management Seminar	0
MANF9049	Operations Research Seminar	0
MANF9191	Special Topic in Production Engineering	2
MANF9192	Special Topic in Production Engineering	2
MANF9193	Special Topic in Production Engineering	2
MANF9200	Design for Production	4
MANF9210	Value Analysis Engineering	3
MANF9220	Product Design and Technological Innovation	3
MANF9300	Methods Engineering	4
MANF9310	Factory Design and Layout	3
MANF9320	Ergonomics	3
MANF9330	Simulation in Operations Research	3
MANF9340	Flexible Manufacturing Systems	3
MANF9400	Industrial Management	3
MANF9410	Inspection and Quality Control	3
MANF9420	Production and Inventory Control	2
MANF9430	Scheduling and Sequencing	2
MANF9440	Management of Distribution Systems	2
MANF9450	Management Simulation	3
MANF9460	Computer Integrated Manufacturing	3
MANF9491	Special Topic in Industrial Engineering	3
MANF9492	Special Topic in Industrial Engineering	3
MANF9500	Computer Aided Programming for Numerical Control	3
MANF9510	Computer Automation	3

		Credits
MANF9520	Computer Aided Manufacturing	3
MANF9530	Discrete Event Simulation Languages	3
MANF9541	Computer Aided Design for Manufacture	3
MANF9542	CAD Manufacture 2	3
MANF9560	Computer Integrated Manufacturing	3
MANF9601	Economic Decisions in Industrial Management	3
MANF9610	Decision Theory for Industrial Management	3
MANF9620	Operatons Research 1	3
MANF9630	Large Scale Optimisation in Industry	3
MANF9640	Industrial Applications of Mathematical Programming	3
MANF9650	Decision Support Systems	3
MANF9660	Energy Modelling, Optimisation and Energy Accounting	3
MANF9691	Special Topic in Operations Research	2
MANF9692	Special Topic in Operations Research	2
MANF9693	Special Topic in Operations Research	2
MANF9811	Industrial Experimentation 1	3
MANF9812	Industrial Experimentation 2	3
MANF9820	Time Series and Forecasting	2
MANF9840	Linear Programming	2
MANF9850	Non-Linear Programming	2
MANF9860	Networks and Graphs	2
MANF9870	Dynamic Programming	2
MANF9880	Optimal Control Operations Research	2

*Candidates wishing to specialise in Refrigeration and Air Conditioning should select this subject.
‡Candidates wishing to specialise in Industrial Automation should select this subject.
Note 1: Candidates taking their Projects in Industrial Management are generally required to take MANF9400 and MANF9040 plus at least 11 credits from MANF9300, MANF9620, MANF9601, MANF9420 and ACCT9062Accounting for Engineers. Before enrolling in the Projects they must have had one year's relevant industrial experience and have access to industry for their project topics.
Note 2: Candidates taking their projects in Operations Research are generally required to take the MANF9620, MANF9450, MANF9049 and ACCT9062 Accounting for Engineers.
Note 3: All Master of Engineering Science candidates in the Industrial Technology and Management Discipline must include MANF9010 Research Project (12cr) in their programs.

Surveying

SURV9106	Special Topic in Surveying A	3
SURV9107	Special Topic in Surveying B	3
SURV9121	Network and Deformation Analysis	3
SURV9122	Elements of Geodetic Equipment	3
SURV9161	Advanced Estimation Techniques	3
SURV9162	Mathematical Methods	3
SURV9210	Satellite Surveying	3
SURV9211	Introduction to Geodesy	3
SURV9213	Physical Meteorology	3
SURV9217	Gravimetric Geoid Evaluations	3
SURV9530	Analytical Photogrammetry	3
SURV9532	Computer Assisted Mapping	3
SURV9600	Principles of Remote Sensing	3
SURV9602	Remote Sensing Procedures	3
SURV9604	Land Information Systems	3
SURV9605	Ground Investigations for Remote Sensing	3
SURV9606	Major Assignment	6
SURV9608	Cadastral Systems	3
SURV9909	Project	9
SURV9912	Project Report	12
SURV9918	Project Report	18

Biomedical Engineering

BIOM9009	Project	9
BIOM9010	Biomedical Engineering Practice	2
BIOM9012	Biomedical Statistics	4
BIOM9018	Project Report	18
BIOM9027	Medical Imaging	4
BIOM9028	Radiation Physics	3
BIOM9030	Project Report	30
BIOM9040	Analogue Electronics for Biomedical Engineers†	4
BIOM9050	Microprocessors and Circuit Design for Biomedical Engineers	4
BIOM9060	Biomedical Systems Analysis	4
BIOM9101	Mathematical Modelling for Biomedical Engineers	4
BIOM9311	Mass Transfer in Medicine	4
BIOM9321	Physiological Fluid Mechanics	4
BIOM9332	Biocompatibility	3
BIOM9501	Computing for Biomedical Engineers	4
BIOM9510	Introductory Biomechanics	3
BIOM9541	Mechanics of the Human Body‡	3
BIOM9551	Biomechanics of Physical Rehabilitation‡	3
BIOM9561	Mechanical Properties of Biomaterials‡	3
BIOM9601	Biomedical Applications of Microcomputers 1**	3
BIOM9602	Biomedical Applications of Microcomputers 2 †††	3
BIOM9603	Image and Flow Cytometry	3
BIOM9611	Medical Instrumentation*	3
BIOM9621	Biological Signal Analysis	3
BIOM9701	Dynamics of the Cardiovascular System	3

†*Prerequisite BIOM9501 and BIOM9040 or equivalents.*
‡These 3 electives vary according to session offered. Only one is offered each year.
**Prerequisite BIOM9040 or equivalent.*
***Prerequisite BIOM9040 or equivalent.*
†††Follows on from BIOM9601.

Graduate Diploma Subjects

Graduate Diploma programs in all schools of the Faculty may include subjects from the above list, subject to the approval of the Head of School responsible for the subject.

In addition the following subjects are offered specially for Graduate Diploma candidates. Not all electives are necessarily offered in any particular year.

School of Computer Science and Engineering		Credits
COMP9011	Literacy and Programming	3
COMP9012	Software Engineering and Tools	3
COMP9013	Data Bases and Expert Systems	3
COMP9014	Computer Organisation and Interfacing	3
COMP9015	Issues in Computing	3
COMP9018	Computer Graphics and Applications	3
School of Electrical Engineering		
ELEC9411	Introductory Physiology for Engineers	3
School of Mechanical and Industrial Engineering		
MECH9201	Digital Logic Fundamentals for Mechanical Engineers	3
MANF9300	Methods Engineering	4
MANF9602	Engineering Economic Analysis	3
MANF9629	Operations Research	6
ACCT9001	Introduction to Accounting A	3
ACCT9002	Introduction to Accounting B	

Project Reports and Theses

Supervision of project reports and theses will generally be available in the following areas of research interest in the Schools of the Faculty. Alternatively, design and other topics may be chosen by arrangement. Contact staff members are listed within disciplines.

Civil and Environmental Engineering

Engineering Construction and Management — Prof Carmichael

Construction techniques. Equipment selection. Field studies of spatial layout, material flow, and construction operations.
Micro, macro, and system structure of construction operations.
Civil engineering management.
Critical path methods, and operations research methods in engineering construction.
Information flow requirements and decision processes of office and field agents.

Environmental Engineering — A/Prof Wilkinson

Geotechnical Engineering — A/Prof Shackel

Shear strength of jointed rock, soft rock and clay soils.
Expansive soils.
Mine tailings and power station ash disposal.
Uncertainty in geotechnical engineering.
Landsliding–groundwater response to rainfall, progressive failure, probability of failure.
Influence of soil fabric and mineralogy on properties.
Grouting with cement and chemicals.
Predicting excavatibility of rock.

Numerical Methods in Geomechanics — A/Prof Shackel

Finite element techniques and their applications in geotechnical engineering including static and dynamic loading.
Theoretical and numerical studies of rock blasting.
Numerical techniques in static and dynamic fracture mechanics.
Application of artificial intelligence and fuzzi-sets in geotechnical engineering.

Pavement Engineering — A/Prof Shackel

Skid resistance.
Pavement management and rehabilitation.
Interlocking concrete block pavements.
Accelerated trafficking studies of pavements and pavement materials.
Constitutive relationships of soils and pavement materials.
Pavement designs and analysis.

Civil Engineering Materials — A/Prof Shackel

Specification and quality control of concrete.
Investigation of alternative cementicious materials.
Examination of pozzolanic potential of indigenous materials.
Utilisation of industrial waste materials in concrete.
Chemistry and mineralogy of cement and lime stabilisation.

Groundwater — Dr Acworth

Water movement in unsaturated soils.
Pollutant movement in soils.
Salinity studies.
Groundwater studies and modelling.
Well hydraulics.

Hydrology — Prof Pilgrim

Flood estimation.
Yield and reservoir studies.
Hydrological instrumentation, data collection, and processing.
Mathematical rainfall-runoff models.
Stochastic hydrology.
Hydrological processes.
Hydrometeorology.
Urban drainage.
Arid lands hydrology.

Hydraulics — A/Prof Dudgeon

Two-fluid systems with small density differences.
Sediment motion.
Air entrainment in water in open channels and closed conduits.
Wave action and coastal engineering.
Flow through porous media.

Hydraulic transportation of solids.
Coastal engineering and breakwater stability.
Closed conduit flow.

Prestressed Concrete Structures Prof Gilbert
Partially prestressed concrete beams.
Analysis and design of end blocks for post-tensioned beams.
Strength of precast prestressed concrete planks.
Continuous prestressed concrete structures.

Public Health Engineering Mr Bliss
Sewage sludge conditioning and filtration.
Clarifiers and sedimentation in water and waste water treatment.
Filtration.
Fluidised bed aerobic and anaerobic treatment.
Aerobic digestion.
Nutrient control.
Treatment of high strength waste waters.
Chemical fixation of hazardous wastes.

Reinforced Concrete Structures Prof Gilbert
Behaviour and strength of slender reinforced concrete columns. Studies on high-strength concrete.
Behaviour of slabs in the vicinity of columns.
Reinforced concrete deep beams.
Creep and shrinkage effects in reinforced concrete structures.
Composite steel-concrete and concrete-concrete construction.

Structural Analysis Dr Lawther
Development and application of finite element techniques.
Investigation of elastic stability.

Dr Mickleborough
Analysis of dynamic response of off-shore structures and buildings.

Dr Tin Loi
Shakedown analysis of structures.

Transport Engineering Prof Black
Problems of land use and transport interaction.
Theories of traffic structure and flow.
Measurements, planning and control of traffic.
Transport systems analysis.
Transport and the environment – accidents, energy, intrusion, noise and pollution.
Economic evaluation of transport investments.
Transport planning – local, urban, and regional systems.
Investigations into transport economics, policy and decision making.
Investigations of the geometric shape of the road alignment on the driver's view of the road.
Study of road alignment design in three dimensions.

Water Resources Engineering Prof Pilgrim
Multi-objective water resources planning.
Hydro-economic studies.
Optimisation problems in water resource systems design.
Drought studies.
Flood plain management.
Arid lands management.

Waste Management Mr Moore
Landfill site selection.
Leachate testing.
Chemical fixation.
Domestic solid waste collection routing.
Hydrogeological sampling.
Acid Waste treatment.
Metals removal.
Toxicity testing.
Legal aspects of hazardous waste.

Computer Science and Engineering

Artificial intelligence	Dr Sowmya
Artificial intelligence	Dr Parameswaran
Artificial intelligence	Dr Sammut
Artificial intelligence	Mr Chan
Artificial intelligence	Mr Compton
Cognitive engineering	Dr Quinn
Cognitive modelling	Dr Wilson
Combinatorial algorithms	Dr Wilson
Complexity	Dr Whale
Computational Geometry	Mr Lambert
Computer aided design	Prof Hellestrand
Computer Organisation	Dr Matheson
Computer architecture	Dr Matheson
Computer assisted learning	Dr Matheson
Computer assisted learning	Dr Piotrowski
Computer assisted learning	Dr Sammut
Computer assisted learning	Dr Quinn
Computer graphics	Mr Lambert
Computer vision for robotics	Dr Sowmya
Data base management	Prof Hiller
Decision making under uncertainty	Prof Hiller
Distributed operating systems	Dr Heiser
Distributed synchronisation and load balancing	Dr Chaudhuri
Electronic publishing	A/Prof Lions
Expert systems	Dr Sammut
Expert systems	Mr Chan
Expert systems	Dr Parameswaran
Fault tolerant computer systems	Prof Hellestrand
Formal methods	Mr Robinson
Functional programming	Mr Robinson
Graph Theory	Dr Chaudhuri
Human interface computing	Prof Hiller
Human interface computing	Dr Matheson
Human interface computing	Dr Quinn
Information retrieval	Prof Hiller
Integrated circuit design and logic testing	Prof Hellestrand
Knowledge acquisition	Mr Compton
Knowledge based systems	Mr Compton
Knowledge representation using conceptual graphs	Mr Chan
Languages	Mr Robinson
Learning algorithms	Dr Gedeon
Logic Programming	Dr Piotrowski
Logic Programming	Mr Chan

Machine learning	Dr Sammut
Mechanical theorem proving	Mr Chan
Microprocessor based equipment	Dr Matheson
Model based reasoning	Mr Compton
Natural language processing	Dr Whale
Natural language understanding	Dr Wilson
Natural language	Dr Amin
Neural networks	Dr Gedeon
Neural networks	Dr Wilson
Non-standard logics (modal and temporal logics)	Mr Chan
Office automation	A/Prof Lions
Operating systems	A/Prof Lions
Operating systems	Dr Olszewski
Parallel and distributed algorithms	Dr Chaudhuri
Parallel and distributed systems	Prof Hellestrand
Parallel languages	Dr Olszewski
Parsing and translation	Mr Robinson
Plagiarism detection	Dr Whale
Persistent objects	Dr Olszewski
Programming languages and implementation	Mr Robinson
Program verification	Dr Piotrowski
Parallel and distributed algorithms	Dr Chaudhuri
Parallel and distributed systems	Dr Heiser
Pattern recognition	Dr Amin
Production systems	Dr Parameswaran
Program similarity	Dr Whale
Program transformation	Dr Gedeon
Programming environments	Dr Gedeon
Query language testing	Prof Hiller
Reverse engineering	Dr Gedeon
Software engineering	Mr Robinson
Software engineering	Prof Hellestrand
Specification and refinement	Mr Robinson
Specification & verification of reactive systems	Dr Sowmya
String matching	Dr Whale
Temporal logic	Dr Sowmya
VLSI systems	Prof Hellestrand

Electrical Engineering

Communications

Optical communications	Prof Chu, Dr Zakarevicius
Optical fibres and integrated optics	Prof Chu
Electro-optic devices including sensors	Prof Chu
Digital communications	A/Prof Korn, Dr Zakarevicius, Dr Radzyner, Dr Irving, A/Prof Holmes
Digital radio and modulation methods	A/Prof Korn, Dr Zakarevicius, Dr Radzyner
Computer communications and local area networks	Prof Karbowiak, Dr Dewar
New architectures for local area networks	Prof Karbowiak, Dr Dewar
Switching and stored program control systems	Prof Karbowiak
UHF and microwave circuits and devicess	Dr Fooks, Dr Zakarevicius, A/Prof Vu
Microwave measurements and electronics	Dr Fooks, Dr Zakarevicius, A/Prof Vu
Antennas and phased arrays	A/Prof Vu, Dr Dewar
Radar and navigational aids	Dr Zakarevicius, A/Prof Vu, Dr Dewar, Dr Fooks
Land & Satellite Mobile Communications	A/Prof Korn
Mobile satellite communications	A/Prof Vu, Dr Fooks, Dr Zakarevicius, A/Prof Korn, Dr Radzyner, Dr Irving
Signal processing and analysis	A/Prof Holmes, Dr Radzyner, Dr Irving, Dr Zakarevicius, Dr Phillips
Active and adaptive filtering.	A/Prof Holmes, Dr Radzyner, Dr Irving, Dr Phillips
Digital filters	A/Prof Holmes, Dr Radzyner, Dr Irving, Dr Phillips
Digital signal processor chip applications	Dr Radzyner, Dr Irving, Dr Phillips
Acoustic and seismic signal processing	A/Prof Holmes
Digital image processing	Dr Phillips
Electronic music	A/Prof Holmes
SAW Signal Processing	Dr Zakarevicius

Electric Power

i. Power Systems

Power systems analysis	Dr Outhred, Dr Sutanto, Dr Kaye
Power System Protection	Prof Morrison
Stability, Dynamics and Control of Power Systems	Prof Morrison, Dr Sutanto
Distribution System Planning and Operation	Dr Kaye
Organization of Hydro-Electric Power Systems	Dr Kaye
Electromagnetic Transient Analysis	Dr Sutanto
Static VAR Compensation	Dr Sutanto
Power System Planning and Economics	Dr Outhred, Dr Kaye
Load Management and Control	Dr Outhred, Dr Sutanto, Dr Kaye
Renewable Energy Sources - Remote Area Supply	Dr Outhred, Dr Kaye

ii. Electrical Power Equipment and Utilization

High Voltage and High Current Phenomena	Dr Blackburn
Insulating Material Application	Dr Blackburn
Electrical Testing	Dr Blackburn
Voltage Disturbances in LV and MV Systems	Dr Blackburn
Electrical Measurements and Data Acquisition	Dr Blackburn, Mr Spooner, Dr Rahman

Electrical Machines and Drives	Dr Rahman, A/Prof Grantham, Mr Spooner
Arcing Fault characteristics	Dr Blackburn
Partial Discharge Detection and Location	Dr Blackburn
Distribution System Protection	Dr Blackburn
Gaseous discharges and insulation	Dr Blackburn
Equipment for Harzardous Atmospheres	A/Prof Grantham,
Synthetic Loading of Machines	A/Prof Grantham, Mr Spooner
Computer Aided Teaching	A/Prof Grantham

iii. Power Electronics

DC/DC Converters	Dr Daly
High Frequency Power Transformers	Dr Daly
Inverters for Machine Drives	Dr Daly, Dr Rahman, Mr Spooner
Microprocessor Control of Power Electronics	Dr Daly, Dr Rahman, A/Prof Grantham, Mr Spooner
Variable Speed Drives	Dr Daly, Dr Rahman, A/Prof Grantham, Mr Spooner
Power Electronic Simulation Studies	Dr Rahman,
Electronic Commutation	Dr Rahman,
Remote area supplies	Mr Spooner

Electronics

Semiconductor device physics	Prof Green, Dr Kwok, Dr Huang
Novel Semiconductor Devices	Prof Green
Integrated circuit design	Prof Rigby
Integrated circuit technology	Dr Horwitz, Dr Huang, Dr Kwok
Optical & Infrared Detector Arrays	Prof Green, Dr Wenham
Microelectronic sensors	Dr Huang, Prof Green
Photovoltaic solar energy conversion	Prof Green, Dr Wenham
Silicon Solar Cells	Prof Green
Computer-aided IC design	Prof Rigby
Plasma Processing	Dr Horwitz, Dr Wenham
Intergrated Circuits for Advanced Signal processing	Prof Rigby
High-Speed Bipolar Logic	Dr Horwitz

Systems and Control

Multivariable Control, stimulations, modelling, expert systems in control design, advanced control of power plant, computer aided design and adaptive control.	Prof Rees
Cybernetic engineering and advanced robotics: signal, pattern, image and scene, analysis and processing, brain modelling, neural computing and learning machines, vision robotics and assembly, adaptive control, hierarchical control, formal systems and functional representation.	A/Prof Tait
Robust control, computation issues in control, adaptive control.	Dr Clements
Adaptive and multivariable systems, multirate control, robust digital control, motion control systems.	Dr Lim
Digital and adaptive control, real-time computing, multivariable control.	Dr Hesketh
Biomedical engineering, biological signal analysis, physiological systems modelling and analysis, computer hardware and software, data acquisition, signal processing, ecg analysis.	A/Prof Celler
Control and simulation, digital system and digital signal processing, physiological system modelling, biological signal processing, computer modelling of information processing, neural computing and learning machines, adaptive control.	A/Prof Nielson

Mechanical and Manufacturing Engineering

Applied Mechanics

Mechanics of solids	Dr Stark, Prof Patterson, A/Prof Kelly, Dr Chowdhury
Stress analysis	Dr Stark, A/Prof Kelly, Prof Patterson
Impact mechanics	A/Prof Byrne
Spatial and planar linkages	A/Prof Baker
Dynamics of machines	A/Prof Baker, A/Prof Hahn, Dr Ford
Rotor bearing dynamics	A/Prof Hahn, Mr Randall
Vibrations	Mr Randall, Dr Ford, A/Prof Hahn, A/Prof Byrne, Prof Patterson, A/Prof Kelly
Lubrication and wear	A/Prof Hahn, Dr Challen, Prof Oxley, Dr Kopalinsky
Hydrodynamic dampers	A/Prof Hahn
Acoustics	A/Prof Byrne, Mr Randall

Design

Biomechanics	A/Prof Churches, Mr Frost, Prof Svensson
Design of surgical equipment	Mr Frost, A/Prof Churches, Mr Crawford
Computer aided design	Mr Frost, Dr Challen, Mr Crawford

Development of engineering design courses	A/Prof Churches, Prof Svensson, Mr Frost
Design methodology	Mr Frost
Crash protection devices	Prof Svensson, A/Prof Churches
Design projects: analysing testing and development for industry	Mr Frost, A/Prof Churches
Computer-aided ship design	Dr Pal
Ships design methodology	Dr Pal

Fluid and Thermal Engineering

Two-phase flow with and without heat transfer	Dr Behnia, Prof de Vahl Davis
Slurries	A/Prof Reizes
Conveying of solid dusts by gases	A/Prof Reizes
Hydraulic transients	A/Prof Reizes
Hydrodynamics	A/Prof Doctors
Water hammer	A/Prof Reizes
Conduction, convection, and radiation	A/Prof Morrison, Prof de Vahl Davis, Dr Leonardi, Dr Behnia, A/Prof Reizes, Dr Madhusudana
Natural convection	Prof de Vahl Davis, Dr Leonardi, Dr Behnia, A/Prof Reizes, A/Prof Morrison
Computational fluid dynamics and heat transfer	Prof de Vahl Davis, Dr Leonardi, Dr Behnia, A/Prof Reizes, A/Prof Morrison
Refrigeration and air conditioning	Dr Leonardi, Dr Maclaine-cross Dr Behnia
Energy conversion and conservation	A/Prof Reizes, Dr Behnia,
Solar energy and emissions	A/Prof Morrison, Dr Maclaine-cross
Engine performance and emissions	Prof Milton, Dr Behnia,
Gas dynamics, transonic flow, shock waves	Prof Milton
Optical measuring methods	A/Prof Morrison, Dr Behnia, A/Prof Reizes,
Hydrodynamics of planing surfaces	A/Prof Doctors
Problems in wave resistance	A/Prof Doctors
Finite element methods	A/Prof Doctors

Industrial Technology and Management

Efficiency of production lines	Dr Kerr
Job shop scheduling	Dr Kerr
Least-cost tolerance	Dr Farmer
Operational simulation	Dr Mathew
Variety reduction	
Probabilistic networks	Dr Kerr
Optimisation techniques relevant to information processing systems	Dr Kerr
Production scheduling for variable demand	Dr Kerr
Inventory and production control	Dr Kerr
Applications of operations research to real-world problems	Dr Kerr
Stochastic processes	Dr Kerr
Experimental and theoretical investigations of the following process: machining, extrusion, indentation, compression, rolling, drawing	Dr Mathew
Performance of single and multipoint cutting tools including tool life and economics of machining	Dr Mathew
Properties of materials at high rates of strain	Dr Mathew
Materials handling studies	Dr Mathew
Factory design and location studies	Dr Mathew
Plant layout by computer	Dr Mathew
Ergonomics	Dr Mathew
Occupational health and safety	Dr Mathew
Production design studies	Dr Farmer
Engineering design analysis and tolerance technology	Dr Farmer
Metrology studies	Dr Farmer
Group technology studies	Dr Mathew

Mechatronics

Applications of AI in engineering	Dr Willgoss
Applications of AI in engineering	Dr Tordon
Computer interfacing	Dr Willgoss
Computer interfacing	Dr Tordon
Electromagnetic systems in manufacturing	Dr Tordon
Electromagnetic systems in manufacturing	Dr Willgoss
Electromagnetic systems in manufacturing	A/Prof Morrison
Logic programming	Dr Willgoss
Logic programming	Dr Tordon
Microcomputer control	Dr Tordon
Neural nets	Dr Willgoss
Reliability engineering	Dr Tordon
Robotics & manufacturing	Dr Willgoss
Sensors	A/Prof Morrison
Sensors	Dr Willgoss
Sensors	Dr Tordon
Welding research	Dr Willgoss

Surveying

Analysis if deformation measurements	Dr Harvey, A/Prof Rüeger
Applications of inertial technology	A/Prof Rüeger
Cadastral surveys	Dr Robinson
Cadastral systems	Dr Robinson
Computer assisted mapping	Prof Trinder

Computer controlled surveying	A/Prof Rüeger
Coordinate transformation	Dr Harvey
Database technology for geodetic analysis	Dr Masters
Electromic distance measurement	A/Prof Rüeger
Geoid determination	A/Prof Kearsley
Deopotential model testing	A/Prof Kearsley
Geodesy	A/Prof Stolz
GPS geodynamics	Prof Brunner, A/Prof Stolz
GPS geodetic positioning	Prof Brunner
GPS surveying	Dr Rizos
High-precision surveying	A/Prof Rüeger
Image analysis	Prof Trinder
Land altimetry	A/Prof Kearsley
Land information management	Dr Robinson
Least squares estimation	Dr Harvey
Metrology and dimensional measurement	Dr Harvey, A/Prof Rüeger
Monitoring of structures and terrain	A/Prof Rüeger
Photogrammetry	Prof Trinder
Precise orbit determination	Dr Rizos
Precise GPS navigation	Dr Rizos
Quality issues in land information systems	Dr Masters
Radar altimetric analysis for oceanography	Dr Rizos
Remote sensing	A/Prof Forster, Prof Trinder
Satellite geodesy	Dr Rizos, A/Prof Stolz
Spatial query languages	Dr Masters
Survey network adjustment	Dr Harvey
Wave propagaton effects	Prof Brunner

Biomedical Engineering

Modelling of respiratory function, cardiovascular function, nervous system, artificial kidney therapy, extracorporeal heart-lung support, endocrine system and other body systems
Development of biomaterials
Investigation of physiological fluid mechanics
Microprocessor control of medical equipment
Limb and joint dynamics studies
Development of implantable electrodes
Development of rehabilitation devices
Statistical analysis of patient therapy and modes of patient treatment
Development and evaluation of new hospital equipment and treatment procedures
Signal analysis of wave forms from medical diagnostic equipment
Implants for fracture support and joint replacement
Improved drug administration
Arterial haemodynamics and ventricular-vascular interaction
Mechanisms of age-related arterial degeneration and hypertension
Isolated heart studies of the coronary circulation and electrophysiology

Remote Sensing

Incorporation of auxiliary data into classification procedures
Application of satellite data to Urban Area studies
Monitoring land use change using remotely sensed data
Determining the characteristics of surface reflectance
Analysis of image quality
Application of satellite imagery to small scale mapping
Multispectral linear transformations
Application of spaceborne synthetic aperture radar data
Application of aircraft and satellite data to arid land studies
Application of satellite data to geological studies
Synergism of radar, visible and infrared remotely sensed data
Analysis of high resolution SPOT and Landsat TM data
Application to pollution and environmental monitoring

Subject Descriptions

Identification of Subjects

A subject is defined by the Academic Board as 'a unit of instruction approved by the University as being a discrete part of the requirements for a course offered by the University'.

Each approved subject of the University is identified by a sequence of eight characters, consisting of a four character alphabetical prefix which identifies the organizational unit responsible for administering the subject, and a four digit numeric suffix identifies the subject.

Subject identifiers are approved by the Registrar and the system of allocation is based on the following guidelines:

1. The authority offering the subject, normally a School of the University, is indicated by the four character alphabetical prefix.

2. Each subject identifier is unique and is not used for more than one subject title.

3. Subject numbers which have previously been used are not used for new subject titles.

Subjects taught are listed in full in the handbook of the faculty or board of studies responsible for the particular course within which the subjects are taken. Subject descriptions are contained in the appropriate section in the handbooks.

Appropriate subjects for each school appear at the end of each school section.

The identifying alphabetical prefixes for each organizational unit are set out on the following pages.

Servicing Subjects are those taught by a school or department outside its own faculty. Their subject descriptions are published in the handbook of the faculty which originates the subject and are also published in the handbook of the faculty in which the subject is taught. The following pages contain descriptions for most of the subjects offered for the courses described in this book, the exception being General Education subjects. For General Education subjects see the *Centre for Liberal and General Studies* Handbook which is available free of charge.

HSC Exam Prerequisites

Subjects which require prerequisites for enrolment in terms of the HSC Examination percentile range, refer to the 1978 and subsequent Examinations.

Candidates for enrolment who obtained the HSC in previous years or hold other high school matriculation should check with the appropriate school on what matriculation status is required for admission to a subject.

Information Key

The following is the key to the information which may be supplied about each subject:

S1 session 1, **S2** session 2
F session 1 *plus* session 2, ie full year
S1 or **S2** session 1 *or* session 2, ie choice of either session
SS single session, but which session taught is not known at the time of publication
CCH class contact hours
P/T part-time
L lecture, followed by hours per week
T laboratory/tutorial, followed by hours per week
hpw hours per week
wks weeks of duration
C credit or credit units
CR Credit level
DN Distinction
HD High Distinction
X External

In the Faculty of Engineering, Schools and Centres have allocated the first digit in the numeric suffix of all new subject identifiers as indicating the level of the subject. **Please note that the value '9' in this position is reserved for graduate subjects.**

Prefix	Organizational unit	Faculty
ABIO	School of Applied Bioscience	Applied Science
ACCT	School of Accounting	Commerce & Economics
ACHM	Department of Chemistry	University College
ACMA	Department of Civil Engineering	University College
ACSC	Department of Computer Science	University College
ADSC	Australian Defence Studies Centre	University College
AECM	Department of Economics & Management	University College
AELE	Department of Electrical Engineering	University College
AENG	Department of English	University College
AERO	Aerospace Engineering	Engineering
AGOC	Department of Geography & Oceanography	University College
AHIS	Department of History	University College
AINT	University College(Interdisciplinary)	University College
AMAT	Department of Mathematics	University College
AMEC	Department of Mechanical Engineering	University College
ANAT	School of Anatomy	Medicine
APHY	Department of Physics	University College
APOL	Department of Politics	University College
APSC	Faculty of Applied Science	Applied Science
APSE	Faculty of Applied Science	Applied Science
ARCH	School of Architecture	Architecture
ARTS	Faculty of Arts and Social Sciences	Arts and Social Sciences
ASIA	Asian Studies	Arts and Social Sciences
ATAX	Board of Studies in Taxation	
AUST	Australian Studies	Arts and Social Sciences
BIOC	School of Biochemistry	Biological & Behavioural Sciences
BIOM	Centre for Biomedical Engineering	Engineering
BIOS	School of Biological Science	Biological & Behavioural Sciences
BIOT	Department of Biotechnology	Applied Science
BLDG	School of Building	Architecture
BSSM	Board of Studies in Science & Mathematics	
CEIC	School of Chemical Engineering & Industrial Chemistry	Applied Science
CHEM	School of Chemistry	Science
CHEN	Department of Chemical Engineering	Applied Science
CHIN	Chinese	Arts and Social Sciences
CIVL	School of Civil Engineering	Engineering
CMED	School of Community Medicine	Medicine
COFA	College of Fine Arts	
COMM	Faculty of Commerce and Economics	Commerce & Economics
COMP	School of Computer Science and Engineering	Engineering
ECOH	Department of Economic History	Commerce & Economics
ECON	School of Economics, Departments of Economics and Econometrics	Commerce & Economics
EDST	School of Education Studies	Professional Studies
ELEC	School of Electrical Engineering	Engineering
ENGL	School of English	Arts and Social Sciences
EURO	European Studies	Arts and Social Sciences
EXPA	School of Arts and Music Education	Professional Studies
FIBR	School of Fibre Science & Technology	Applied Science
FILM	Department of Theatre and Film Studies	Arts and Social Sciences
FINS	School of Banking & Finance	Commerce & Economics
FOOD	Department of Food Science and Technology	Applied Science
FREN	School of French	Arts and Social Sciences
FUEL	Department of Fuel Technology	Applied Science
GENS	Centre for Liberal & General Studies	
GEOG	School of Geography	Applied Science
GEOL	Department of Applied Geology	Applied Science
GERS	Department of German Studies	Arts and Social Sciences
GREK	Modern Greek	Arts and Social Sciences
GSBE	Graduate School of the Built Environment	Architecture
HEAL	School of Health Services Management	Professional Studies
HIST	School of History	Arts and Social Sciences
HOSP	School of Marketing	Commerce & Economics
IDES	Department of Industrial Design	Architecture
INDA	Industrial Arts	Architecture
INDC	Department of Industrial Chemistry	Applied Science
INDO	Indonesian	Arts and Social Sciences
INFS	School of Information Systems	Commerce & Economics
INTD	Interdisciplinary Studies	Arts and Social Sciences
IROB	School of Industrial Relations & Organizational Behaviour	Commerce & Economics
JAPN	Asian Studies Unit	Commerce & Economics
KCME	Key Centre for Mines	Applied Science
LAND	School of Landscape Architecture	Architecture
LAWS	School of Law	Law
LEGT	Department of Legal Studies & Taxation	Commerce & Economics
LING	Linguistics	Arts and Social Sciences
LIBS	School of Librarianship	Professional Studies
MANF	Manufacturing Management	Engineering
MARK	School of Marketing	Commerce & Economics
MATH	School of Mathematics	Science
MATS	School of Materials Science and Engineering	Applied Science

Prefix	Organizational unit	Faculty
MDCN	School of Medicine	Medicine
MDSG	Medicine Surgery Clinical Studies	Medicine
MECH	School of Mechanical and Manufacturing Engineering	Engineering
MEED	School of Medical Education	Medicine
MFAC	Medical Faculty (Administration)	Medicine
MICR	School of Microbiology	Biological & Behavioural Sciences
MINE	Department of Mining Engineering	Applied Science
MNGT	Australian Graduate School of Management	
MSCI	Board of Studies and Mathematics	Board of Studies
MUSI	Department of Music	Arts and Social Sciences
NAVL	Naval Architecture	Engineering
OBST	School of Obstetrics & Gynaecology	Medicine
OCEA	Faculty of Science	Science
OPTM	School of Optometry	Science
PAED	School of Paediatrics	Medicine
PATH	School of Pathology	Medicine
PDCS	Professional Development Centre	Professional Studies
PHIL	School of Philosophy	Arts and Social Sciences
PHPH	School of Physiology & Pharmacology	Medicine
PHYS	School of Physics	Science
PLAN	School of Town Planning	Architecture
POLS	School of Political Science	Arts and Social Sciences
POLY	Department of Polymer Science	Applied Science
PROF	Faculty of Professional Studies	Professional Studies
PSCY	School of Psychiatry	Medicine
PSYC	School of Psychology	Biological & Behavioural Sciences
PTRL	Department of Petroleum Engineering Studies	Applied Science
REMO	Centre for Remote Sensing	Engineering
RUSS	Department of Russian Studies	Arts and Social Sciences
SAFE	Department of Safety Science	Applied Science
SCTS\ HPST	School of Science & Technology Studies	Arts and Social Sciences
SLSP	Department of Social Science & Policy	Arts and Social Sciences
SLST	School of Sport & Leisure Studies	Professional Studies
SOCI	School of Sociology	Arts and Social Sciences
SOCW	School of Social Work	Professional Studies
SPAN	Spanish & Latin American Studies	Arts and Social Sciences
SURG	School of Surgery	Medicine
SURV	School of Surveying	Engineering
TEDG	School of Teacher Education (graduate)	Professional Studies
TEED	School of Teacher Education (undergraduate)	Professional Studies
TESL	TESOL	Arts and Social Sciences
TEXT	Department of Textile Technology	Applied Science
THFI	Department of Theatre and Film Studies	Arts and Social Sciences
THST	Department of Theatre and Film Studies	Arts and Social Sciences
USOM	School of Mines	Applied Science
WOMS	Women Studies	Arts and Social Sciences
WOOL	Department of Wool & Animal Science	Applied Science

Accounting

ACCT9062 Accounting for Engineers F L1.5
Problems related to industrial situations, and their relevance in decision-making. Manufacturing and cost accounts, budgeting and budgetary control, cost analysis and control and profit planning.

Biomedical Engineering

BIOM9009 Project C9

BIOM9010 Biomedical Engineering Practice S2 L2 C2
Introduction to clinical situations in hospitals. Presentation of guest lectures by eminent people working in this field. Lecture topics include cardiology, neurology, orthopaedics, rehabilitation, etc. Visits to various biomedical engineering units.

BIOM9012 Biomedical Statistics S2 L2.5 T1.5 C4
Probability and distributions. Estimation and hypothesis testing. Associations between disease and risk factors. Linear models; analysis of variance, simple and multiple regression, discriminant analysis. Distribution-free methods. Analysis of survival data. Experiment design.

BIOM9018 Project Report C18

BIOM9027 Medical Imaging S2 L2 T2 C4
Fundamentals of producing a medical image, image collection techniques, image reconstruction algorithms. Four main areas of medical imaging will then be examined in detail: Nuclear Medicine, Ultrasound, Diagnostic Radiology, Magnetic Resonance Imaging. Clinical application of each area.

BIOM9028 Radiation Physics S1 L2 T1 C3
Basic physics of interaction of photons and particules with matter. Nuclear/atomic structure, nuclear reactions, radioactivity counting statistics, dosimetry, detectors. Radiation biology, interaction of ionising radiation with water and tissues. X-ray therapy. Medical uses of non-ionising electro-magnetic radiation.

BIOM9030 Project Report C30

BIOM9040 Analogue Electronics for Biomedical Engineers S1 L2 T2 C4
Basic theory of passive components, simple network analysis, small signal amplifiers, feedback and oscillators, operational amplifiers and their uses, analogue integrated circuits. Transistors as logic devices, gates. Safety requirements for medical instruments, circuit diagram analysis and component identification. Laboratory work involves both design and construction of analogue circuits.

BIOM9050 Microprocessors and Circuit Design for Biomedical Engineers S2 L2 T2 C4
Prerequisite: 32.040G and 32.501G or equivalents.
Examination of the fundamental digital and analogue signal conditioning circuits commonly found in medical applications. Emphasis is given to project-oriented practical experience involving aspects of biological signal acquisition by microcomputers. Fundamentals of microprocessor hardware and software.

BIOM9060 Biomedical Systems Analysis S1 L2 T1 C3
Compartmental analysis serves to unify modelling and analysis in many diverse fields. It has wide application in pharmocokinetics, metabolic, ecosystem and chemical kinetic modelling, and in the future will be applied increasingly to engineering systems. Topics include: classes of compartmental structure; fundamental properties; rate processes; inferred parameters; input-dependent kinetics; optimal input design; algorithms for identification and control.

BIOM9101 Mathematical Modelling for Biomedical Engineers S1 L3 T1 C4
Model formulation and validation, solution of ordinary and partial differential equations by analytical and numerical techniques.

BIOM9311 Mass Transfer in Medicine S2 L2 T2 C4
Material and energy balances, modelling of intrabody mass transfer, elementary treatment of diffusion, convection, hydraulic permeability and osmosis in biological and synthetic membranes. Applications to hemodialysis, blood oxygenators, artificial pancreas and slow release drug delivery systems.

BIOM9321 Physiological Fluid Mechanics S2 L2 T2 C4
Fundamentals of biological fluid flow by way of the governing equations. Kinematics and dynamics, viscous and inertial flow, boundary layers, separation, physiological flows (cardiac, vascular, pulmonary, urinary, etc.) and flow in artificial organs.

BIOM9332 Biocompatibility S2 L2 T1 C3
Interaction of biological fluids and cells with foreign surfaces, in vitro tests to assess biocompatibility and thrombogenicity, current status of biocompatible materials as applied to extracorporeal systems, surgical implants and prosthetic devices.

BIOM9501 Computing for Biomedical Engineers S1 L2 T2 C4
Problem of definition; algorithm design and documentation; definition of data structures, structured program development; realisation of program development through the Pascal programming language; application to biomedical problems.

BIOM9510 Introductory Biomechanics S1 L2 T1 C3
The principles of the mechanics of solid bodies: force systems; kinematics and kinetics of rigid bodies; stress-strain relationships; stress analysis of simple elements application to musculoskeletal system.

BIOM9541 Mechanics of the Human Body SS L2 T1 C3
Prerequisite: 32.510G or equivalent.
Statics and dynamics of the musculoskeletal system: mathematical modelling and computer simulation, analysis of pathological situations.

BIOM9551 Biomechanics of Physical Rehabilitation **SS L2 T1 C3**

Prerequisite: 32.510G or equivalent.

The application of biomechanics principles to the areas of: performance testing and assessment, physical therapy, design of rehabilitation equipment, design of internal and external prostheses and orthoses.

BIOM9561 Mechanical Properties of Biomaterials **SS L2 T1 C3**

Prerequisite: 32.510G or equivalent.

The physical properties of materials having significance to biomedical engineering; human tissues; skin; soft tissues; bone; metals; polymers and ceramics: the effects of degradation and corrosion.

BIOM9601 Biomedical Applications of Microcomputers 1 **S1 L3 C3**

Assumed knowledge: 32.050G or equivalent.

Microcomputer architecture; physiological data acquisition systems: input/output signals and devices; assembly language programming; interfacing to higher level languages; the numeric data co-processor; interrupts; graphics; practical sessions on use of Debug, Assembler, familiarisation with interrupt vector table and I/O ports. Major assignment on specific biomedical application (eg. bedside ECG monitor).

BIOM9602 Biomedical Applications of Microcomputers 2 **S2 L3 C3**

Prerequisite: 32.601G or equivalent.

Data communication; serial and parallel ports; BIOS and DOS interrupts; interfacing to external devices; DMA and interval timer; control systems and devices; stepper motor control. Implementation and analysis of a range of microcomputer-based biomedical applications, eg. variable rate infusion pump, physiological reaction-time monitoring system; measurement of coronary sinus flow, temperature control; position control; operation of intra-aortic balloon pump.

BIOM9603 Image and Flow Cytometry **S2 L3 C3**

Technology, techniques and uses of flow and image cytometry. Flow and cytometers analysis and cell sorting, image analysis and cell counting from slides. Preparation and staining of cells. Data acquisition and analysis. Applications in medical research and diagnosis.

BIOM9611 Medical Instrumentation **S2 L2 T1 C3**

Prerequisite: 32.040G or equivalent.

A critical survey of the theory and practical applications of medical transducers and electromedical equipment in common use in hospitals and research laboratories.

BIOM9621 Biological Signal Analysis **S1 L3 C3**

Use of digital computers to extract information from biological signals. Signal processing using filtering, averaging, curve-fitting and related techniques, and analysis using model simulations, correlation, spectral analysis etc.

BIOM9701 Dynamics of the Cardiovascular System **S1 L2 T1 C3**

Structure of the heart; organization of the mammalian vasculature; mechanical, electrical and metabolic aspects of cardiac pumping; the solid and fluid mechanics of blood vessels; rheology of blood.

Biotechnology

Biotechnology is a department within the School of Applied Bioscience.

BIOT7100 Biological Principles **S1 L3**

A study of the characteristics of living systems. Biological molecules: carbohydrates, lipids, proteins and nucleic acids. Cell structure and function: prokaryotic and eukaryotic cells. Basic biochemistry: thermodynamics and catalysis of metabolism; catabolic and anabolic processes; properties of enzymes; DNA replication; protein synthesis. Comparative metabolism of viruses, bacteria, fungi, plants and animals. Metabolic regulation. Modes of nutrition and nutrient cycles. Reproduction and genetics: eukaryotic and prokaryotic systems; sexual and asexual reproduction; bacterial genetics; recombinant DNA technology. Basic plant biology, plant structure and function; transport. Invertebrate zoology, evolution and animal behaviour. Microorganisms of commercial significance. Biodeterioration and biodegradation.

Chemical Engineering and Industrial Chemistry

CEIC5630 Industrial Water and Wastewater Engineering **S1 or S2 L3**

Environmental consequences of water pollution. Water quality criteria and regulations related to industrial use and disposal. Water sources and requirements of industry. Theoretical and practical aspects of treatment methods, including screening, sedimentation, oil separation, coagulation and flocculation, filtration, biological treatment, adsorption, ion exchange, membrane processes. Strategies for industry including waste surveys, prevention at source, correction before discharge water reuse. Economic aspects. Seminars. Factory visits/ laboratory.

Civil Engineering

CIVL9402 Transport, Environment, Community **F C6**

Effect of transport on public health, environment and communities. Analysis of unwanted effects of transport activity: accidents, noise, pollution, intrusion; causation, measurement, preventative and remedial action. Community reaction to transport activity; government, bureaucracy and public involvement in transport policy and environment impact statements.

CIVL9403 Theory of Land Use Transport Interaction **SS C3**

Theoretical aspects of land use transport planning. Basic concepts, data collection methods, systems models and equation of state function (behavioural, optimizing).

Introduction to land use-transport modelling (land use, generation, distribution, modal assignment, network assignment, evaluation). Planning methodologies (short-, medium-, long-term; action planning, strategic planning; local, urban, regional, national).

CIVL9405 Urban Transport Planning Practice SS C3
Analytical techniques for urban land use/transport planning practice. Planning methodology: traffic generation, trip distribution, modal-choice, traffic assignment, evaluation. Land use forecasting: calibration and verification of behavioural models, application of mathematical programming models, case studies, public transport problems.

CIVL9407 Transport Systems Design (Non-Urban) S1 C3
Process of location of road, railway and airport facilities. Data collection, alternative routes, public discussion, methods, techniques, aids, plans and diagrams produced. Geometric form; differences between road, railway and airport carriageway layout. Optical guidance, design models, landscape, provision for surface-water, signposting, fencing and posts.

CIVL9408 Transport Systems Design (Urban) S2 C3
Types of urban transport facilities. Distributors, streets, bicycle routes, walk-oriented areas, bus lanes and rapid transit lanes, stops and change terminals, noise control. Minimum geometric form; speed range controls, provision for surface water on urban roads, landscape. Design of intersection and parking areas.

CIVL9410 Highway Engineering Practice S1 C3
Highway systems and organization. Roles and interaction of public and statutory highway and transportation authorities and research organizations. Sources and administration of highway finance. Highway programming. Feasibility studies. Engineering investigation and planning of highways and interchanges. Factors affecting long-term performance of transport facilities. Definition of design parameters. Factors of safety.

CIVL9412 Economics for Transportation Studies SS C3
Introductory macro and micro economic theory. The pricing mechanism in transport and distinctive characteristics of transport demand and costs. National income and social accounts with particular reference to the transport sector. Economics of public enterprise. Cost-benefit analysis and modelling. Engineering economics (compound interest) and budget determination. Econometrics. Selected special problems in the economics of transport modes.

CIVL9414 Transport Systems Part 1 S1 C3
Definition of basic traffic elements, zero flow travel time, capacity, impedance flow relationship. Transport networks. The determination of shortest path, maximum flow, in networks. The topological description of networks. System parameters, performance. Application of network analysis to existing road, rail and air transport systems.

CIVL9415 Transport Systems Part 2 S2 C3
Historical introduction to transport systems and development of various transport modes, road (vehicles, pedestrians, cycles), conveyor, rail, sea and air. Analysis of the operational characteristics of vehicles in the transport modes of road, rail and air. Analysis of the requirements of the rights of way for each transport mode. Development of optimum criteria for the distribution of cargo and passenger traffic. Terminals and mode transfer facilities. Development of system operational models. Energy consideration, new systems.

CIVL9416 Traffic Engineering F C6
Road inventory; traffic measurements; flow, speed, origin-destination, accidents, road structure. Road capacity: controlled and uncontrolled intersections, highways and freeways. Signal systems. Traffic operations and control; arterial and network systems. Parking. Hazard analysis and safety improvement. Enforcement. Bus service operation.

CIVL9417 Transport and Traffic Flow Theory F C6
Analysis of deterministic and stochastic models of the traffic stream. Topics covered include the following. Definition and measurement of traffic stream parameters. Space and time distribution of speed. Overtaking models and the moving-observer method. Fundamental diagram of traffic. Car-following theory. Headway and counting distributions. Introduction to queueing theory. Simulation techniques. Signalized and unsignalized intersections.

CIVL9418 Statistics for Transport Studies Part 1 SS C3
Data collection and processing. Probability, variates, sampling of values. Standard distributions, sampling distributions. Inference: point estimation, hypothesis testing and interval estimation; power, confidence, sample size. Regression. Generating functions. Sums of random variable. Distribution-free inferences.

CIVL9419 Statistics for Transport Studies Part 2 SS C3
Assumed knowledge: CIVL9418.
Linear models. Analysis of variance and co-variance. Simple and multiple regression. Design of experiments, interpretation of results. Sample survey design and analysis.

CIVL9420 Special Topic in Transport Engineering S2 C3
This syllabus changes to allow presentation of a special topic of current interest particularly by visitors with recognised expertise in the topic.

CIVL9701 Economic Decision Making in Engineering SS C3
Review of practical engineering decision-making problems and relevant techniques. Engineering economics, benefit/cost analysis, consideration of inflation and taxation in investment decisions, bidding, decision theory, microeconomic theory, objectives and multiple objective planning.

CIVL9702 Project Planning and Control S1 C3
The critical path method, PERT, arrow diagrams, precedence diagrams, resource levelling, resource constrained scheduling, network compression, overlapping relationships, applied cpm, cost control, cash flow, project control, legal considerations, simulation in networks, stochastic networks, project management, applications.

CIVL9704 Quantitative Engineering Management S2 C3
Models and techniques to assist the manager in making decisions; modelling and regression, forecasting; job planning, layout planning, capacity planning; work measurement;

optimization (linear programming, non-linear programming, dynamic programming), inventory models, transportation, assignment and allocation, heuristic techniques, multiple and single objectives, applications.

Techniques dealing with uncertainty and variability in management situations, including a review of probability theory, reliability, availability, quality control, decision analysis, queuing, simulation, applications.

CIVL9705 Engineering Management Practice SS C3
Management theory and processes, the structure and function of organizations; decision making, gaming behaviours in management, interpersonal skills, conflict management, management of group action, management information, marketing, negotiating, quality.

CIVL9706 Management of People SS C3
The development of skills for the management of people and their workplaces; industrial relations, health and safety issues; the recognition of people as the basic unit of engineering productivity and engineering organizations.

CIVL9710 Engineering Risk Management S2 C3
Introduction to the concept of risk and decision making under conditions of uncertainty; project objectives and planning, risk identification in engineering processes; human error, natural hazards and unforeseen risks; risk evaluation and quantification methods; relevant statistical techniques; risk avoidance and minimization; financial risk, portfolio theory, risk sharing and financing; ambient and acceptable risk levels; insurances.

CIVL9714 Special Topic in Engineering Management SS C3
A series of lectures from industry experts or visiting specialists in current and advanced engineering management.

CIVL9723 Construction Design SS C3
Design theory as applied to construction processes; application to selected areas of the construction industry such as temporary works design, formwork and falsework, dewatering systems, ground support systems and mixed construction activities such as tunnelling and high rise building construction.

CIVL9724 Construction Engineering and Technology S2 C3
Construction engineering theory, construction processes: methods engineering, automation and mechanization concepts; modelling, design and analysis; problem solving; task analysis; adaptive systems and control concepts; experimental studies of construction processes. Construction technologies; construction robotics, applications of expert and knowledge based systems. Studies to be selected from: drilling, blasting techniques, tunnelling, rock-bolting and other ground support, earth/rock transport, harbours, railways, dams, bridges, structural steelwork techniques, pipeline construction, foundation grouting compressed air work.

CIVL9725 Engineering Financial Management S1 C3
Engineering financial planning, control of labour, plant and materials. Insurances. Financial accounting. Project finance and taxation. Management accounting techniques and cost controls.

CIVL9726 Legal Studies and Professional Practice S1 C3
Nature and sources of law, court procedures, interpretation of documents, evidence, technical opinions, expert witness; contract law, contract administration; company law; arbitration; duties of an engineer; professional liability.

CIVL9727 Construction Planning and Estimating S2 C3
Project initiation and development, feasibility studies, planning and estimating procedures, contract administration; estimating cost of labour plant and materials, indirect cost and overheads, profit; construction administration. Preparation of cost estimate for a major civil engineering project.

CIVL9728 Special Topic in Construction SS C3
A construction topic presented in depth by industry experts or visiting specialists.

CIVL9731 Project Management SS C3
A problem-oriented approach to project management; the nature of engineering and construction projects; the project team, organizational and behavioural aspects, team motivation; behavioural aspects of project management; the organization and management of project resources; short term field planning and management strategies; project success evaluation techniques; project management decision processes; fast track projects; work delegation across organizational boundaries, contract design, development and administration; management information and decision support systems; management control systems and large project cost and schedule control; case studies in project management.

CIVL9732 Masonry Construction, Design and Materials SS C3
Properties of masonry units, mortar, grout and accessories; advantages and limitations of masonry in construction; construction planning, methods and productivity; general design principles, details and performance limit states; structural design of masonry subject to axial, in-plane and out-of-plane lateral loads; reinforced and prestressed masonry; design for fire resistance; workmanship and site control; cleaning, maintenance and repair.

CIVL9753 Soil Engineering SS C3
Clay mineralogy and its effect on soil properties. Principles of preloading of soils and its effect on foundation behaviour. Design and construction aspects of soil improvement techniques including lime and cement stabilization, chemical grouting, vertical drains, dynamic consolidation, vibroflotation, sand and gravel piles, lime piles, freezing, electro-osmotic dewatering. Design and construction of diaphragm walls, ground and rock anchors.

CIVL9776 Rock Mechanics SS C3
Description of rock mass and discontinuities, strength and failure criteria, classification systems. Data collection and presentation. Initial stresses and their measurements, methods of stress analysis, stresses around underground openings. Selection of design of tunnel support systems, steel sets, rock bolts and shotcrete. Design of large underground openings. Excavation. Methods of prediction. Blasting.

CIVL9777 Numerical Methods in Geomechanics S1 C3
Fundamentals of finite element and boundary element methods; application to practical geotechnical design and case studies; deformation and flow problems; linear and non-linear

analysis; application to underground opening, stability of slopes, foundations, mining excavation; seepage and consolidation soil-structure interaction problems; earth pressures, retaining walls and buried pipes, thermal stress analysis.

CIVL9781 Advanced Concrete Technology SS C3
Basic structure of concrete. Morphology of hydrated cement paste. Constituents of cements. Paste – aggregate bond, strength microcracking and failure mechanisms. Code and special criteria for acceptance and rejection of concrete. Statistical principles, applications to specification and quality control of concrete non-destructive testing. Accelerated curving and special high strength concretes for column and prestressed construction. Recent developments in constituent materials, special cements and admixtures. Workability, mix design theories and practical applications.

CIVL9783 Pavement Materials S1 C3
Properties and usage of soil and rock as pavement materials. Response of pavement materials to traffic and environmental factors. Concepts of durability. Improvement of soil properties by stabilisation. Compaction. Selection and comparative evaluation of selected subgrade, sub-base and base materials. Specifications and acceptance testing. Quality control. Properties and usage of bitumens, asphalts and tars. Manufacture and use of bituminous concrete. Mix design. Sprayed seals. Concrete for rigid pavements and sub-bases. Lean concrete, cement-grouted bituminous concrete.

CIVL9784 Pavement Design S2 C3
Types of pavement, selection on basis of cost and performance. Sub-grade conditions, working platforms and use of geofabrics. Soil moisture equilibrium and drainage requirements. Prediction and characterisation of traffic wheel loadings. Role of environmental factors including temperature and moisture. Stress distribution in flexible and rigid pavements. Computer-based and approximated methods of analysis. Principles of mechanistic design. Comparative evaluation of design criteria and design procedures for flexible and rigid pavements for roads and airfields.

CIVL9785 Pavement Evaluation and Maintenance S2 C3
Types of pavement distress, their origins and remedy. Evaluation and prediction of pavement condition. Pavement instrumentation and monitoring. Routine monitoring using deflection, role of accelerated trafficking tests. Measurement and reporting of physical distress including cracking, rutting and roughness. Measurement and prediction of skid resistance. Environmental factors. Pavement maintenance for flexible and rigid pavements. Overlays and membranes recycling. Maintenance scheduling and management. Optimal use of maintenance funds.

CIVL9786 Industrial and Heavy Duty Pavements S2 C3
Functions of industrial and heavy-duty pavements. Port pavements, container facilities, bulk cargo areas, mine haulage roads, factory and warehouse floors and hardstands operation requirements. Economic considerations. Types of industrial pavement. Advantages and disadvantages of flexible, rigid and segmented pavements. Types of load, industrial vehicles, contained stacking, bulk cargo. Load equivalency concepts, port area wheel loads, standard design vehicles, formulation and application of loading spectra. Pavement design procedures for new pavements and overlays. Selection of pavement materials. Construction, maintenance and rehabilitation of industrial pavements. Railtrack design, integration of railtrack and vehicular pavements. Settlement and drainage considerations.

CIVL9788 Site Investigations S1 C3
Engineering geology mapping and terrain classification. Drilling, trenching and sampling of rock and soil. *In-situ* testing of soil and rock. Laboratory testing of soil and rock. Assessment of design parameters. Instrumentation to measure pore pressure, stress, displacement.

CIVL9790 Stability of Slopes S1 C3
Stability of natural and constructed slopes in civil and mining engineering. Stability analysis; stabilization methods and design; monitoring. Design of slopes in soft ground, soil and rock, and in partially saturated slopes; design of open cut mines. Probabilistic methods.

CIVL9791 Foundation Engineering 1 S1 C3
Stress distribution beneath foundations, settlement analysis, design of shallow footings, design of pile foundations, cast *in situ* piles, foundation on shrink-swell soils, lateral earth pressures, foundations on rock, site investigations.

CIVL9792 Foundation Engineering 2 S2 C3
Advanced consolidation theory, non-linear behaviour, soil structure interaction, design of rafts and piled rafts, analysis and construction of piled foundations, steel piles, braced cuts, temporary support of excavations, design of foundations for dynamic loading, machine foundations.

CIVL9793 Geomechanics SS C3
The fundamentals of the effective stress concept, clay mineralogy, seepage analysis and Laplace equation, method of fragments, fundamentals of liquefaction and cyclic mobility, basic and advanced consolidation theory including Terzaghi's 1D theory, nonlinearity and Biot's theorem, critical state soil mechanics theory, hyperbolic model, fundamentals of continuum stress analysis, theory of elasticity, constitutive relationships and failure criteria for real soils and rocks and soil plasticity.

CIVL9802 Elastic Stability 1 SS C3
Euler strut; uniform and non-uniform cross sections. Eccentric loading; stressing beyond the elastic limit. Struts continuous over several supports. Stability of frames.

CIVL9803 Elastic Stability 2 S2 C3
Energy methods of formation of stability problems. Approximate methods. Thin-walled open section struts; lateral buckling of beams; bending and buckling of thin plates.

CIVL9804 Vibration of Structures 1 SS C3
Review of basic aspects. Analysis of lumped mass systems with various degrees of freedom. Vibration in beams and other continuous structures.

CIVL9805 Vibration of Structures 2 SS C3
Vibration of buildings. Earthquake and blast loading. Bridges under moving loads. Vibration effects in foundations. Generalized dynamics and Lagrange's equations.

CIVL9806 Prestressed Concrete 1 S1 C3
Historical development. Methods of prestressing. Elastic analysis and design. Flexural capacity and shear capacity of prestressed elements.

CIVL9807 Prestressed Concrete 2 S2 C3
Analysis and design of statically indeterminate structures. Methods of securing continuity. Composite structures. Creep and shrinkage effects in concrete structures.

CIVL9809 Reinforced Concrete 1 S1 C3
Historical development. Methods of analysis and design, including limit state concepts. Analysis and design for bending, compression and combined bending and compression. Slenderness effects in columns. Shear and torsion. Serviceability requirements.

CIVL9810 Reinforced Concrete 2 S2 C3
Application of limit theorems to structural concrete. Lower bound methods of design. Analysis and design of plates and slabs. Detailing of members and connections for strength and serviceability. Joints.

CIVL9814 Analysis of Plates and Shells SS C3
Stress and strain in thin elastic plates bent by transverse loads. Solutions of the plate equation. Application. Stress and strain in thin plates loaded in the plane of the plate. Applications.

CIVL9817 Experimental Structural Analysis SS C3
Dimensional analysis and principles of similitude, model analysis and design of models. Instrumentation and special methods of measurement. Evaluation of data.

CIVL9818 Bridge Design 1 S1 C3
Historical development. Design philosophies. Loadings and factors of safety. Design of slab and slab-and-beam bridges; skew and stiffened-kerb bridges, multibeam bridge decks. Analysis of orthotropic plates and grid frames. Plate web girders and box girders.

CIVL9819 Bridge Design 2 SS C3
Advanced bridge design. Box girder and cable-braced bridges in steel and reinforced concrete. Orthotropic plate construction. Design of bridges by limit state methods. Serviceability requirements.

CIVL9820 Structural Analysis and Finite Elements 1 S1 C3
Stiffness analysis of structures. Basis of finite elements: principle of virtual work, variational theorems, constraint equations. Effects of inplane rigid floors and axially rigid members on the behaviour of multi-storey frames.

CIVL9821 Structural Analysis and Finite Elements 2 S2 C3
Variational formulation of the finite elements. Plane stress and plate-bending elements. Mesh grading. Flat slabs and flat plates in building frames. Hybrid elements and shear wall analysis. Isoparametric elements, numerical integration. Finite elements methods in numerical analysis.

CIVL9822 Steel Structures 1 S1 C3
Introduction to limit states design, methods of analysis of steel structures, columns, tension members, bending of beams, lateral buckling of beams, design by buckling analysis, beam-columns, elastic design of frames.

CIVL9823 Steel Structures 2 S1 C3
Effective lengths of columns in braced and sway frames, uniform torsion of steel structures, warping torsion of steel structures, design rules for torsion, design of bolted plates and connections, design of welded plates and connections, design process for industrial frames.

CIVL9830 Hydromechanics SS C3
General equation of fluid motion, potential flow, conformal mapping, laminar flow, Navier-Stokes equations; turbulence, shear flows, jets and wakes, boundary layers, turbulent mixing, diffusion, air entrainment, cavitation, stratification.

CIVL9831 Closed Conduit Flow SS C3
Theories for energy loss in conduit flows, roughness at pipe walls and tunnels, design applications. Cavitation in conduits, transport of waterborne mixtures in pipes, accuracy of flow measurement in pipe lines.

CIVL9832 Pipe Network and Transients SS C3
Multiple and branching pipes, energy distribution in pipe systems. Computer solution of pipe network problems. Unsteady flow in pipes. Branching pipes and reflectors. Effect of pumping plant behaviour.

CIVL9833 Free Surface Flow S1 C3
Theory of waterflow in open channels. Application of theory to design of hydraulic structures, spillways, control gates, energy dissipators, channel transitions. Use of hydraulic models.

CIVL9835 Coastal Engineering 1 SS C3
Theory of periodic waves as applied to tides and wind generated waves in water of varying depths. Wave and tide prediction.

CIVL9836 Coastal Engineering 2 SS C3
Wave forces on structures, shore processes and beach erosion. Estuarine hydraulics, wave and tide models.

CIVL9847 Water Resources Policy SS C3
Resource economics, water supply, water demand, multiple objective planning, multiple purpose projects, water law, water administration, case studies.

CIVL9848 Water Resource System Design SS C3
Principles of the optimal design and operation of multiple purpose, multiple component, water resource system; evaluation of cost and benefits in complex and simple systems.

CIVL9849 Irrigation S1 C3
Soils, soil-water relationships, plants, climate, crop requirements; water budgets, sources, quality, measurement; irrigation efficiency. Design of irrigation systems, appurtenant works, distribution.

CIVL9851 Unit Operations in Public Health Engineering S1 C3
Theory of physical, chemical, biological, and hydraulic processes used in both water and wastewater treatment. Applications where these are common to both water and wastewater treatment.

CIVL9852 Water Distribution and Sewage Collection SS C3
Water collection, transmission and distribution systems – layout design and analysis, reservoirs, pumping. Sewage collection design and analysis – capacities, corrosion, pumping.

CIVL9855 Water and Wastewater Analysis and Quality Requirements S1 C3
The effects of impurities in water and wastewater on its suitability for various beneficial uses, and methods used for detecting impurities. Analytical methods used in water and wastewater treatment for monitoring and process control.

CIVL9855 Water and Wastewater Analysis and Quality Requirements **S1 C3**

The effects of impurities in water and wastewater on its suitability for various beneficial uses, and methods used for detecting impurities. Analytical methods used in water and wastewater treatment for monitoring and process control.

CIVL9856 Water Treatment **S2 C3**

Application of processes and process variations used to upgrade the quality of water for specified uses, with particular reference to the treatment of water for municipal use.

CIVL9857 Sewage Treatment and Disposal **S2 C3**

CIVL8857 Sewage Treatment and Disposal (external) **S2 C3**

Application of processes and process variations used to improve the quality of sewage effluent, and the disposal of the effluent. Re-use of effluents where applicable. Sludge treatment and disposal.

CIVL9858 Water Quality Management **SS C3**

Fundamental concepts; systems approach to quality aspects of water resource systems; quality interchange systems; quality changes in estuarine, surface, and ground water. Quality management by engineered systems. Economic criteria relating to water use and re-use systems.

CIVL9860 Investigation of Groundwater Resources 1 **SS C3**

Occurrence and extraction of groundwater, investigation and drilling methods, systems approach, optimization techniques, conjunctive use studies, quality of groundwater.

CIVL9861 Investigation of Groundwater Resources 2 **SS C3**

Geophysical methods, remote sensing, photo-interpretation, arid- environment studies, analogue models, case studies.

CIVL9862 Fluvial Hydraulics **S2 C3**

Unsteady and varied flow in non-uniform channels, secondary currents, sediment transport, channel morphology, scour and shoaling, river control works, modelling of fluvial processes.

CIVL9863 Estuarine Hydraulics **S2 C3**

Classification of estuary types and their characteristics. Tides, their origin, prediction and effect on estuarine circulation. Entrainment and mixing process in estuaries. Salinity intrusion, tidal flushing, dispersion of pollutants. Sediment transport, channel stability.

CIVL9868 Public Health Science **S1 C3**

Impact of water and wastewater treatment on disease transmission. Monitoring methods used for pathogens and indicator organisms, structure and degradation of large molecules, biochemical pathways of anabolism and catabolism and the characterization of micro-organisms.

CIVL9870 Hydraulics and Design of Water and Wastewater Treatment Plants **S2 C3**

Corequisites: CIVL9856, CIVL9857 or equivalent.

Application of hydraulic principles to flows within treatment plants. Selection and integration of unit processes required for water and wastewater treatment, plant layout, plant design including hydraulic profiles, the influence of flow and load variability, instrumentation and control strategies.

CIVL9871 Water Supply and Sanitation in Developing Countries **SS C3**

Prerequisites: CIVL9851, CIVL9855, CIVL9868 or equivalent.

Selection of appropriate technology for water supply and wastewater treatment and disposal to account for hot climates and low per capita incomes. Design basis for systems and the operating requirements.

CIVL9872 Solid Waste Management **C3**

CIVL8872 Solid Waste Management (external) **S2 C3**

Characterisation of municipal solid waste; collection; transfer stations; waste minimisation and recycling; waste treatment, including size reduction, composing, incineration, emerging technologies; landfill disposal, including preparation of landfill management plans and operational aspects; introduction to planning of waste management systems.

CIVL9875 Hydrological Processes **S1 C3**

Hydrological cycle, water and energy balances and circulation, precipitation process, interception, infiltration, storm runoff process, evaporation and transpiration, surface groundwater interactions, land use effects.

CIVL9876 Applied Hydrological Modelling **S1 C3**

Introduction to hydrological models, deterministic catchment models, model calibration and verification, stochastic models, storage yield analysis for reservoir design, extension of records, stochastic reservoir analysis or identification of groundwater systems, conjunctive use systems.

CIVL9877 Flood Design 1 **S1 C3**

Introduction to flood estimation, frequency analysis of hydrological data, design rainfall data, hydrograph analysis, storm rainfall-runoff relations, design flood estimation for small to medium sized catchments including the rational method, introduction to urban drainage design.

CIVL9878 Flood Design 2 **S2 C3**

Introductory flood routing, loss rates, linear and nonlinear response, unit hydrographs, runoff routing, choice of method of flood estimation, urban drainage design.

CIVL9880 Groundwater Modelling **S1 C3**

Groundwater modelling of porous media, fractured rock and low permeability materials. Analogue, numerical analytical models. Matrix structure and inverse methods, stochastic modelling and characterization of variability, modelling multiphase fluids and regional groundwater flow. Applications to borefield management, salt water intrusion, mine dewatering, geotechnical problems.

CIVL9881 Hazardous Waste Management **S2 C3**

CIVL8881 Hazardous Waste Management (external) **S2 C3**

Waste audits and characterisation of hazardous wastes in regions and industries; control of generation and transport of hazardous waste, manifest systems; waste minimisation; on-site treatment methods; integrated off-site treatment facilities; management of residues from treatment facilities; introduction to planning of regional hazardous waste management systems. Characteristics of individual waste types (dioxins, PCBs, pesticides, heavy metal, etc.) and waste management in individual industries (steel, pulp and paper, petro-chemical, food processing, etc.) covered by assignments.

CIVL9884 Environmental Engineering Science 1 S1 C3

CIVL8884 Environmental Engineering Science 1 S1 C3 (external)

Microbial structure and function; introduction to epidemiology and biochemistry; monitoring methods used for pathogens and indicator organisms; biological treatment principles.

Fundamentals of soil dispersion common to all environmental media (air, water, soil). Aspects of soil chemistry relevant to contaminant behaviour in soils. Classification of soils and improvement of the engineering properties of soils. Introduction of hydrogeology.

CIVL9885 Environmental Engineering Science 2 S1 C3

Water chemistry; impurities in water, detection of impurities, analytical methods, monitoring and process control. Air chemistry: interaction and degradation of gaseous pollutants in the atmosphere. Dispersion processes: nature of dispersion processes, advection and diffusion. Modelling of dispersion in the atmosphere, water bodies and soil.

CIVL9886 Environmental Engineering Science 3 S1 C3

Fundamentals of dispersion common to all environmental media (air, water, soil). Aspects of soil chemistry relevant to contaminant behaviour in soils. Classification of soils and improvement of the engineering properties of soils related to waste management. Introduction to hydrogeology. Management of waste projects: basic management concepts; management of environmental studies, investigations and design projects; management of operating waste facilities.

CIVL9887 Advanced Topics in Waste Management S2 C3

Prerequisites or Co-requisites: CIVL9872, CIVL9881.

A selection of at least 7 topics from the following to suit the class needs, expertise of visiting academics and researchers in the Cooperative Research Centre for Waste Management and Pollution Control, and issues of current interest. Background and basis of solid and hazardous waste classification and control systems; legislative and economic (market) regional pollution control mechanisms; developing techniques for waste minimisation; site selection and EIS preparation for waste facilities; dispersion of contaminants in the atmosphere; community consultation; detailed legislative requirements; application of systems concepts in waste management; environmental management plans; risk assessment at waste facilities; contaminated site characterisation and remediation; topics of interest to visiting academics; case studies by way of assignments.

CIVL9888 Environmental Management and Economics S2 C3

Spectrum of modern environmentalism, sustainable development and urban growth. The structure of the environmental regulatory process. Decision making and management systems; case studies; introduction to micro-economics with reference to environmental issues, sustainable economic growth and zero growth. Environmental costing.

CIVL9889 Legislative Aspects of the Environment S2 C3

Statutory and common law regulation of access to, use and management of natural resources and waste disposal in the natural environment. Case studies from waste treatment and disposal, water resources management, disposal of mine wastes and other areas as appropriate.

CIVL8803 Project (GradDip) C3

A critical review of literature on a selected topic or a minor design project.

CIVL9901 Speical Topic in Civil Engineering SS C3

This syllabus changes to allow presentation of a special topic of currrent interest particularly by visitors with recognized expertise in the topic.

CIVL9902 Special Topic in Civil Engineering S2 C3

This syllabus changes to allow presentation of a special topic of current interest particularly by visitors with recognised expertise in the topic.

CIVL9909 Project C9

CIVL8909 Project (external)

A minor research investigation involving analysis and interpretation of data, or a critical review and interpretation of literature on a selected topic, or a design project.

CIVL9915 Project Report C15

Computer Science and Engineering

COMP9011 Literacy and Programming C3

In this subject the student will be introduced to a number of the packages such as: spreadsheets, word processing, data base systems, hypertext, graphics, networking. It will be necessary that skills be acquired with these systems.

There will also be an introduction given to both procedural and functional programming.

COMP9012 Software Engineering and Tools C3

This subject introduces the Data Flow/Process Interaction model of software specification and architecture. The techniques of Software Engineering involved in specification, analysis, design, implementation, testing, debugging, maintenance, and modification are discussed. Modern CASE tools are discussed and used.

In the second part of this subject Software Tools are introduced. The concepts of: reusability, packages, libraries, processes, concurrency, intercommunication channels, windows, graphics, data bases, translators, pattern matchers, sorters, and user interfaces are discussed and used in the context of a programmers' shell.

COMP9013 Data Bases and Expert Systems C3

This subject will introduce some basic material on data structures. It will provide experience with commercial relational data base systems and an application generator. Some of the notions of data base design and the redundancy: efficiency tradeoff will be discussed.

There will be an overview given of expert systems, artificial intelligence, knowledge based systems and decision support systems.

COMP9014 Computer Organisation and Interfacing C3
Logic and Boolean algebra. Digital logic circuits. Components and architecture of a digital computer. Machine code and assembly language programming. Design and operation of interfaces between the computer and the outside world. Applications: interfacing scientific intruments to a microcomputer.

COMP9015 Issues in Computing C3
A review of issues that affect the use of Computer Systems. Topics that may be covered include: the human implications of computing systems, the affect of computing operations on organisational structure, software copyright, privacy, the role of computing systems and information systems in decision making, the significance of the timeliness of information and its implication on the value of decision making and the requirements for a computing system.

COMP9018 Computer Graphics and Applications C3
This subject will provide both a series of lectures on topics such as the basics of graphic systems and graphic devices. Application areas to be considered may include business, entertainment, computer-based training, mapping. The laboratory work will involve use of sophisticated hardware for drawing, animation, simulation and CAD operations.

COMP9021 Introduction to Computer Science C3
Defining and recognising problem classes. Reasoning about problems and abstracting solution skeletons, iteratively leading to the specification, analysis, design, and refinement of computing solutions. The representation of data and control in a procedural programming environment. Data types and abstractions, and mechanisms for manipulating data. The partitioning of control; statements, control structures, functions, procedures, and modules. Data structures; lists, queues, trees. Practical work will involve extensive reading of, modification to, and composing Modula-2 programs. A brief introduction to problem solving using a functional notation and the functional language Miranda.

COMP9022 Digital System Structures S1 C3
Prerequisites: Assumed knowledge: COMP9021 or COMP1021. Excluded: COMP2021.

Analysis, design, and realisation of modest digital subsystems, and the organisation and design of major subsystems in a model computer; data path, instruction decode, address generation, arithmetic algorithms, and the fetch-execute cycle of a typical computer. Timing, minimisation techniques, switch and gate logic, combinational and sequential circuits, flip-flops, hardware description techniques, circuit schematics and simulation tools. The translation of higher level programming abstractions and data structures to a real computer using a macro assembler as the target; study of the relationships between a hardware model, a programming model, and the I/O subsystem of a computer. An understanding of the inter-relationships between the fundamental layers of a modern digital computer system.

COMP9023 Concurrent and Functional Programming S2 C3
Prerequisites: Assumed knowledge: COMP9021 or COMP1021. Exlcuded: COMP2031.

The process model – sequential versus parallel computation, interprocess communication and synchronisation mechanisms; coroutines, message passing, buffers, pipes, remote procedure calls, semaphores, monitors. Resource sharing, exclusion, deadlock, livelock, scheduling. Distributed algorithms; detection of a deadlock, detection of termination. Protocols for data transfer. Development of functional programming techniques introduced in COMP9021.

COMP9024 Data Structures, File Systems and Data Bases C3
Prerequisites: COMP9021 or COMP1021. Excluded: COMP2011.

The abstraction and representation of information; fundamental types, sets and sequences, recursive sets (arrays and structures (lists, trees)), classes (structure and manipulation). Practical work will use in Modula-2 and Miranda.

Internal (memory) and external (file system) representation of information (files and processes, state, scope and binding). Structured policies for packaging information (data bases (sets, hierarchy, network, relations), knowledge bases and frames). Efficiency and complexity of representation. Accessing information; virtual accessing, modes and protection, policy enforcement, sharing, distributing information, consistency. Efficiency and complexity of accessing. Practical work would be performed in Modula-2 and Miranda. Introduction to data bases and query languages. The manipulation of knowledge. Prolog as a query language.

COMP9101 Design and Analysis of Algorithms C3
Assumed knowledge: COMP9024 or COMP2011

Techniques for design and performance analysis of algorithms for a number of classes of problems. Analysis of algorithms: order notation, recurrence equations, worst case and expected order statistics. Design of efficient algorithms: recursion, divide and conquer, balancing: backtracking algorithms, branch and bound, dynamic programming; set manipulation problems; fast search algorithms, balanced optimal and multiway trees; graph representations and algorithms, pattern matching algorithms. NP-complete problems. Design and specification of programs; modularization, interface design, introduction to formal specification techniques.

COMP9102 Compiling Techniques and Programming Languages C3
Assumed knowledge: COMP9024. Excluded: COMP3131.

Language description; phrase structure grammars. Chomsky classifications, context-free grammars, finite state grammars, Backus Naur Form, sysntax graphs, LL(k), LR(K), LSL(k). Lexical analysis: translation of an input (source) string into a (machine independent) quasi-terminal symbol string Finite state recognisers. Syntax analysis: top-down compilation for LL1 grammars using syntax graph driven analysers or recursive descent. Bottom-up compilation for simple and weak-precedence and LR(k) grammars. Semantic analysis; program translation and code generation, attributed grammars. Compiler generators: automatic generation of compilers for LALR(1) grammars. Code optimization by systematic program transformation. Run-time organization; activation record stacks heap management.

COMP9114 Formal Specification C3
Assumed knowledge: Background to final year Computer Science Level, equivalent to subjects COMP3111, COMP3121, and COMP3131.

Introduction to formal specification techniques; use of predicate logic and modern set theory to describe computing systems; Schema notation for structuring large specifications;

Schema calculus to prove properties of specifications: Refinement techniques for transformation of specifications into executable programs; refinement of abstract data types.

COMP9115 Programming Languages: Fundamental Concepts **C3**

Assumed knowledge: Background to final year Computer Science level, equivalent to subjects COMP3111, COMP3121 and COMP3131.

Fundamental aspects of programming language definition, semantics and implementation models. The current approach uses denotational semantics. Denotational semantics is a formal method for describing the abstract meaning of programming languages.

COMP9201 Operating Systems **C3**

Assumed knowledge: COMP9023 and COMP9024. Excluded: COMP3231.

Services provided by operating systems. System calls and user commands (command languages, menus, etc). Virtual machines. Efficient techniques and methods of process management, memory management, input/output and communication handling. Performance evaluation and tuning. Protection and security.

COMP9211 Computer Organization and Design **S1 C3**

Prerequisites: Assumed knowledge: ELEC2012 or COMP9022. Excluded: COMP3211.

Topics will be chosen from: Advanced Design Strategies: combinational and sequential circuit design and realisation; synchronisation, communication and arbitration; register transfer specification (Modal). Arithmetic Design Strategies. Memory Organization; physical and virtual address space; memory hierarchy; operating system and compiler support; memory mapping and caching. Communications Organization: shared memory, memory mapping; network systems. Processor Design: the instruction pipeline; hardwired and micro-programmed control; instruction sets; RISC and object-based processor organization. Error Detection/Correction and Fault Tolerance; testing and testability; faults, errors and failures; coding theory; diagnosing and correcting errors.

COMP9214 Computer Architectures **S1 C3**

Review of conventional computer architectures, description methods and performance evaluation. Alternative approaches to CPU, memory, communication, busses and I/O organization. Influences on computer architecture, including technologicial innovation and new application areas. Case studies of specialized machines, including array, associative and functional processors and general-purpose machines that aim for high performance, ultra-reliability or minimal cost.

COMP9215 VLSI System Design **C3**

Assumed knowledge: Background in electronic design equivalent to ELEC4532.

The design and implementation of very large scale integrated systems, using both nMOS and CMOS technologies. The use and construction of CAD tools, including simulators, layout generators, and plot utilities. MOS failure modes, testing and design for testability. A study of some digital subsystems, digital architectures and design styles will be carried out. An integral part of the course is an MSI LSI design project. Selected project designs will be submitted for fabrication and returned to students for testing.

COMP9216 Parallel and Distributed Computing Systems **C3**

Assumed knowledge: Background to final year Computer Science level, equivalent to subjects COMP3111, COMP3121 and COMP3131.

Not offered in 1992.

Parallelism concurrency in functionally coupled and distributed communicationally coupled, hardware and software, computing systems. Topics will be selected from: Synchronisation, communication and arbitration; Computational paradigms -s; concurrent synchronous processing, lists, trees; Computational paradigms - p: vectors, arrays, APL tables, associative look-up structures; Synchronous bit-serial architectures: n-operand arithmetic, n-operand comparison; Pure pipeline and Systolic architectures and problems; Pipelined ALUs – multiple bus data path architectures; Memory-Processor architecture: super-imposed code-word processors, image identifiers, inner product processors; Object based systems; Languages with communication and processes; CSP, ADA C; Locally and geographically distributed systems: Failure tolerant computer systems.

COMP9231 Integrated Digital Systems **S2 C3**

Prerequisites: Assumed knowledge: ELEC2012 or COMP9022. Excluded: ELEC4532.

Integrated circuit logic families with emphasis on MOS technologies, structured chip design, custom and semi-custom approaches, system architecture, computer aided design, layout considerations, timing estimates, circuit failures, faults, fault modelling, testing, design for testability.

COMP9221 Microprocessor Systems **S2 C3**

Assumed knowledge: COMP1021. Excluded 6.0318, 6.613, 5.087G, 5.088G, COMP3221, ELEC3020.

Concepts of a microprocessor system: address spaces, memory devices, bus timing and standards, the VME bus. Input/output interfacing: polling and interrupts. DMA interfaces. The MC68000 family and assembly programming language. Other microprocessors. The subject includes two hours per week of laboratory work involving interfacing to and programming MC68000-series micrprocessor-based systems.

COMP9311 Data Base Systems **C3**

Prerequisites: Knowledge of storage structures. Excluded: 6.659G, 55.823G

A first subject on data base management systems to be presented at a level appropriate for a graduate subject.

The material to be covered will include a selection from: the relational, hierarchic/network, and inverted file data models; normalisation and the problems of redundancies; views and their updates; high level query languages; distributed systems; deductive data bases; data definitions; application generators.

COMP9314 Advanced Data Base Management 1 **C3**

Assumed knowledge corresponds to the treatment in COMP9311.

This subject will examine in detail some of the commercially oriented issues associated with recent developments in data base management systems. Topics to be treated may include: functional analysis and data base design, object data bases, application generators, and office data systems. The subject will involve the students in performance of a significant data base design task.

COMP9315 Advanced Data Base Management 2 **C3**

Assumed knowledge corresponds to the treatment in COMP9311.

This subject will examine in details some of the technical issues associated with recent developments in data base management systems. Topics to be treated may include: query optimisation, concurrent processing and its control, recovery and restart, and distributed dbms.

COMP9331 Computer Networks and Applications **C3**

Assumed knowlege: COMP9024. Excluded: COMP3331.

Introduction: What is a computer network?, applications, LANs, MANs, and WANs, topologies. Protocol Layers: ISO Model, outline of layer functions, layer interfaces, terminology. Physical Layer: Outline of functions, transmission media and line codes. Data Link Layer: Functions, frames, error control, flow control, performance. Network Layer: Functions, routing. Transport Layer: Functions, connection control. Examples: Networks: Ethernet, Token Ring, FDDI, TCP/IP, Internetworking, standardised formats, XDR. Application Layer: Functions. Distributed file systems, NFS. Distributed processing, NCS, Electronic Mail, Virtual Terminals and File Transfer, Telnet/FTP. Graphical interfaces, X. WAN: Interconnecting computers and LANS. Modems, X25, N-ISDN. Future Networking: B-ISDN, Multi-Media.

COMP9414 Artificial Intelligence **C3**

Assumed knowledge: Background to final year Computer Science level, equivalent to subjects 6.613, 6.642, 6.632 and 6.643.

Overview of current research in Artificial Intelligence. Some of the topics are: the representation of knowledge, search techniques, problem solving, machine learning, expert systems, natural language understanding, and languages for Artifical Intelligence. Students are also required to prepare a report and give a seminar on one aspect of A.I. such as: robotics, vision, language understanding, speech recognition, A.I. languages, learning.

COMP9415 Computer Graphics **C3**

Assumed knowledge: Background to final year Computer Science levels, equivalent to subjects COMP3111, COMP3121 and COMP3131.

Background to use and evaluate existing graphics packages, or to write a graphics package of your own. Topics include graphics hardware - raster, random scan, and storage tube displays, graphical imput devices, scan conversion of lines and polygons, basic 2D transformations, windowing, clipping, viewports, display segmentation, the user interface for graphics, basic 3D transformations, perspective transformation, 3D clipping, hidden line and surface removal, shading and lighting, modelling curves and sorfaces with splines and fractals. Existing graphics standards will be examined - GKS, PostScript, CGM, PHIGS. Use will be made of the Apollo packages GPR, GMR-2D GMR-3D and Dialog.

COMP9416 Expert Systems and Deductive Data Bases **C3**

Prerequisites: COMP9311 or equivalent. Knowledge of rule based systems and reasoning procedures.

Introduction to Expert Systems including knowledge representation, inference, reasoning under uncertainty, qualitative modelling and knowledge acquisition. Students will build an expert system using a shell. Introduction to deductive database including logic programming, clause indexising and query optimisation, integration of deductive databases and expert systems.

COMP9511 Human-Computer Interaction **C3**

Co-requisites: Knowledge of data base query languages. Excluded: 55.821G.

This subject will discuss man-machine communication with an emphasis on applications related to use of high level query languages and searching techniques.

Topics to be covered include: theories and principles of interface design; interaction styles; interaction devices; interface and language testing; approaches to the null value problem; information overload.

COMP9514 Advanced Decision Theory for Information Science **C3**

Prerequisites: A graduate level in expert systems or D55, 55.821G or equivalent.

This subject will link results from fields such as information theory, the economics of information, the theory of judgement and choice, certainty theory and the theory of evidence. There will be a review of maximum utility theory decision making and the associated axioms. Developments of maximum expected utility theory including prospect theory, regret theory and duality theory will be introduced. The results will be linked to system design.

COMP9596 Advanced Topics in Information Science **C6**

Prerequisite: 55.821G or equivalent.

This subject will integrate information science skills in an experimental situation involving software development and assessment. The subject will be project oriented. There may be a lecture portion that relates to statistical aspects of experimental design and hypothesis testing.

COMP9918 Project Report **C18**

Electrical Engineering

ELEC9201 Power System Planning and Economics **C3**

Review of conventional planning techniques and their limitations. Introduction of a novel approach based on welfare maximisation. Examples of its application to coordinated supply and demand side planning in problems such as demand forecasting, supply reliability, maintenance scheduling, transmission planning and demand management.

ELEC9202 Power System Operation, Control and Protection **C3**

Control of system frequency: system frequency dynamics, load frequency control of interconnected systems, automatic generation control. Unit commitment and economic despatch. Control of system voltage and reactive power. Problems of power system operation: security of supply, load forecast, power flow control, fault level containment, stability. Protection of power system and transmission lines: main protection, back up protection, system protection under emergency. Protection in distribution systems.

ELEC9203 Power System Analysis S2 C3

Assumed knowledge: ELEC4202 or equivalent. Excluded 6.203.

Emphasis on interconnected system operation, performance and control. Digital computer techniques for power system operation, performance and control. Digital computer techniques for power system analysis. Review of topics in numerical analysis, simultaneous linear and non-linear equations, numerical integration, sparsity programming techniques. Load-flow. Short-circuit analysis. Steady-state and transient stability analysis. Harmonics.

ELEC9211 High Voltage Technology C3

Assumed knowledge: ELEC4202 or equivalent.

Introduction to the technology involved in the design and testing of high voltage power system equipment. Study of the practical applications of relevant materials, with emphasis on properties of insulation systems (gases, liquids and solids) and the interaction of the materials in non-uniform fields. Methods of testing under steady state, AC and DC, and surge conditions are incorporated in the laboratory work. Design examples are taken from insulator, bushing, cable, power capacitor, transformer, rotating machine and switchgear technologies.

ELEC9212 Partial Discharges in Electrical Insulation C3

Assumed knowledge: ELEC4202 or ELEC4215 or equivalent.

Aspects of partial discharge phenomena and their effect on electrical insulation. The physical processes involved in partial discharges plus the interpretation of results from measurements on simple and complex apparatus, such as power cables, power capacitors, rotating machines and transformers. Techniques studied include digital based systems with particular emphasis being given to practical applications, in order to relate theoretical concepts to measurements which are subject to laboratory or on-site limitations.

ELEC9213 Insulation Performance in Electrical Plant C3

Assumed knowledge: ELEC4202 or ELEC4215 or equivalent.

Design test requirements. Forms of high voltage works test: alternating, impulse, switching surge and direct. Non-destructive tests: dielectric loss angle, partial discharge and insulation resistance. Methods of determining material condition: moisture content, gas in oil, liquid chromatography, impurities, statistical breakdown tests, determination of aging and residual life. Commissioning and site tests.

Demonstrations and projects to support the lecture material.

ELEC9214 Power System Equipment C3

Assumed knowledge: ELEC4202 or equivalent.

Operating characteristics and design features of the major equipment components of a power system. Includes a general treatment of equipment rating, thermal design, electrodynamic forces, equipment protection and data acquisition. Specific items of equipment include power transformers, instrument transformers, switchgear, overhead lines and underground cables, surge arrestors, gas insulated systems, power factor correction equipment and alternators. Protection of electrical equipment. Effects of electromagnetic fields on personnel.

ELEC9215 Fields and Materials C3

General description of the inter-relationship between the different types of fields (electric, magnetic and thermal) and materials when used in various areas of electric power engineering. Topics include: a general coverage of dielectric, conducting, magnetic and thermal materials; solution of Poisson's Laplace's and Fourier's equations for simple geometries and calculation of electric, magnetic and thermal fields, including boundary effects; a selection of typical applications from thermal rating, electric heating, contact effects, laser action, surface electron emission, etc; a brief outline of some measurement techniques applicable to the above.

ELEC9221 Special Topic in Power

This syllabus changes to allow presentation of a special topic of current interest particularly by visitors with recognised expertise in the topic.

ELEC9222 Special Topic in Power C3

This syllabus changes to allow presentation of a special topic of current interest particularly by visitors with recognised expertise in the topic.

ELEC9330 Special Topic C3

This syllabus changes to allow presentation of a special topic of current interest particularly by visitors with recognised expertise in the topic.

ELEC9336 Digital Communication Networks C3

Excluded: ELEC9337, ELEC4351, ELEC4352.

Introduction to data communication. Analog versus digital transmission. Transmission media. LAN's; WAN's, ISDN. Protocols: IEEE standards for LAN's; fibre optic networks; satellite networks. OSI reference model. Some design issues and examples: topics include error detection and correction; routing and congestion control; internetworking; connection management; data representation and coding; file management; electronic mail.

ELEC9337 Data Networks 2 C3

Prerequisitse: ELEC4351.

Data transmission on telephone networks. Local area network interconnection. Analysis of protocols for data link, network and transport layers. TCP/IP protocols. Operating system views of communications; network protocol drivers, network servers. Case studies: ARPAnet and ACSnet.

ELEC9338 Television Systems C3

Prerequisites: ELEC9351, ELEC9341. Excluded: ELEC4333.

Principles and practice of modern television systems. Human perception of coloured visual images. Techniques and standards for terrestrial and satellite broadcasting, and cable TV systems. High definition television. Digital television. Data transmission within the television signal: Teletext. Networks. Recording techniques on video tapes and laser discs.

ELEC9340 Communication Electronics C3

Assumed knowledge: ELEC3016 or similar.

Electronic aspects of modern analogue and digital communication systems. Topics selected from: electronic systems design; electromagnetic compatibility and interference; electronic system noise; analogue modulators, demodulators, frequency conversion circuits, AM and FM transmitters and receivers; television electronics; phase locked loops; switched capacitor and other practical filter technologies; surface acoustic wave devices.

ELEC9341 Signal Processing 1 – Fundamental Methods C3

Excluded: ELEC4042.

Fundamental principles of the analysis and processing of analogue and digital signals with emphasis on digital methods. Generalized Fourier analysis; convolution, correlation, energy and power density spectra for signals and linear systems. Sampling, the discrete Fourier transform (DFT) and fast Fourier transform (FFT) algorithms. Fundamentals of filter design and realization including programmable digital signal processors. Digital processing of analogue signals, filter stability, sensitivity and finite word length effects in the realization of digital filters.

ELEC9342 Signal Processing 2 – Advanced Techniques C3

Prerequisite: ELEC9341 or similar.

Advanced techniques of digital signal processing with applications in communications and control, radar and sonar and the processing of speech, seismic signals and images. Topics selected from: digital methods for sampling rate changes, advanced FFT algorithms and the chirp z-transform algorithm. Advanced digital filtering methods. Analysis of random signals and noise in linear systems and non-linear devices. Estimation and measurement of power density spectra. Linear prediction and parameter estimation for speech analysis and spectrum estimation. Mean-square estimation and adaptive filtering for the detection and estimation of signals in noise, equalization, echo and noise cancelling and deconvolution. Nonlinear techniques; homomorphic signal processing and cepstral analysis, median filtering, etc. Short-time spectral analysis and time-frequency distributions. Two-dimensional signal processing.

ELEC9343 Principles of Digital and Analogue Communications C3

Prerequisite: ELEC3012 or similar. Excluded: ELEC4323.

Random variables:Probability density, probability distribution and characteristic functions; averages and moments. Random processes: Autocorrelation and power spectral density. Modulation and detection of binary and M-ary symbols: Error probability, bandwidth, energy-to-noise ratio and complexity. Information Theory; Entropy, source coding, mutual information, channel capacity. Coding theory; Block, cyclic and convolutional codes; Viterbi decoding; Trellis coded modulation.

ELEC9347 Digital Modulation C3

Prerequisite: ELEC9343 or similar.

A research orientated, advanced treatment of digital modulation and detection in Gaussian and fading channels. Modulation includes: M-ary ASK, PSK, DPSK, QASK, OQASK, FSK and CPM (including MSK).

Detection includes: coherent, partially coherent and noncoherent like differential phase detection for DPSK, FSK and CPM and limiter-discriminator detection and limiter-discriminator-integrator detection for FSK and CPM. Channels include: Gaussian, Rician (Satellite Mobile), Rayleigh (Land Mobile) with frequency selective fading and Doppler frequency shifts. Analysis and design includes: probability of error formulas and bounds; power spectral density and bandwidth; effect of intersymbol, cochannel and adjacent channel interference; symbol constellations, eye diagrams, equalization; partial response, full response and Nyquist signals; complexity and comparisons.

ELEC9350 Theory of Optical Fibres and Optical Signal Processing C3

Wave propagation in single mode and multimode optical fibres, gaussian approximation of fields in single mode fibre, spot size, equivalent step index of single mode fibre, material and waveguide dispersions, birefringent fibres. Ray theory in multimode fibre, intermodal dispersion, optimal profile, mode coupling, optical equalization. Measurement of fibre characteristics. Fundamentals of optical image formation. Spatial filtering. Optical sensors. Optical signal processing including holography and Radon transform.

ELEC9351 Propagation and Transmission of Electromagnetic Waves C3

Fundamental concepts and analytical techniques of guided wave propagation. Waveguide theory; coaxial lines, rectangular and circular waveguides and surface wave propagation. Poynting theorem, power flow, impedances. Wave attenuation: evanescent modes, conductor and dielectric losses. Phase and group velocities, dispersion. Numerical techniques; the finite difference method. Tropospheric and ionospheric propagation. Basic antenna theory. Aperture antennas. Phased Arrays.

ELEC9352 Antenna Design and Applications C3

Prerequisite: ELEC9351.

Principles of phased arrays and reflector antennas with some emphasis on space-borne and ground-terminal antennas for satellite communications. Analysis and synthesis of phased array, null steering theory. Single and dual reflector antennas, offset- reflector systems, optimization techniques. Effects of satellite orbital saturation on design of ground terminal antennas. Monopulse tracking antennas. Antenna tolerance theory.

ELEC9353 Microwave Circuits: Theory and Techniques C3

A review of transmission line theory, the Smith Chart and matching networks. The measurement and use of scattering parameters. Passive component design for microstrip circuits. Noise properties of two-port networks. The characterization and use of microwave transistors and diodes. Microwave subsystems.

ELEC9354 Microwave and Optical Devices C3

Principles and applications of microwave amplifying and control devices. Includes microwave transistors, Gunn and impatt diodes and recent developments in ultra high speed transistors. Principles and applications of optical sources and detectors. Includes lasers, LEDS, electro-optic and acoustic-optic modulators and switches, optical detectors.

ELEC9355 Optical Communications Systems C3

Prerequisites: ELEC9350, ELEC9354.

Calculation of bandwidth of single mode and multimode fibres. Review of transmitter and receiver circuits. Connection and launching efficiency between fibre and optical source. Fibre to fibre splicing and connection, losses due to fibre imperfection, fault location. Fibre cable, mechanical strength of fibre. Direct intensity modulation system, sensitivity of receiver, repeater design. Coherent optical communication system: laser frequency and intensity stability, polarization-maintaining

optical fibre, heterodyne receiver. Coding for digital optical communication systems: OOK, PSK, FSK, DPSK. Analogue optical communication system: optical source linearity, PFM, repeater spacing calculation. Wavelength division multiplex. Optical fibre local area networks. Synchronization. Optical communication in hostile environments.

ELEC9370 Digital Image Processing Systems C3

Excluded: ELEC9407.

The fundamentals of digital image processing with topics selected from the following: Visual perception and the image model, transforms, enhancement, sharpening and smoothing, restoration, encoding, segmentation, reconstruction of images from projections and tomography, satellite imaging and imaging in remote sensing; image processing hardware and systems; picture processing; measurement and inspection.

ELEC9401 Computer Control Systems 1 C3

An introduction to the use of CAD packages and coverage of the control theory necessary to understand the design of fundamental control systems. Selected computer packages, sampling and conversion, difference equation models, polynomial forms, z-transforms, differential equation models, operator forms, s-transforms, block diagrams, flow diagrams and state space models, connections between discrete and continuous models, classical continuous design, Root locus, Nyquist, Bode, classical discrete design, w-transforms, PID controllers, simple controller design schemes (time polynomial), Dahlin Higham, pole placement, approximations, Smith predictor, deadbeat, stochastic observers, pre-whitening, stochastic processes, time domain, frequency domain, correlation, identification, moving average models.

ELEC9402 Computer Control Systems 2 C3

Prerequisite: ELEC9401.

Builds on the material of 6.401G, completing coverage of basic material considered necessary for modern control system synthesis and design. Revision of model forms: discrete-continuous, polynomial-state space. Observability, controllability, observers – deterministic, stochastic processes, stochastic models, innovation models, prediction, multivariable PI tuning, linear quadratic regulator design, Kalman filtering, stochastic control, LQG, disturbances, measured disturbances, feedforward control, estimated disturbances, identification, simultaneous estimation of states and parameters, simple adaption, servomechanism problems, cascade control, multiple sampling rates, non-linear elements.

ELEC9403 Real Time Computing and Control C3

Prerequisites: ELEC9401 or assumed knowledge equivalent to ELEC4432 or ELEC4413.

Examines the implementation of modern control techniques and associated instrumentation using distributed computers. Practical hardware aspects, including measurement and actuation, data conditioning, acquisition and transmission, microprocessor devices, and other distributed computing components. Commercial realisations ranging from PLCs to full process control computing systems. Software: executive operating systems, concurrency, control algorithms, numerical problems, languages and development tools in the real-time context. Design of the man-machine interface using interactive computer display systems. The role of simulation and other CAD tools. Steps of engineering development from concept to commissioning. The viewpoint of industrial design is maintained throughout.

ELEC9404 Topics in Digital Control C3

Prerequisites: ELEC9401, ELEC9402.

Possible modules include: identification, estimation, multivariable systems, robust control, optimatization, adaptive control, biomedical applications, instrumentation and sensors, robotics, industrial design case studies, non-linear identification, non-linear control, variable structure systems, expert systems and others to be decided.

ELEC9405 Advanced Control Topics C3

Prerequisites: ELEC9401, ELEC9402.

From one to three models, covering advanced control theory, with an emphasis on applications. The modules are not limited to digital control. Typical modules include: identification, estimation, multi-variable systems, robust control, optimization, adaptive control, biomedical applications, instrumentation and sensors, robotics, industrial design case studies, non-linear identification, non-linear control, variable structure systems, expert systems and others to be decided.

ELEC9407 Cybernetic Engineering C3

The genesis of cybernetics; fundamentals of cybernetic engineering; machines modelled on life and their evolution to robots. Topics include biological information transmission, memory and efficiency with aspects of biochemical coding and control, genetic and neural; basics of brain models and the development of pattern recognition techniques, learning machines and syntactic structures; includes the Perceptron view and brain modelling; neural networks and neural computing; the albus approach to robotics, anthropomorphic robots; the social consequences of the dual evolution of robots.

ELEC9409 Cybernetic, Machine and Robot Vision C3

Assumed knowledge: ELEC9370 or equivalent.

Material oriented towards image understanding, scene analysis and world models for robots incorporating vision; including imaging techniques and geometries for vision, modelling the imaging process and image understanding, edges, range information, surface orientation, boundaries and regions, motion and optic, flow, texture, structural description, matching and inference, vision robotics.

ELEC9410 Robotics, Automation and Productivity Technology C3

Principles of Robotics relevant to trends in automating the manufacturing process. Such aspects as arm configurations, dynamics and control with relevant sensing methods; assembly and control together with trends in artificial intelligence for Robotics are discussed.

ELEC9411 Introductory Physiology for Engineers S1 L2 T2 C3

Excluded: ELEC3402.

This subject is intended primarily for Biomedical Engineering students.

An introduction to biophysics and physiology for Engineers. Cells, tissues and organ systems with emphasis on their functional and regulatory characteristics and their interaction. An introduction to computer models of physiological control systems demonstrating their value in understanding the

dynamics of complex neural, hormonal and circulatory responses to changes in homeostasis.

ELEC9412 Biological Signal Analysis C3

Excluded: ELEC9341.

Digital computer methods of extracting information from biological signals using filtering and averaging, expectation density functions, correlation functions, spectral analysis and other techniques. Methods of constructing models of biological systems.

ELEC9415 Optimisation and Optimal Control SS C3

Prerequisites: 1 undergraduate Control subject plus MATH2501.

Constrained and unconstrained optimisation, Euler, Bernouli, Lagrange. Linear quadratic and geometrical programming techniques, the simplex method, Kuhn-Tucker necessary conditions, gradient methods. Dynamic optimisation, dynamic programming, the optimum principle. Design control systems by optimisation methods, optimisation of parameters, decoupling and other methods. Introduction to integer programming.

ELEC9416 Non-linear Systems and Simulation SS C3

Prerequisites: 1 undergraduate Control subject plus MATH2501.

Dynamic and static non-linear systems; Non-linear control, phase plane, describing function, stability, Liapunov, Popov and the circle criterion, special systems. Simulation and Non-linear systems, numerical methods, simulation languages and shells, CACE, intelligent interfaces, discrete event simulation.

ELEC9501 Advanced Semiconductor Devices C3

Excluded: ELEC4512.

Theory and operating characteristics of a range of semiconductor devices including bipolar diodes and transistors, MOS devices and circuit connections, charge coupled devices, solar cells, light emitting diodes and semiconductor lasers.

ELEC9502 Integrated Circuit Technology C3

Technologies for the fabrication of bipolar, CMOS, and BiCMOS VLSI integrated circuits. Includes technology modules of Crystal growth, wafer preparation, maskmaking, photolithography, oxidation, diffusion, ion implantation, plasma processing, thin film deposition and metallization. Advanced technologies such as GaAs high speed IC and SOI for radiation hard or 3-D integration are briefly discussed. Process integration and the link of device physics, circuit design to technology development are emphasized.

ELEC9503 Integrated Circuit Design C3

Assumed knowledge: ELEC3016 or 6.322.

An advanced treatment of the design of integrated circuits with emphasis on the relationships between technology, device characteristics and circuit design. Includes properties and modelling of bipolar and MOS circuit components, circuit analysis and simulation, layout rules, analog functions such as operational and power amplifiers; multipliers, D A and A D converters. Analog MOS circuits. Switch capacitor filters. Digital circuits include gates, compound functions, RAM, ROM, speed and power analysis. Economics and yield analysis for MSI, LSI and VLSI devices.

ELEC9504 Solar Energy Conversion C3

World and Australian energy resources. General energy conversion principles and their application. Characteristic of received solar radiation. Thermal conversion and selectively absorbing surfaces. Biological methods of conversion. Fundamentals of photovoltaic generation.

ELEC9505 Solar Cells – Operating Principles, Technology, and System Applications C3

Excluded: ELEC4540.

Harnessing of sunlight by using solar cells to convert it directly to electricity. The properties of sunlight and of the semiconductors used in solar cells are briefly reviewed and their interaction described. Factors important in the design of solar cells and the current technology used to produce cells. Emphasis is placed on applications including system design and operation. System applications range from those which are currently viable economically to residential and central power systems which have considerable potential for the future. The role of small business within the photovoltaic industry is briefly considered.

ELEC9506 Special Topic In Electronics C3

This syllabus changes to allow presentation of a special topic of current interest particularly by visitors with recognised expertise in the topic.

ELEC9912 Project Report C12

The project is done in a major area, in which it is offered under the supervision of an academic member of staff. Where the work is carried out externally a suitable co-supervisor may be required. Projects can take many forms such as the design and construction of experimental equipment or a theoretical investigation. At the end of the work a comprehensive project report giving an account of the student's own research must be submitted. Information on the preparation of project reports is contained in the University Calendar. The 12 credit project is not available in all areas.

ELEC9918 Project Report C18

As above. The 18 credit project is not available in all major areas.

Fuel Technology

Fuel Technology is a department within the School of Chemical Engineering and Industrial Chemistry.

FUEL5880

Please see subject description for FUEL5881.

FUEL5881 Unit Operations In Wastewater, Sludge and Solid Waste Management

Physical wastewater treatment processes including sedimentation, flotation, flocculation, pecipitation. Sludge management including conditioning, filtering, lagoons, drying. Introductory fuel engineering. Combustion principles. Incineration. Pyrolysis. Gasifcation. Resource recovery and recycling. Incinerator and afterburner design.

FUEL5920 Practical Aspects of Air Pollution Measurement and Control **S1 or S2 T3**

Prerequisite: FUEL5910 or equivalent.

Laboratory and tutorial programs in the measurement and analysis of ambient and industrial air pollutants. Computation tutorials in advanced dispersion models, aerosol dynamics and control equipment design parameters.

Geography

GEOG9150 Remote Sensing Applications **S1 L1 T2 C3**

The application of remotely-sensed data and information in the description, classification and assessment of earth resources and environmental conditions. Different types of remote sensing data and imagery, their attributes, acquisition and uses. Relevance of remote-sensing data and imagery to a range of applications, including assessment of conditions of terrain, soils and surface materials; multitemporal monitoring and inventory of rangelands, croplands and forests; rural and urban land use assessment; surveillance of surface water resources and sedimentation; appraisal of changes in the coastal zone. Use of remote sensing in environmental management and in environmental impact assessment.

GEOG9210 Computer Mapping and Data Display **C3**

Introduction to automated cartography and thematic mapping; theoretical and practical problems in displaying and mapping data by computer; review and application of selected computer mapping packages. INFO is used for database management, and ARC-INFO and GIMMS for cartographic manipulation and output.

GEOG9240 Principles of Geographic Information Systems **S1 L1 T3**

Study of selected geographic information systems; problems of data capture and display, data storage and manipulation, system design and development; cartographic displays and computer mapping. INFO is used for database management, and ARC-INFO and MAP for spatial data manipulation and display.

GEOG9300 Vegetation Management **S1 L2 T1 C3**

The subject provides a background in theory and practice in vegetation management, particularly under Australian conditions. It covers the description and measurement of vegetation, vegetation dynamics, vegetation response to perturbation and human impacts, theories, and modelling of vegetation change. A third of the subject is devoted to management strategies of selected vegetation types.

GEOG9310 River Management **S1 L2 T1 C3**

The principles of river management including total or integrated catchment management, environment impact assessment, in-stream uses and hydrogeomorphic behaviour. Issues covered include regulrs, interbasin diversions, extractive industries, urbanization, river engineering, legislative controls and institutional responsibilities. The course develops an understanding of how and why rivers respond to human activities and ways of ameliorating negative impacts. Field work is an essential part of the subject and the Nepean River will be used as a case study of management problems.

GEOG9320 Soil Degradation and Conservation **S2 L2 T1 C3**

Identification, assessment and analysis of the main processes of soil degradation, including the role of climate, vegetation, geomorphology and pedology in controlling the processes. Discussions of appropriate management strategies for reducing degradation and for reclaiming degraded landscapes. Topics include: surface wash, gully eosion, wind erosion, soil acidification, soil structure decline, salinization, accumulation of toxins and desertification.

GEOG9512 Project **C12**

An investigation of a problem in remote sensing or geographical information systems which involves an identifiable research-component. Such an investigation should be related to the research interests of particular Schools within the Faculty of Applied Science.

Applied Geology

Applied Geology is a Department within the School of Mines.

GEOL9010 Hydrogeology **S1 L1.5 T1.5 C3**
S2 X C3

Surface and sub-surface methods of geological and geophysical investigation; ground water exploration of confined and unconfined aquifiers. Geological and hydraulic characteristics of rocks; aquifer boundaries, groundwater storage and quality. Hydraulics of wells. Hydrogeological systems analysis, including computer methods, mapping techniques and groundwater resources evaluation. Hydrogeology of arid and semi-arid zones. Case history studies of groundwater fields.

GEOL9011 Hydrogeology G **S1 L1.5 T1.5 C3**

Hydrologic and hydrochemical cycles, catchment hydrogeology and principles of groundwater flow. Elements of groundwater chemistry, will hydraulics, pumping tests, hydrogeological environments and exploration for groundwater. Groundwater engineering, drilling technologies, geophysical bore logging, dewatering of excavation groundwater resource evaluation.

GEOL9020 Geopollution Management **S1 L1 T1 C3**

Please see subject description for GEOL9320

GEOL9110 Hydro and Environmental Geology **S L3 T1**

Prerequisite: GEOL5100

Hydrogeology: Hydraulics of groundwater in fractured rock, hydrodynamic dispersion of cantaminants in poroous and fractured media, sources of contaminants in the groundwater system, monitoring and sampling of contaminants in groundwater, groundwater quality and environmental standards, *Environmental Geology:* Domestic, industrial and radioawaste disposal, deep well injections. Geological hazards and urban planning. Impaact of dams, mineral exploration, mining and immpact statement techniques. Land use conflicts. *Coastal Geology:* Properties of sedimentary populations. Sampling practices. Geological significance of sediment parameters. The shore's processes, littoral and longshore drifts and net sand movement. Field work of up to two days is a compulsory part of this subject.

GEOL9120 Groundwater Contaminant Transport **S1 L3 T1**

Prerequisites: GEOL9110, CIVL3007.

Available at commencement of 1993 only.

Hydrogeochemistry: Chemical composition of natural and contaminated groundwater, inorganic and organic chemical principles. Application of chemical thermodynamics. Mineral dissolution and precipitation. Non-equilibrium approaches. Chemical classification of groundwaters and hydrochemical facies in alquifie.rs. Geochemical evolution of groundwater. Application of stable and radioactive isotopes. Computer models. Case studies. Interactions of solid, liquid and gaseous phases. Salt sieving and brine development. Chemical and microbiological reactions in and near boreholes and relevance to borehole performance, deterioration, rehabilitation. Chemical dispersion theories for contaminants, hydrochemical modelling for inorganic and organic contaminant plumes. Practical field measurement and laboratory analysis for determination of hydrochemical parameters, adsorption, desorption, Kd, dispersivity. Groundwater Modelling: Types of groundwater models and their physical bases for porous and fractured rock alquifiers. Modelling low permeability materials. Analogue, analyltical and numerical model forms. Stochastic modelling and characterization of variability. Modelling multiphase, immiscible fluids, and regional groundwater flow. Applications of modelling to borefield management, saltwater intrusion, mine dewatering, wast disposal and contaminant transport.

GEOL9320 Geopollution Management **S1 X C3**

Material properties and hydrodynamic factors influencing surface and subsurface flow of pollutants in rocks and soils. Dispersion theory and modelling for pollutants in aquifers. Water quality and the problems of standards. Use of field instruments for quality determination. Geological and technological factors in waste disposal: domestic and industrial wastes, including the Rocky Mountain Arsenal Well case study, deep well injection methods. Management of radioactive wastes, waste disposal problems in limestone areas. Case studies of aquifer pollution and practical measures for preventing pollution. Rational planning of water resources for industrial and domestic use.

GEOL9060 Environmental Geology **S1 L1.5 T1.5 C3**

Geological hazards: seismic risk, landslides, subsidence, floods, erosion, volcanic eruptions, discrete and continuous hazards, event return time. Geological resources and their management: types of resources, use and potential environmental conflict, resource economics and policy formulation. Waste disposal and the mineral industry, reclamation and rehabilitation of land used for extractive purposes. Swamp drainage. Geology and urban planning: map preparation, multiple land use principle, aesthetic criteria for landscape evaluation. Environmental impact of dams, roads, explorative and extractive stages of mining, impact statement techniques, case studies. Communication of geological information to technical and non-technical people. Geological legislation for water resources and waste disposal.

GEOL9504 Project **9**

Industrial Relations and Organizational Behaviour

IROB5701 Industrial Relations A **S1 L3**

Prerequisite: Nil.

Concepts and issues in Australia industrial relations at the macro or systems level, with overseas comparisons where appropriate. Labour movements and the evolution of employee-employer relations in the context of industrialization and change; origins and operations of industrial tribunals at the national and state levels; their instrumentalities; nature of industrial conflict and procedures for conflict resolution such as arbitration and bargaining; and national wage policy.

Librarianship

LIBS0815 Economics of Information Systems **S1**

Use of surveys, user studies and market research to determine demand. Costing, financial planning, control and forecasting. Cost-benefit analysis. Economics of networks. Economic implications of new technologies.

LIBS0817 Information Storage and Retrieval Systems

Role of thesauri and other indexing language structures. Automated thesaurus design and maintenance. Automatic indexing and classification systems. Concept co-ordination, use of Boolean operators and search strategy design. Systems analysis, design and costing. Design of user and interactive cueing tutorials. Choice criteria for on-line and batch systems. Testing, analysis and evaluation of systems. Advanced technologies for information storage and retrieval.

Industrial Technology and Management

Industrial Technology and Management is a Discipline within the School of Mechanical and Manufacturing Engineering.

MANF9010 Research Project **C12**

MANF9040 Seminar Industrial Management **C0**

MANF9049 Seminar Operations Research **C0**

MANF9191 Special Topic in Production Engineering* **C2**

MANF9192 Special Topic in Production Engineering* **C2**

MANF9193 Special Topic in Production Engineering* **C2**

MANF9200 Design Production **C4**

Influence of manufacturing processes on design; design simplification and standardization; value engineering; economics of process selection; case studies. planning

experiments; significance testing; simple comparative experiments, accelerated experiments; fatigue testing, tool life.

MANF9210 Value Analysis and Engineering C3
Cost reduction through value analysis engineering illustrated by case studies. Selection of projects to be studied, collection of information, creative problem solving, development of alternatives, functional analysis system technique, functional evaluation, cost-function relationship, decision making, communication and implementation of the proposal. Applications to engineering design and services.

MANF9220 Product Design and Technological Innovation C3
Definitions of design and innovation. Product design. Technological innovation. The creative process. Organizational strategies and practices for innovation. Design, marketing and the consumer. Diffusion of innovations. Government policies for design and innovation. Design evolution, technological innovation and economic growth. Innovation projects.

MANF9300 Methods Engineering C4
Methods study: history and objectives. Charting and systematic improvement of methods, factory and workplace layout. Ergonomics. Physical and social aspects of working conditions. *Work measurement:* defining and using 'standard times'. Time study techniques and problems, predetermined motion-time systems, work sampling, standard data and formulae. Accuracy and statistical testing of data. *Industrial psychology:* motivation to work, socio-technical systems, sources of job satisfaction. Financial incentive schemes, job enrichment and worker participation. Laboratory exercises.

MANF9310 Factory Design and Layout C3
Assumed knowledge: MANF3309 or MANF9300 or equivalent.

Production requirements: processes, machines and storage; optimum factory size, multiple factories. *Plant location:* single and multiple factories and warehouses; location models and economic analysis. *Factory design:* function; appearance; economic factors; environmental factors. *Materials handling systems:* influence on layout; economic choice between alternatives; long-distance transport. *Layout design:* by product: types of production line, means of line balancing, queueing theory applications. By process: travel charts and computer programs for optimization. Group technology. Practical aspects; provision of services and amenities; layout visualization methods.

Note: A project forms a substantial proportion of the assessment for this subject.

MANF9320 Ergonomics C3
Applied anatomy and kinesiology, anthropometry; application to work place arrangement, seating and bench design, tool and equipment design, lifting techniques, consumer product and architectural design. Physiological and psychological aspects of work and fatigue; measurement of energy consumption, limits to energy expenditure at work, static muscular fatigue, boredom. Environment effects; natural and artificial lighting arrangements, problems of perception, colour; noise and vibration, preventive measures; heat and ventilation, thermal regulation in humans, criteria for comfort, effects of pollutants. Man-machine interface. Displays, machine controls, reaction times, vigilance. Applications of ergonomics to occupational safety and health. Ergonomic research methology.

Note: A project forms a substantial proportion of the assessment for this subject.

MANF9330 Simulation in Operations Research C3
Excluded MANF3609, 6.646.

The relationship of simulation to other methods of comparing alternative solutions to industrial problems. Computer simulation languages. Process generation. Variance reduction techniques. Analysis of simulation generated time series. Formulation and construction of models for simulation. Problems of simulation. Design of simulation experiments. Optimization through simulation. Examples of the use of simulation. Heuristics.

MANF9340 Flexible Manufacturing Systems C3
Prerequisite: MANF9520.

Technical aspects of FMS components, including automated material-handling devices, job selection design and their aggregation. Hierarchical structure of FMS; mathematical models of FMS.

MANF9400 Industrial Management C3
Definitions of management; evolution of management thought, classical, quantitative and behavioural schools; interactions between organizations and their environment. The planning process; strategic and tactical planning, developing planning premises, nature of managerial decision making, quantitative aids, management by objectives. Organizational structures; coordination and spans of control, the informal organization, authority delegation and decentralization, groups and committees, managing organizational change and conflict. Motivation, performance and satisfaction; leadership, interpersonal and organizational communication, staffing and the personnel function. The control process; budgetary and non-budgetary methods of control, use of management information systems.

MANF9410 Inspection and Quality Control C3
Economics of measurement; advanced measuring and inspection methods; non-destructive testing; quality control systems; sampling by attributes and variables; standardization; case studies; process capability and variability; machine tools acceptance testing; alignment procedures.

MANF9420 Production and Inventory Control C2
Excluded: MANF4429

Overview of basic issues of production planning and control; use of inventory as a buffer; Economic Batch Quantities and their limitations; simple re-order point systems; statistical inventory control and its limitations. Material Requirements Planning: the basic material requirements explosion process; capacity planning and control, Master Production Scheduling; structuring the Bill of Materials for MRP; cycle counting; lot sizing techniques; implementation of MRP in practice; limitations of MRP. OPT (Optimised Production Technology), its basic philosophy and approach to production scheduling. Just in Time Production; basic philosophy of JIT; prerequisites for JIT; planning a JIT product mix; the Kan Ban System. Comparative evaluation of alternative Production Management Approaches and their relationship to manufacturing strategy.

MANF9430 Scheduling and Sequencing C2
Criteria for evaluation schedules. Scheduling of single machines. Job-shop scheduling with two, three or more

machines. Permutation schedules. Groups of machines. Scheduling constrained resources.

MANF9440 Management of Distribution Systems C2

Assumed knowledge: MANF3609.

The distribution system: single depot location, multi-depot location, vehicle scheduling, vehicle loading, fleet size, case studies.

MANF9450 Management Simulation C3

Problem definition. Principles of model building. Participation in an operational simulation. Construction of decision rules. Operations. Research case studies and seminars.

MANF9491 Special Topic in Industrial Engineering* C3

MANF9492 Special Topic in Industrial Engineering* C3

MANF9500 Computer Aided Programming for Numerical Control C3

Assumed knowledge: MECH1500 or equivalent.
Excluded: MANF4509.

Overview of N.C. systems and manual programming. Computer assisted programming dealing with specific and generalized part programming. Mathematics for computer assisted part programming. High level language requirements for part programming. Study of the structure and use of automatic programmed tools (APT). Selection of operating conditions.

MANF9510 Computer Automation C3

Computer architecture including central processer, randomaccess memory, read only memory, input output ports, peripherals, and the relationships between each. A systematic study of the requirements for interfacing computers to the real world. Machine code, assembly language, and high level languages such as BASIC or FORTRAN with a comparison of each for particular applications. Development of smallcomputer system for machine tool control, automated inspection, supervision, stock control, etc.

MANF9520 Computer-Aided Manufacturing C3

Brief review of numerical control (NC) manufacturing systems. Elements of the CAM systems: CAM data base, production management, manufacturing control. Computers in manufacturing. Computer process monitoring and control. Production systems at the plant and operations levels. Supervisory computer control. Flexible manufacturing systems.

MANF9530 Discrete-Event Simulation Languages C3

Assumed knowledge: MANF3609 or 6.646 or equivalent.

Basic elements of simulation languages: random number generation, process generation, list and set processing, data structures, time advance and event scanning, gathering and resetting statistics, graphics, Simulation language world views. Comparative review of commercially available simulation languages such as Simscript, GPSS, ECSL, and Simula, and a study of one of them in depth. Simulation using personal computers. Simulation language preprocessors.

MANF9541 Computer Aided Design for Manufacture C3

Principles underlying the interactive computer graphics packages such as AUTOCAD, CADAM, CATIA. Applications to design and engineering processes. Projects on building packages for design or upgrading the existing packages.

MANF9542 CAD for Manufacture 2 C3

Prerequisite: MANF9541.

Topics related to methods of geometric modelling for curves, surfaces and solid models, and their applications to computer-aided design problems in manufacturing industry. Finite element methods in CAD. Intelligent CAD systems: principles and applications.

MANF9560 Computer Integrated Manufacturing C3

Prerequisite: MANF9520.

Systems analysis and design of computer integrated manufacturing, including flexible manufacturing systems and automated factories.

MANF9601 Economic Decisions in Industrial Management C3

Excluded: MANF3619.

General aspects: the economic objective, the single-period investor's model, economic criteria, the mathematics of finance. *Deterministic models:* project evaluation using discounted cash flow analysis; capital structure; debt and equity financing; cost of capital and the minimum acceptable rate of return; taxation; inflation and its effects. *Probabilistic models:* multiple objectives and multi-attribute value systems based on means and variances of cash flows. *Particular applications of economic decision-making:* venture and risk analysis, risk management, static and dynamic replacement models, rent-or-buy decisions, breakeven analysis, expansion and economic package concepts, analysis of projects with public financing.

MANF9602 Engineering Economics Analysis C3

Price-output decisions under various competitive conditions. The time-value of money, net present worth and DCF rate of return, and their application in the selection and replacement of processes and equipment. Construction and optimization of particular models, eg replacement, capital rationing. Measures of profitability.

MANF9610 Decision Theory for Industrial Management C3

Decisions with multiple objectives. Indifference curves and tradeoffs. Value functions for two or more attributes. Decisions under uncertainty. Utility theory. Bayesian decisions in discrete and continuous space. Value of information. Optimal sampling. Applications in investment, marketing, production.

MANF9620 Operations Research 1 C6

Excluded: 6.646, 18.503, MANF4610, MANF9629.

The formation and optimization of mathematical models. The development of decision rules. Some techniques of operations research such as mathematical programming, queueing theory, inventory models, replacement and reliability models and simulation. These techniques are applied to situations drawn from industrial fields, for example, production planning and control. Practical problems of data collection, problem formulation and analysis.

MANF9629 Operations Research C6

Excluded: 6.646, MANF3609, MANF4610, MANF9620.

The formulating and optimization of mathematical models. The development of decision rules. Some techniques of operations research such as mathematical programming, queueing theory,

inventory models, replacement and reliability models; simulation. These techniques applied to situations drawn from indus trial fields, eg production planning and inventory control. Practical problems of data collection, problem formulation and analysis.

MANF9630 Large Scale Optimization In Industry C3

Excluded: MECH4130.

Large-scale linear programming: sparse constraint matrices, updating basis factorizations. Large-scale nonlinear programming: the limitations of classical quasi-Newton and conjugate gradient methods, sparse Hessian approximations, superbasic variables, augmented Lagrangian methods for sparse nonlinear constraints. Applications, examples and case studies from industry: optimal power flow, steam and power plant design, pipeline network optimization and other.

MANF9640 Industrial Applications of Mathematical Programming C3

Problem formulation: development of objective and constraints. Conventions for large-scale matrix construction; list and table processing. Matrix generator languages; the MGG package. Data organization, interpretation of output, automatic preparation of report. Examples from industry. Case studies and projects.

MANF9650 Decision Support Systems C3

Perspectives on individual and organisational decision making; definitions and basic philosophy of DSS; DSS classification and architectures. DSS technology: spreadsheet and multi-dimensional array modelling; data models, databases and database management system; normalisation and query languages; data information and knowledge; knowledge based systems in DSS; basic knowledge representation techniques; forward and backward chaining; integration of knowledge based systems in DSS architecture; user interfaces (including natural language). Design of a DSS (project).

MANF9660 Energy Modelling, Optimization and Energy Accounting C3

The analysis of energy systems using computer models. Applications of such models range from policy analysis at government level investment analysis within individual industries. Covers both the formulation of energy models and the techniques used to obtain optimized solutions, with examples from actual studies. Effects of uncertainty and the use of energy accounting as an analytical tool.

MANF9691 Special Topic in Operations Research* C2

MANF9692 Special Topic in Operations Research* C2

MANF9693 Special Topic in Operations Research* C2

MANF9811 Industrial Experimentation 1 C3

Excluded: MANF3809 or equivalent.

Design of experiments with reference to industrial problems; planning experiments; significance testing; simple comparative experiments, accelerated experiments; economic aspects of experimental design; analysis of variance or randomized block, latin square and factorial experiment designs.

MANF9812 Industrial Experimentation 2 C3

Regression analysis; use of orthogonal polynomials in regression analysis and analysis of variance; confounding in factorial design; response surfaces and determination of optimum conditions.

MANF9820 Time Series Forecasting C2

Stationary series. Autoregression. Spectral analysis. Estimation of trends, seasonal effects and parameters. Exponential smoothing. Error analysis and tracking signal. Choice of method.

MANF9840 Linear Programming C2

Formulation of models. The revised simplex method. Sparse matrix techniques. Implementation on computers. Duality and postoptimality analysis. Extensions to the simplex method. Generalized upper bounding. Decomposition. Integer programming. Applications in industry.

MANF9850 Nonlinear Programming C2

Formulation of models. Single variable optimization. Numerical techniques for unconstrained optimization. Methods for linear constraints. Penalty function methods for nonlinear constraints: Lagrangian methods. Applications in industry.

MANF9860 Networks and Graphs C2

Basic concepts. Application of Hamiltonian paths, Euler cycles, tress, planar graphs, dominating and independent sets to operations research problems. Shortest route algorithms. Concept of maximum flow in a network applied to transportation assignment and scheduling problems.

MANF9870 Dynamic Programming C2

The principle of optimality. Structure and formulation of dynamic programming problems. One-dimensional deterministic and probabilistic sequential decisions. Approximations in function and policy space. Multidimensional problems, computational aspects. Applications to allocation problems, inventory theory, replacement.

MANF9880 Optimal Control in Operations Research C2

Brief survey of dynamic optimization techniques. Introduction to the calculus of variations and the maximum principle for both continuous and discrete systems. Applications to operations research problems drawn from the areas of production and inventory control, machine maintenance, investment and natural resource utilization.

* These syllabi change to allow presentation of a special topic of current interest particularly by visitors with recognised expertise in the topic.

Mathematics

MATH5045 Advanced Mathematics for Electrical Engineers C3

Boundary value problems in partial differential equations. Selected topics from complex variable analysis, integral transforms, and orthogonal functions and polynomials.

Mechanical Engineering

MECH9010 Project **C12**

MECH9201 Digital Logic Fundamentals for Mechanical Engineers **C3**

Excluded: 6.021E, 6.631 and equivalent.

Introduction. Review of number theory. Symbolic logic. An introduction to TTL compatible devices. Formulation and implementation of problems in logic. Microprocessor architecture. Components of a microprocessor based system. Memory maps. Input/Output devices. Dedicated and special purpose computers. Principal features of a microprocessor based system. Laboratory complement to lectures.

MECH9202 Microprocessor Fundamentals for Mechanical Engineers **C3**

Prerequisite: MECH9201 or equivalent. Excluded: 6.0318, ELEC4432,6.613,COMP9221,ELEC9406,ELEC4351 and equivalent.

Introduction to microprocessor programming. Machine code programming. Instruction sets. Program branching and condition codes. Addressing modes. Interrupts. Address decoding and memory interface. Input/Output interfacing techniques. Programmable peripheral devices. Serial and parallel interfaces. Microprocessor control of electromechanical devices. Laboratory complement to lectures.

MECH9203 Industrial Applications of Microprocessors **C3**

Prerequisite: MECH9202 or equivalent. Excluded: ELEC4432, ELEC9406, ELEC4351 and equivalent.

Coding and programming. Transducer selection. Information transfer. Data storage. Power output device control. Application to industrial automation and control. Laboratory complement to lectures.

MECH9204 Elements of Industrial Automation **C3**

An introductory overview of the elements of Industrial Automation systems and the factors governing their use in industry.

MECH9205 The Analysis and Use of Integrated CAD/CAM Systems **C3**

Prerequisite: MECH9204.

Economic background to the use of CAD/CAM systems. Elements in systems for use with machining centres, lathes and sheet metal machinery. Data input techniques. Coordinate handling. Machine specific post processors. Data verification and output integrity analysis. Techniques for interfacing machine tools with computers. Restrictions imposed by requirements for real time control. Integration with accounting and cost analysis systems. Choice of computer. Factors in CAD CAM system selection.

MECH9211 Control and Modelling of Mechanical Systems 1 **C3**

As for MECH9212.

MECH9212 Control and Modelling of Mechanical Systems 2 **C3**

Prerequisite: MECH9211 or equivalent.

Development of modelling techniques using both digital and analogue computation, with special emphasis on the representation of non-linearities. Typical examples of mechanical systems.

MECH9221 Industrial Robotics **C3**

Applications survey. System structure, hardware, software, han- dling. Linkage kinematic structure; power transmission. Linkage structural design. Actuator choice. Interface hardware. Feedback. Function programming philosophies. Control algorithms. Problem specification; solution preparation. Writing, storage, implementation of computer algorithms.

MECH9222 Artificially Intelligent Machines **C3**

The principles of operation of machines into which limited powers of decision making have been delegated. The grouping of intelligent machines. Cognition; sensor technology; parsing; information representation; convolutions; software and hardware environments.

MECH9301 Advanced Mechanism Analysis and Synthesis 1 **C3**

Assumed knowledge: MECH2300 or 5.333 or equivalent. Excluded: MECH4301.

Algebraic displacement, velocity and acceleration analyses of simple and complex planar mechanisms. Instantaneous kinematics: centrodes; inflection and Bresse circles; acceleration centre; Euler-Savary equation; cubic of stationary curvature; centring point curve. Coupler curves and their properties; curve cognates. Constraint and freedom; mobility; velocity closure of a loop; special configurations; singularities. Various methods of synthesis.

MECH9302 Advanced Mechanism Analysis and Synthesis 2 **C3**

A selection of topics from Planar mechanisms: kinematic analysis of complex mechanisms; kinetic analysis; kinematic geometry; precision position synthesis. *Cams:* basic and common curves; equations of motion; development of profile; determination of system geometry and mechanical properties; noise, wear, backlash and manufacture. *Spatial linkages:* structural analysis; closure equations; screw system algebra; special configurations.

MECH9310 Advanced Vibration Analysis

Assumed knowledge: MECH3310 or equivalent.
Excluded: MECH4310.

Introduction to experimental vibration analysis using Fast Fourier Transform (FFT) techniques. Typical sources of vibration in machines. Analysis of continuous systems via classical and finite element techniques. Experimental modal analysis. Torsional vibrations, including geared shaft systems.

MECH9320 Random Vibrations **C2**

Assumed knowledge: MECH3310.

Probability, vibration theory review, linear mechanical system response to random vibrations. Statistical characteristics: autocorrelation, spectral density, convolution, narrow band processing, consistency, applications.

MECH9321 Acoustic Noise 1 C2

Excluded: MECH4341.

Acoustic plane wave equation, standing waves, energy density, intensity, decibel scales. Human response, annoyance and damage criteria. Transmission between media, absorbing materials. Mufflers, Three dimensional wave equation. Transmission in ducts. Room acoustics.

MECH9322 Acoustic Noise 2 C2

Prerequisite: MECH4322 or equivalent. Excluded: MECH9321.

Noise measurement, microphones, frequency analysis, transient and average measurement. Frequency weightings. Flow noise, noise from jets, fans, propellers. Noise of machines, modal response, damping.

MECH9361 Lubrication Theory and Design 1 C2

Excluded MECH4361.

History of lubrication, types of bearing and bearing operation, nature of surfaces and their contact, modes of lubrication, properties of lubricants, viscous flow in pipes and channels, measurement of viscosity, infinitely long and short bearing approximations, one dimensional analysis of short bearing, other slider bearing geometries, the effect of end leakage, hydrostatic or externally pressurised bearings, squeeze films.

MECH9362 Lubrication Theory and Design 2 C2

Prerequisite: MECH9361 or equivalent.

Continuum equations of hydrodynamic lubrication. Journal bearing dynamics. Rolling contacts. Elastohydrodynamic lubrication. Grease lubrication. Plasto-elastohydrodynamic lubrication. Metal forming, cutting lubrication.

MECH9400 Mechanics of Fracture and Fatigue C3

Excluded: MECH4400.

Theories of fracture; failure modes. Ductile, brittle fracture. Mechanics of crack propagation, arrest. Measurement of static fracture properties. Fatigue crack initiation, propagation. Engineering aspects of fatigue.

MECH9410 Finite Element Applications C3

Excluded: MECH4410, MECH4400.

Introduction to finite element and associated graphics packages. Principles of mesh design and validation. Specification of boundary conditions including use of symmetry. Estimation of the cost of solution. Interpretation of results. Assessment of the accuracy of the results. Convergence to the exact solution. Selection of applications from linear and non-linear elasticity: three dimensional solids, plates and shells, plasticity, buckling and post-buckling behaviour, thermal stresses, dynamics including natural and forced vibration.

MECH9421 Stress Analysis for Mechanical Engineering Design 1 C3

Assumed knowledge: MECH3400 or equivalent.

Plates, shells: primary, secondary and peak stresses, relations to strength. Pressure vessels. Current design philosophies.

MECH9422 Stress Analysis for Mechanical Engineering Design 2 C3

Assumed knowledge: MECH3400 or equivalent.

Topics selected from: Plastic collapse. Limit state design. Stress concentrations. Plate girder panel structures. Lightweight structures. Machine frames. High temperature components. Gears.

MECH9460 Experimental Stress Analysis C3

Strain gauging: practice, theory, instrumentation, data acquisition and processing, applications, load cell design. Photoelasticity: transmission and reflective. Brittle coatings. Dye penetrants. Practical laboratory classes throughout.

MECH9620 Computational Fluid Dynamics C3

Incompressible flow: primitive equations; stream function, vortic- ity equations. The conservative property. Stability analysis. Explicit, implicit methods. Upwind differences. SOR methods. Fourier series methods. Pressure, temperature solutions. Solving the primitive equations.

MECH9631 Gasdynamics 1 C2

Excluded: AERO3601.

One dimensional steady flow: isentropic channel flow, normal shock waves, supersonic wind tunnels and diffusers. Two dimensional steady flow: oblique shock waves, Prandtl-Meyer expansions, nozzles, airfoils. One dimensional unsteady flow: moving waves, reflections, explosions in ducts, shock tubes; method of characteristics, internal flows, piston and valve effects.

MECH9632 Gasdynamics 2 C2

Prerequisite: MECH9631 or equivalent.

Kinematics, dynamics, thermodynamics, vorticity. Nozzle. Wind tunnel. Diffusers. Shock waves; steady, moving. Method of characteristics. Combustion. Real gas behaviour at high temperature. Hypersonic aerodynamics, free molecule flow, re-entry; high energy experimental methods.

MECH9710 Numerical Fluid Dynamics and Heat Transfer C3

Assumed knowledge: MECH3800 or equivalent. Excluded: MECH2600 or equivalent.

Introduction: Review of the mechanisms of heat transfer. Governing equations for convection: continuity, Navier-Stokes, energy. Boundary layer equations for forced and natural convection. Boundary conditions. *Approximate analytical solution methods:* momentum and energy integral equations. Polhausen technique. Similarity formulation. Solution by conversion to initial value problem. *Finite difference methods:* finite difference approximations of partial differential equations. Consistency stability and convergence. Application to the boundary layer and full equations of motion and energy.

MECH9711 Analysis of Heat Transfer C4

Assumed knowledge: MECH3701 or equivalent.

Steady-state and transient heat conduction in one, two and three dimensions with application of analytical, numerical and analogical techniques. Conduction in solids with a heat source. Heat transfer in moving fluid media. Free and forced convection for internal and external flows. Differential and integral treatments of boundary layer problems. Laminar and turbulent boundary layers. Heat exchange between two fluids separated by a wall. Radiation properties of surfaces and gases. Analysis of radiation exchange between real and idealized surfaces. Interaction of radiation with conduction and convection. Heat transfer analysis of selected problems.

MECH9720 Solar Thermal Energy Design C3

Excluded: MECH4720 and equivalent.

Characteristics of solar radiation and solar collectors. Collector efficiency evaluation and prediction of long term performance. System modelling, energy storage; computer simulation and modelling of performance and economic worth.

MECH9730 Two Phase Flow and Heat Transfer C3

Assumed knowledge: MECH3701 or equivalent.
Excluded: MECH4720.

Nature of multiphase flow. Flow regime maps. Two-phase flow in vertical, horizontal and inclined pipes. Modelling of two-phase flow: homogenous model; drift flux model; drift velocity model; separated model. Annular and stratified flows. Flow in adiabatic pipes. Flow in heated pipes. The critical flow of a two-phase mixture. Pressure drop and heat transfer correlations in pipes. Subcooled, nucleate, pool and film boiling. Forced convection surface boiling. Critical heat fluxes in boiling. Mechanisms of heat transfer in boiling. Nucleation, bubble dynamics and bubble parameters. Film and dropwise condensation on flat plates. Condensation on horizontal tubes and tube banks. Condensation inside tubes. Two-phase heat exchangers. Experimental techniques in two-phase flow.

MECH9740 Power Plant Engineering C3

Assumed knowledge: MECH2600 and MECH2700 or equivalent.

Energy sources, power plant, thermodynamics. Fuel, combustion processes and equipment. Boilers, turbines, and condensers. Heat exchangers, pumps, water supply and treatment systems. Air circulating and heating systems. Station operation and performance. Economics of electrical power production. Environmental impacts of power plants. Alternate sources of energy.

MECH9741 Energy Conservation and System Design C3

Examination of some existing systems, assessment of their energy losses and their improvement by tuning. Alternative energy sources and their availability, energy utilization and efficiency in various systems. Environmental aspects, assessment of emissions, means of improvement. Economically viable energy technology under present conditions. Expected trends in energy technology in the short and long term. A number of case studies.

MECH9742 Power Production Assessment C3

Assumed knowledge: MECH3600 and MECH3701 or equivalent.

Components of hydro, coal and nuclear fuel power station designs. Economics of power production. Operation and maintenance of costs. Efficiency and heat balance calculations of thermal power stations. Comparison of electrical energy production costs of different power stations.

MECH9751 Refrigeration and Air Conditioning 1 C3

Review of thermodynamic principles; evaluation of thermodynamic properties of real fluids. Refrigerants, their properties and applications. Gas cycle refrigeration. Steam-jet refrigeration. Vapour compression refrigeration; analysis and performance characteristics of the complete cycle; analysis and performance of multipressure systems. Analysis of the performance of compressors, condensers, evaporators and expansion devices. Thermo-electric refrigeration.

MECH9752 Refrigeration and Air Conditioning 2 C3

Assumed knowledge: MECH9751 or equivalent.

Psychrometrics; application to air conditioning design. Direct contact heat and mass transfer; application to the design of cooling towers and air washers. Cooling and dehumidifying coils. Properties of homogeneous binary solutions; steady flow processes with binary mixtures. Rectification of a binary mixture. Analysis of absorption systems. Production of low temperatures. Liquefaction and rectification of gases. Magnetic cooling.

MECH9753 Refrigeration and Air Conditioning Design 1 C3

Assumed Knowledge: MECH9730, MECH9751, MECH9752 or equivalent.

MECH9754 Refrigeration and Air Conditioning Design 2 C3

Prerequisite: MECH9753 or equivalent.

Design of refrigeration equipment compressors; throttling devices; condensers; evaporators. Cooling towers: evaporative condensers; air conditioning coils. Generators and absorbers for absorption systems. Piping systems. Air ducts. Steam raising and water heating equipment. Calculation of transient heating and cooling loads. Air conditioning systems. Load analysis and system capability.

MECH9755 Refrigeration and Air Conditioning Applications C3

Industrial, commercial and domestic applications of refrigeration and air conditioning. Refrigeration technology. The science and technology of foods. Building design and construction.

MECH9756 Refrigeration and Air Conditioning Experimentation C3

Prerequisites: MECH9751, MECH9752. Co-requisites: MECH9753, MECH9754.

Performance testing and system evaluation of multistage R22 brine system, R12 forced draft cooler system and dual duct air conditioning plant. Instrumentation, data acquisition and control of refrigeration plant. Use of calorimeter rooms for testing and rating of equipment. Transient performance characteristics of direct expansion coil and system, under different ambient conditions. Group project involving the designing, building, commissioning, instrumenting and testing of refrigeration and air conditioning equipment.

MECH9757 Ambient Energy Air Conditioning C2

Assumed knowledge: MECH3701 or equivalent.

Prediction of heat storage effects in air conditioned structures. Performance of passive and active ambient energy heating and cooling systems using correlations and simulation. Use of TRNSYS program package. Simple evaporative cooling. Open cooling cycles: single and double regenerative evaporative cooling and applications; nearly reversible evaporative cooling; adiabatic desiccant open cooling cycles.

MECH9761 Internal Combustion Engines 1 C3

Thermodynamic cycles. Combustion, reaction kinetics. Real engine cycles. Chart, computer analysis. Spark ignition engines. Flame physics. Combustion chamber design. Charging, discharging; heat transfer; friction. Emissions, fuels, computer modelling: efficiency, performance, emissions. Testing. Laboratory.

MECH9762 Internal Combustion Engines 2 C3

Prerequisite: MECH9761 or equivalent.

Modifications, alternatives to SI engine: Stratified charge, rotary, orbital, turbo charged, two stroke. Compression ignition engine: combustion knock, chamber design, emissions. Gas turbines. Cycles, limitations, regeneration, combustion, emission. Axial, centrifugal compressors, turbines; matching. Aircraft, automotive, industrial types. Stirling engines: cycle analysis, design. Laboratory.

MECH9800 Ordinary Differential Equations in Mechanical Engineering C3

Solutions and their meaning, integration constants, linearity; special methods of solution; integration factors; variation of parameters; Euler, higher order linear equations; physical origins of ordinary differential equations and linear systems; linearization of engineering problems; stability of engineering systems.

MECH9900 Special Topic in Mechanical Engineering C2

MECH9910 Special Topic in Mechanical Engineering C2

MECH9920 Special Topic in Mechanical Engineering C3

MECH9930 Special Topic in Mechanical Engineering C3

These syllabi change to allow presentation of a special topic of current interest particularly by visitors with recognised expertise in the topic.

Mines

MINE1524 Mining Conservation

The reclamation of excavated land; integration with operational stages of mining. Mining cycles of alluvial, strip, and open cuts, land clearing, stabilizing the mined area, socio-economic aspects of mining, rehabilitation costs, government regulations. Examination and evaluation of a current operation.

MINE5355 Mine Fill Technology F2

Fill properties and their assessment. Fill preparation, placement and dewatering. Field sampling and *in situ* testing. Mining methods employing fill. Pozzolanic fills. Dry fills and rock fills. Economic aspects of fill practice. Soil and rock mechanics aspects. Environmental aspects. Specific fill practice in mining coal and uranium.

Remote Sensing

REMO9580 Image Analysis in Remote Sensing C3

Prerequisite: 10.361 or similar.

Techniques for extracting information from remotely sensed data with particular emphasis on satellite imagery. Topics taken from: nature and characteristics of earth resources and related satellites; satellite sensors and data formats; image enhancement techniques; image classification methods, including clustering, classification and feature selection; image classification methodologies; new horizons in remote sensing image analysis.

REMO9581 Microwave Remote Sensing C3

Use of passive and active (radar) microwave techniques in remote sensing of earth resources. Topics include: real and synthetic aperture radar systems; passive microwave radiometry; energy-surface interactions; interpretation of microwave image data: applications in agriculture, geology, oceanography and hydrology; issues in signal and image processing; characteristics of airborne and spaceborne microwave sensors.

Safety Science

Safety Science is a Department within the Faculty of Applied Science

SAFE9213 Introduction to Safety Engineering M C3

The treatment of the following topics covers similar material as SAFE9211, but assumes a basic knowledge of differential calculus. The following workplace topics are considered; safety management, ergonomics, equipment design and task consideration, machine guarding and electrical safety, fire and explosion, management of dangerous materials, ventilation, radiation protection, noise and vibration control, environmental safety, transport safety, safety issues in different industries.

SAFE9224 Principles of Ergonomics C3

Applied anatomy and kinesiology, anthropometry; application to work place arrangement, seating and bench design, tool and equipment design, lifting techniques, consumer product and architectural design. Physiological and psychological aspects of work and fatigue; measurement of energy consumption, limits to energy expenditure at work, static muscular fatigue, boredom. Environment effects; natural and artificial lighting arrangements, problems of perception, colour; noise and vibration, heat and ventilation, thermal regulation in humans, criteria for comfort. Person-machine interfaces, displays, machine controls, reaction times, vigilance. Applications of ergonomics to occupational safety and health. Ergonomic research methodology.

Note: A project forms a substantial proportion of the assessment for this subject.

SAFE9232 Introduction to Occupational Health and Safety Law C3

The concept of law; the creation and interpretation of statutes; the judicial and court systems; locus standi; common law and equity; basic principles of legal liability (civil and criminal); basic principles of administrative law and the liability of the Crown; the common law of employment; statutory regulation of employment; compulsory arbitration of industrial disputes. Outline of occupational health, safety and compensation legislation of the Australian States. Actions under the common law.

SAFE9242 Human Behaviour and Safety Science C3
Human behaviour as a major system factor in occupational safety and health. Learning and safety programs. Attitudes and attitude change. Safety compliance – individual and group factors affecting compliance. Work motivation and safety practice. Accident proneness and personnel selection. Individual differences in attitudes to work. Planning and implementing organizational change.

SAFE9533 Electrical Safety C3
Electric current; effects of current flow and electric fields; elementary circuit representation, typical supply situations; likely dangerous conditions; static electricity; hazardous locations; some special problem areas: codes of safe working; treatment of electric shock. Electrical causes of fire and explosion.

SAFE9543 Management of Dangerous Materials C3
Introduction. Atmospheric dispersion of gaseous and particulate materials. Protection against dangerous materials for operators and other personnel. Storage, handling and transport of flammable liquids, dangerous goods and cryogenic material. Storage and transport of compressed gases. Disposal of dangerous materials; incinerators; flare stacks, landfill, dispersal. Treatment of wastewaters. Relevant legislation. Field excursion.

SAFE9553 Radiation Protection C3
Radiation physics; radiation dosimetry and instrumentation; radiation biology; shielding and control of radiation; waste management; emergency procedures; environmental impact, non-ionizing radiation. Relevant legislation and codes of safe practice. Special topics; practical work and site visit.

SAFE9583 Ventilation C3
Prerequisite: SAFE9011 or equivalent.

Nature of airborne contaminants: gases, vapours, dusts, heat and fumes. Assessment criteria. Ventilation systems for contaminant control: booths, enclosures, receiving and capture hoods, general dilution systems and natural ventilation. Design methods based on capture velocity, face velocity, control velocity and flow ratio principles. Properties of fan and duct systems. Alternatives to ventilation. Three laboratory sessions: air flow measurement, fans, capture hoods.

Surveying

SURV9106 Special Topic in Surveying A C3
This syllabus changes to allow presentation of a special topic of current interest particularly by visitors with recognised expertise in the topic.

SURV9107 Special Topic in Surveying B C3
A special subject taken by an individual student or a small group of students by private study in conjunction with tutorial sessions with the member(s) of staff in charge of the subject.

SURV9121 Network and Deformation Analysis SS L2 T1 C3
Selected topics from: Geodetic datum and invariant quantities, measures of accuracy, testing of hypotheses, out-lier detection, internal and external reliability and sensitivity criteria, variance component estimation, design and optimisation of deformation monitoring networks, two-epoch analysis, multi-epoch analysis, case studies of monitoring networks.

SURV9122 Elements of Geodetic Equipment SS L2 T1 C3
Selected topics from: Measuring system definition and design: principles of signal analysis, analogue to digital conversion, modulation techniques, phase and delay lock loops. Satellite receivers: design of satellite ranging systems, propagation effects, generation, reception and processing of GPS signals, GPS antenna and receiving design. Inertial sensors: principle and design of gyroscopes and accelerometers. Electronic theodolites: absolute and incremental angle encoders and electronic circle, tilt sensors, surveying robots. Electronic distance meters: principle of precision distance meters and laser interferometers, phase and time measuring techniques.

SURV9161 Advanced Estimation Techniques SS L2 T1 C3
Selected topics from: Generalised least squares estimation, sequential least squares estimation, matrix partitioning techniques, Kalman Filtering, covariance analysis, management of large data sets, application in satellite geodesy, network analysis and analytical photogrammetry.

SURV9162 Mathematical Methods SS L2 T1 C3
Selected topics from: Principles and applications of spectral analysis techniques, spherical harmonic expansion of the Earth's gravity field, methods of curve fitting, numerical methods of differentiation and integration, case studies in satellite orbit dynamics.

SURV9210 Satellite Surveying SS L2 T1 C3
Concepts of satellite surveying: nomenclature, TRANSIT system, GPS for point and relative positioning, vertical control. Surveying with GPS: planning a survey, field and office procedures, case studies. Considerations for high-precision applications: aspects of satellite geodesy, modelling the observable, dual frequency observations, orbit determination, short-arc techniques.

SURV9211 Introduction to Geodesy S1 L2 T1 C3
Geodesy in the service of mankind. The earth's gravity field. The earth's motion in space. Co-ordinate and time systems used in geodesy. Horizontal and vertical control networks. Earth satellite motion. Principles of satellite positioning. Gravimetric geodesy. Space geodetic methods. Variations of geodetic positions with time.

SURV9213 Physical Meteorology S2 L2 T1 C3
Electromagnetic wave propagation, geometrical optics approximation, emission and transfer of radiation. Structure of the earth's atmospheric envelope, surface layer and boundary layer meteorology, structure of the ionosphere, atmospheric turbulence, meteorological measurements. Interaction and propagation of electromagnetic radiation. Refraction, scattering, absorption, dispersion, reflection. Description, models and solutions of geodetic refraction effects. Atmospheric effects on remote sensing (visible, infrared and microwaves). Remote sensing of atmospheric parameters.

SURV9217 Gravimetric Geoid Evaluations SS L2 T1 C3
Introduction to the representation of the earth's gravity field Physical model for the earth. Geodetic boundary value problem. Techniques, for evaluating Stokes' integrals. Relative geoid determinations. Combination techniques.

SURV9530 Analytical Photogrammetry SS L2 T1 C3
Fundamental relationship, image and object space. Interior orientation, deviations from collinearity. General orientation of one and two images by collinearity. Simultaneous block adjustment by bundles. Additional parameters. Calibration of metric and non-metric cameras. Control requirements in analytical photogrammetry.

SURV9532 Computer-Assisted Mapping SS L2 T1 C3
Introduction to principles of Computer Assisted Mapping. Collection and editing of feature coded digital terrain data in vector and raster form. Digital elevation models; acquisition, interpolation and processing. Automation of mapping procedures. Archival of digital map data. Mapping systems based on computer assisted techniques.

SURV9600 Principles of Remote Sensing S1 L2 T1 C3
History and development. Definition and physics of basic electromagnetic radiation quantities. Basic-energy matter relationship. Spectral signatures of surfaces. Atmospheric considerations and the reduction of atmospheric effects. Sensor concepts including film and electro-optical sensors. An introduction to data processing and enhancement, including image interpretation procedures.

SURV9602 Remote Sensing Procedures S2 L2 T1 C3
Review of atmospheric correction procedures and application to multi-temporal Landsat MSS data. Review of image registration, enhancement and classification procedures with particular reference to multi-source remote sensing data sets. Analysis of techniques over a varied land use area. Land use change project and analysis using multi-source and multi-temporal remotely sensed imagery, including Landsat MSS, TM, SPOT and SAR.

SURV9604 Land Information Systems SS L2 T1 C3
Land information as maps and records. Methods of data collection. Integrated surveys and coordinate systems. Legal boundaries. Land tenure. Identifiers. Computerization of land information. Data input methods. Data storage methods. Data processing and manipulation, including management, searching, existing data base languages, and interactive data editing. Data output, including computer graphics, line printer maps, and digital plotters. Application of Arc-Info LIS software.

SURV9605 Ground Investigations for Remote Sensing S1 L2 T1 C3
The spectral, temporal and spatial characteristics of various surfaces, and the available sensors to effect maximum differentiation. Ground and image comparisons. Instruments available for field measurements. Field investigation procedures including positioning and sampling considerations.

SURV9608 Cadastral Systems SS L2 T1 C3
The cadastral concept. Cadastral surveying and mapping, land registration, valuation of land, land tenure and land administration. Cadastres and land information systems (L.I.S.). Strategies for improving cadastral systems. Cadastral systems in developing countries; legal, technical, administrative, economic and social issues.

SURV9912 Project C12

Graduate Study

Conditions for the Award of Higher Degrees

First Degrees

Rules, regulations and conditions for the award of *first degrees* are set out in the appropriate **Faculty Handbooks.**
For the list of undergraduate courses and degrees offered see Table of Courses by Faculty (Undergraduate Study) in the Calendar

Higher Degrees

The following is the list of *higher degrees, graduate diplomas and graduate certificates* of the University, together with the publication in which the conditions for the award appear.
For the list of graduate degrees by research and course work, arranged in faculty order, see **Table of Courses (by faculty): Graduate Study** in the Calendar.

For the statements Preparation and Submission of Project Reports *and* Theses for Higher Degrees *and* Policy with respect to the Use of Higher Degree Theses **see later in this section.**

Title	Abbreviation	Calendar/Handbook
Doctor of Science	DSc	Calendar
Doctor of Letters	DLitt	Calendar
Doctor of Laws	LLD	Calendar
Doctor of Medicine	MD	Medicine
Doctor of Philosophy	PhD	Calendar and all handbooks
Master of Applied Science	MAppSc	Applied Science
Master of Architectural Design	MArchDes	Architecture
Master of Architecture	MArch	Architecture
Master of Archives Administration	MArchivAdmin	Professional Studies
Master of Art	MArt	College of Fine Arts
Master of Arts Administration	MArtAdmin	College of Fine Arts
Master of Art Education	MArtEd	College of Fine Arts
Master of Arts	MA	Arts and Social Sciences University College
Master of Art Theory	MArtTh	College of Fine Arts

Higher Degrees (continued)

Title	Abbreviation	Calender/Handbook
Master of Biomedical Engineering	MBiomedE	Engineering
Master of Building	MBuild	Architecture
Master of the Built Environment	MBEnv	Architecture
Master of the Built Environment (Building Conservation)	MBEnv	Architecture
Master of Business Administration	MBA	AGSM
Master of Chemistry	MChem	Science*
Master of Clinical Education	MClinEd	Medicine
Master of Cognitive Science	MCogSc	Arts and Social Sciences
Master of Commerce (Honours)	MCom(Hons)	Commerce and Economics
Master of Commerce	MCom	Commerce and Economics
Master of Community Health	MCH	Medicine
Master of Computer Science	MCompSc	Engineering
Master of Construction Management	MConstMgt	Architecture
Master of Education	MEd	Professional Studies
Master of Education in Creative Arts	MEdCA	Professional Studies
Master of Educational Administration	MEdAdmin	Professional Studies
Master of Engineering	ME	Applied Science Engineering University College
Master of Engineering *without supervision*	ME	Applied Science Engineering
Master of Engineering Science	MEngSc	Engineering Applied Science University College
Master of Environmental Studies	MEnvStudies	Applied Science
Master of Fine Arts	MFA	College of Fine Arts
Master of Health Administration	MHA	Professional Studies
Master of Health Personnel Education	MHPEd	Medicine
Master of Health Planning	MHP	Professional Studies
Master of Higher Education	MHEd	Professional Studies
Master of Industrial Design	MID	Architecture
Master of Information Science	MInfSc	Engineering
Master of Landscape Architecture	MLArch	Architecture
Master of Landscape Planning	MLP	Architecture
Master of Laws	LLM	Law
Master of Librarianship	MLib	Professional Studies
Master of Management Economics	MMgtEc	University College
Master of Mathematics	MMath	Science*
Master of Music	MMus	Arts and Social Science
Master of Nursing Administration	MNA	Professional Studies
Master of Optometry	MOptom	Science*
Master of Paediatrics	MPaed	Medicine
Master of Physics	MPhysics	Science*
Master of Project Management	MPM	Architecture
Master of Public Health	MPH	Medicine Professional Studies
Master of Psychology (Applied)	MPsychol	Science†

Title	Abbreviation	Calender/Handbook
Master of Psychology (Clinical)	MPsychol	Science†
Master of Psychotherapy	MPsychotherapy	Medicine
Master of Safety Science	MSafetySc	Applied Science
Master of Science	MSc	Applied Science Architecture Engineering Medicine Science*† University College
Master of Science *without supervision*	MSc	Applied Science Architecture Engineering
Master of Science (Acoustics)	MSc(Acoustics)	Architecture
Master of Science (Industrial Design)	MSc(IndDes)	Architecture
Master of Science and Society	MScSoc	Arts and Social Sciences
Master of Social Work	MSW	Professional Studies
Master of Sports Science	MSpSc	Professional Studies
Master of Statistics	MStats	Science*
Master of Surgery	MS	Medicine
Master of Surveying	MSurv	Engineering
Master of Surveying *without supervision*	MSurv	Engineering
Master of Surveying Science	MSurvSc	Engineering
Master of Town Planning	MTP	Architecture
Master of Welfare Studies and Practice	MWSP	Professional Studies
Graduate Diploma	GradDip	Applied Science Architecture Arts and Social Sciences Engineering Science*†
	DipClinEd	Medicine
	DipPaed	Medicine
	DipEd DipHEd DipIM-ArchivAdmin DipIM-Lib	Professional Studies
	DipFDA	Science*
Graduate Certificate	GradCertHEd GradCertPhilT	Professional Studies Arts and Social Sciences

Higher Degrees (continued)

Graduate Diploma

Graduate Certificate

*Faculty of Science.
†Faculty of Biological and Behavioural Sciences.

Higher Degrees

Doctor of Philosophy (PhD)

1. The degree of Doctor of Philosophy may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate faculty or board (hereinafter referred to as the Committee) to a candidate who has made an original and significant contribution to knowledge.

Qualifications

2.(1)A candidate for the degree shall have been awarded an appropriate degree of Bachelor with Honours from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Committee.

(2)In exceptional cases an applicant who submits evidence of such other academic and professional qualifications as may be approved by the Committee may be permitted to enrol for the degree.

(3)If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribe, before permitting enrolment as a candidate for the degree.

Enrolment

3.(1)An application to enrol as a candidate for the degree shall be lodged with the Registrar at least one month prior to the date at which enrolment is to begin.

(2)In every case before making the offer of a place the Committee shall be satisfied that initial agreement has been reached between the School* and the applicant on the topic area, supervision arrangements, provision of adequate facilities and any coursework to be prescribed and that these are in accordance with the provisions of the guidelines for promoting postgraduate study within the University.

(3)The candidate shall be enrolled either as a full-time or a part-time student.

(4)A full-time candidate will present the thesis for examination no earlier than three years and no later than five years from the date of enrolment and a part-time candidate will present the thesis for examination no earlier than four years and no later than six years from the date of enrolment, except with the approval of the Committee.

(5)The candidate may undertake the research as an internal student i.e. at a campus, teaching hospital, or other research facility with which the University is associated, or as an external student not in attendance at the University except for periods as may be prescribed by the Committee.

(6)An internal candidate will normally carry out the research on a campus or at a teaching or research facility of the University except that the Committee may permit a candidate to spend a period in the field, within another institution or elsewhere away from the University provided that the work can be supervised in a manner satisfactory to the Committee. In such instances the

Committee shall be satisfied that the location and period of time away from the University are necessary to the research program.

(7)The research shall be supervised by a supervisor and where possible a co-supervisor who are members of the academic staff of the School or under other appropriate supervision arrangements approved by the Committee. Normally an external candidate within another organisation or institution will have a co-supervisor at that institution.

Progression

4.The progress of the candidate shall be considered by the Committee following report from the School in accordance with the procedures established within the School and previously noted by the Committee.

(i)The research proposal will be reviewed as soon as feasible after enrolment. For a full-time student this will normally be during the first year of study, or immediately following a period of prescribed coursework. This review will focus on the viability of the research proposal.

(ii)Progress in the course will be reviewed within twelve months of the first review. As a result of either review the Committee may cancel enrolment or take such other action as it considers appropriate. Thereafter, the progress of the candidate will be reviewed annually.

Thesis

5.(1)On completing the program of study a candidate shall submit a thesis embodying the results of the investigation.

(2)The candidate shall give in writing to the Registrar two months notice of intention to submit the thesis.

(3)The thesis shall comply with the following requirements:

(a)it must be an original and significant contribution to knowledge of the subject;

(b)the greater proportion of the work described must have been completed subsequent to enrolment for the degree;

(c)it must be written in English except that a candidate in the Faculty of Arts may be required by the Committee to write a thesis in an appropriate foreign language;

(d)it must reach a satisfactory standard of expression and presentation;

*'School' is used here and elsewhere in these conditions to mean any teaching unit authorised to enrol research students and includes a department where that department is not within a school, a centre given approval by the Academic Board to enrol students, and an interdisciplinary unit within a faculty and under the control of the Dean of the Faculty. Enrolment is permitted in more than one such teaching unit.

(e)it must consist of an account of the candidate's own research but in special cases work done conjointly with other persons may be accepted provided the Committee is satisfied about the extent of the candidate's part in the joint research.

(4)The candidate may not submit as the main content of the thesis any work or material which has previously been submitted for a university degree or other similar award but may submit any work previously published whether or not such work is related to the thesis.

(5)Four copies of the thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of theses for higher degrees.

(6)It shall be understood that the University retains the four copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

6.(1)There shall be not fewer than three examiners of the thesis, appointed by the Committee, at least two of whom shall be external to the University. Examination

(2)At the conclusion of the examination each examiner shall submit to the Committee a concise report on the thesis and shall recommend to the Committee that one of the following:

(a)The thesis merits the award of the degree.

(b)The thesis merits the award of the degree subject to minor corrections as listed being made to the satisfaction of the head of school.

(c)The thesis requires further work on matters detailed in my report. Should performance in this further work be to the satisfaction of the higher degree Committee, the thesis would merit the award of the degree.

(d)The thesis does not merit the award of the degree in its present form and further work as described in my report is required. The revised thesis should be subject to re-examination.

(e)The thesis does not merit the award of the degree and does not demonstrate that resubmission would be likely to achieve that merit.

(3)If the performance at the further work recommended under (2)(c) above is not to the satisfaction of the Committee, the Committee may permit the candidate to re-present the same thesis and submit to further examination as determined by the Committee within a period specified by it but not exceeding eighteen months.

(4)The Committee shall, after consideration of the examiners' reports and the results of any further work, recommend whether or not the candidate may be awarded the degree. If it is decided that the candidate be not awarded the degree the Committee shall determine whether or not the candidate be permitted to resubmit the thesis after a further period of study and/or research.

7.A candidate shall pay such fees as may be determined from time to time by the Council. Fees

Master of Biomedical Engineering (MBiomedE)

1. The degree of Master of Biomedical Engineering may be awarded by the Council to a candidate who has satisfactorily completed a program of advanced study.

2. (1) A candidate for the degree shall have been awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Higher Degree Committee of the Faculty of Engineering (hereinafter referred to as the Committee). Qualifications

(2) In exceptional cases an applicant who submits evidence of such other academic and professional qualifications as may be approved by the Committee may be permitted to enrol for the degree.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribe, before permitting enrolment.

3. (1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least two calendar months before the commencement of the session in which the enrolment is to begin. Enrolment and Progression

(2) A candidate for the degree shall be required to undertake such formal subjects and pass such assessment as prescribed, and shall submit a project report. The program of advanced study, including the preparation of the project report, shall total a minimum of 60 credits. The number of credits allocated for each subject shall be determined by the Committee on the

recommendation of the Director of the Centre for Biomedical Engineering (hereinafter referred to as the head of the school).

(3) The progress of the candidate shall be reviewed at least once annually by the Committee and as a result of its review the Committee may cancel enrolment or take such other action as it considers appropriate.

(4) No candidate shall be awarded the degree until the lapse of two academic sessions from the date of enrolment in the case of a full-time candidate or five sessions in the case of a part-time candidate. The maximum period of candidature shall be five academic sessions from the date of enrolment for a full-time candidate and eight sessions for a part-time candidate. In special cases an extension of these times may be granted by the Committee.

Project Report

4.(1) A candidate shall be required to undertake a project on an approved topic.

(2) The work shall be carried out under the direction of a supervisor appointed from the full-time academic members of the University staff.

(3) The candidate shall give in writing to the Registrar two months notice of intention to submit a report on the project.

(4) Three copies of the project report shall be presented in a form which complies with the requirements of the University for the preparation and submission of project reports for higher degrees.

(5) It shall be understood that the University retains three copies of the project report submitted for examination and is free to allow the project report to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the project report in whole or in part, in microfilm or other copying medium.

Examination

5.(1) There shall be not fewer than two examiners of the project report, appointed by the Academic Board on the recommendation of the Committee, at least one of whom shall be external to the University unless the Committee is satisfied that this is not practicable.

(2) At the conclusion of the examination each examiner shall submit to the Committee a concise report on the project report and shall recommend to the Committee that:

(a) the project report be noted as satisfactory; or

(b) the project report be noted as satisfactory subject to minor corrections being made to the satisfaction of the head of the school; or

(c) the project report be noted as unsatisfactory but that the candidate be permitted to resubmit in a revised form after a further period of study and/or research; or

(d) the project report be noted as unsatisfactory and that the candidate be not permitted to resubmit it.

(3) The Committee shall, after considering the examiners' reports and the candidate's results of assessment in the prescribed formal subjects, recommend whether or not the candidate may be awarded the degree. If it is decided that the project report is unsatisfactory the Committee shall determine whether or not the candidate may resubmit it after a further period of study and/or research.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Computer Science (MCompSc)

Qualifications

1. The degree of Master of Computer Science may be awarded by the Council to a candidate who has satisfactorily completed a program of advanced study.

2.(1) A candidate for the degree shall have ben awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Higher Degree Committee of the Faculty of Engineering (hereinafter referred to as the Committee).

(2) In exceptional cases an applicant who submits evidence of such other academic and professional qualifications as may be approved by the Committee may be permitted to enrol for the degree.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribe, before permitting enrolment.

Enrolment and Progression

3.(1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar two calendar months before the commencement of the session in which the enrolment is to begin.

(2) A candidate for the degree shall:

(a) undertake such formal subjects and pass such assessment as prescribed, or

(b) undertake an approved combination of the above and demonstrate ability to undertake research by the submission of a project report embodying the results of an original investigation of an approved topic.

(3) The program of advanced study shall total a minimum of 48 credits. The number of credits allocated for each subject shall be determined by the Committee on the recommendation of the appropriate head of school.

(4) A candidate's proposed program shall be approved by the head of the Department of Computer Science prior to enrolment.

(5) The progress of a candidate shall be reviewed at least once annually by the Committee and as a result of its review the Committee may cancel enrolment or take such other action as it considers appropriate.

(6) No candidate shall be awarded the degree until the lapse of three academic sessions from the date of enrolment in the case of a full-time candidate or four sessions in the case of a part-time candidate. The maximum period of candidature shall be six academic sessions from the date of enrolment for a full-time candidate and eight sessions for a part-time candidate. In special cases an extension of these times may be granted by the Committee

4.(1) A candidate who undertakes an 18 credit project shall carry out the work on an approved topic under the direction of a supervisor appointed from the full-time academic members of the University staff. — 18 Credit Project Report

(2) The candidate shall give in writing to the Registrar two months notice of intention to submit a project report.

(3) The project report or thesis shall present an account of the candidate's own research. In special cases work done conjointly with other persons may be accepted, provided the Committee is satisfied about the extent of the candidate's part in the joint research.

(4) The candidate may also submit any work previously published whether or not such work is related to the thesis.

(5) Three copies of the project report or thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of project reports and theses for higher degrees.

(6) It shall be understood that the University retains the three copies of the project report or thesis submitted for examination and is free to allow the project report or thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the project report or thesis in whole or in part, in microfilm or other copying medium.

5.(1) There shall be not fewer than two examiners of the project report, appointed by the Academic Board on the recommendation of the Committee, at least one of whom shall be external to the University unless the Committee is satisfied that this is not practicable. — Examination of 18 Credit Project Report

(2) At the conclusion of the examination each examiner shall submit to the Committee a concise report on the project report and shall recommend to the Committee that:

(a) the project report be noted as satisfactory; or

(b) the project report be noted as satisfactory subject to minor corrections being made to the satisfaction of the head of the school*; or

(c) the project report be noted as unsatisfactory but that the candidate be permitted to resubmit it in a revised form after a further period of study and/or research; or

(d) the project report be noted as unsatisfactory and that the candidate be not permitted to resubmit it.

(3) The Committee shall, after considering the examiners' reports and the candidate's results of assessment in the prescribed formal subjects, recommend whether or not the candidate may be awarded the degree. If it is decided that the project report in unsatisfactory the Committee shall determine whether or not the candidate may resubmit it after a further period of study and/or research.

6. A candidate shall pay such fees as may be determined from time to time by the Council. — Fees

* Or department where a department is not within a school, or schools or departments where the research is being undetaken in more than one school or department.

Master of Engineering (ME) and Master of Science (MSc)

1. The degree of Master of Engineering or Master of Science by research may be awarded by the Council on recommendation of the Higher Degree Committee of the appropriate faculty (hereinafter referred to as the Committee) to a candidate who has demonstrated ability to undertake research by the submission of the thesis embodying the results of an original investigation.

Qualifications

2.(1) A candidate for the degree shall have been awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Committee.

(2) An applicant who submits evidence of such other academic or professional attainment as may be approved by the Committee may be permitted to enrol for the degree.

(3) When the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant, before being permitted to enrol, to undergo such examination or carry out such work the Committee may prescribe.

Enrolment and Progression

3.(1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least one calendar month before the commencement of the session in which enrolment is to begin.

(2) In every case, before permitting a candidate to enrol, the head of the school* in which the candidate intends to enrol shall be satisfied that adequate supervision and facilities are available.

(3) An approved candidate shall be enrolled in one of the following categories:

(a) full-time attendance at the University;

(b) part-time attendance at the University;

(c) external - not in regular attendance at the University and using research facilities external to the University.

(4) A candidate shall be required to undertake an original investigation on an approved topic. The candidate may also be required to undergo such examination and perform such other work as may be prescribed by the Committee.

(5) The work shall be carried out under the direction of a supervisor appointed from the full-time members of the University staff.

(6) The progress of a candidate shall be reviewed annually by the Committee following a report by the candidate, the supervisor and the head of the school* in which the candidate is enrolled and as a result of such review the Committee may cancel enrolment or take such other action as it considers appropriate.

(7) No candidate shall be granted the degree until the lapse of three academic sessions in the case of a full-time candidate or four academic sessions in the case of a part-time or external candidate from the date of enrolment. In the case of a candidate who has been awarded the degree of Bachelor with Honours or who had previous research experience the Committee may approve remission of up to one session for a full-time candidate and two sessions for a part-time or external candidate.

(8) A full-time candidate for the degree shall present for examination not later than six academic sessions from the date of enrolment. A part-time or external candidate for the degree shall present, for examination not later than ten academic sessions from the date of enrolment. In special cases an extension of these times may be granted by the Committee.

Thesis

4.(1) On completing the program of study a candidate shall submit a thesis embodying the results of the original investigation.

(2) The candidate shall give in writing two months notice of intention to submit the thesis.

(3) The thesis shall present an account of the candidate's own research. In special cases work done conjointly with other persons may be accepted, provided the Committee is satisfied about the extent of the candidate's part in the joint research.

(4) The candidate may also submit any work previously published whether or not such work is related to the thesis.

(5) Three copies of the thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses.

(6) It shall be understood that the University retains the three copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

Examination

5.(1) There shall be not fewer than two examiners of the thesis, appointed by the Academic Board on the recommendation of the Committee, at least one of whom shall be external to the University unless the Committee is satisfied that this is not practicable.

(2) At the conclusion of the examination each examiner shall submit to the Committee a concise report on the merits of the thesis and shall recommend to the Committee that:

(a) the candidate be awarded the degree without further examination; or

(b) the candidate be awarded the degree without further examination subject to minor corrections as listed being made to the satisfaction of the head of the school*; or

(c) the candidate be awarded the degree subject to further examination on questions posed in the report, performance in this further examination being to the satisfaction of the Committee; or

(d) the candidate be not awarded the degree but be permitted to resubmit the thesis in a revised form after a further period of study and/or research; or

(e) the candidate be not awarded the degree and be not permitted to resubmit the thesis.

(3) If the performance at the further examination recommended under (2)(c) above is not to the satisfaction of the Committee, the Committee may permit the candidate to re-present the same thesis and submit to a further oral, practical or written examination within a period specified by it but not exceeding eighteen months.

(4) The Committee shall, after consideration of the examiners' reports and the reports of any oral or written or practical examination, recommend whether or not the candidate may be awarded the degree. if it is decided that the candidate be not awarded the degree the Committee shall determine whether or not the candidate may resubmit the thesis after a further period of study and/or research.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Engineering (ME), Master of Science (MSc) and Master of Surveying (MSurv) *without supervision*

1. The degree of Master of Engineering or Master of Science or Master of Surveying without supervision may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate faculty (hereinafter referred to as the Committee) to a candidate who has demonstrated ability to undertake research by the submission of a thesis embodying the results of an original investigation.

Qualification

2. A candidate for the degree shall have been awarded an appropriate degree of Bachelor of the University of New South Wales with at least three years relevant standing in the case of Honours graduates and four years relevant standing in the case of Pass graduates, and at a level acceptable to the Committee.

Enrolment and Progression

3. An application to enrol as candidate for the degree without supervision shall be made n the prescribed form which shall be lodged with the Registrar not less than six months before the intended date of submission of the thesis. A graduate who intends to apply in this way should, in his or her own interest, seek at an early stage the advice of the appropriate head of school* with regard to the adequacy of the subject matter and its presentation for the degree. A sypnosis of the work should be available

Thesis

4.(1) A candidate shall submit a thesis embodying the results of the investigation.

(2) The candidate shall give in writing to the Registrar two months notice of intention to submit the thesis.

(3) The thesis shall present an account of the candidate's own research. In special cases work done conjointly with other persons may be accepted, provided the Committee is satisfied about the extent of the candidate's part in the joint research.

(4) The candidate may also submit any work previously published whether or not related to the thesis.

(5) Three copies of the thesis shall be presented in a form which complies with the requirements of the University for the preparation an submission of theses for higher degrees.

(6) It shall be understood that the University retains the three copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

*'School' is used here and elsewhere in these conditions to mean any teaching unit authorised to enrol research students and includes a department where that department is not within a school, a centre given approval by the Academic Board to enrol students, and an interdisciplinary unit within a faculty and under the control of the Dean of the Faculty. Enrolment is permitted in more than one such teaching unit.

Examination

5.(1) There shall be not fewer than two examiners of the thesis, appointed by the Academic Board on the recommendation of the Committee, at least one of whom shall be external to the University unless the Committee is satisfied that this is not practicable.

(2) Before the thesis is submitted to the examiners the head of the school* in which the candidate is enrolled shall certify that it is prima facie worthy of examination.

(3) At the conclusion of the examination each examiner shall submit tot he Committee that:

(a) the candidate be awarded the degree without further examination; or

(b) the candidate be awarded the degree without further examination subject to minor corrections as listed being made to the satisfaction of the head of the school*; or

(c) the candidate be awarded the degree subject to a further examination on questions posed in the report, performance in this further examination being to the satisfaction of the Committee; or

(d) the candidate be not awarded the degree but be permitted to resubmit the thesis in a revised form after a further period of study and/or research; or

(e) the candidate be not awarded the degree and be not permitted to resubmit the thesis.

(4) If the performance at the further examination recommended under (3)(c) above is not to the satisfaction of the Committee, the Committee may permit the candidate to re-present the same thesis and submit to further examination as determined by the Committee within a period specified by it but not exceeding eighteen months.

(5) The Committee shall, after consideration of the examiners' reports and the results of any further examination, recommend whether or not the candidate may be awarded the degree. If it is decided that the candidate be not awarded the degree the Committee shall determine whether or not the candidate may resubmit the thesis after a further period of study and/or research.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Engineering Science (MEngSc) and Master of Surveying Science (MSurvSc)

1. The degree of Master of Engineering Science or Master of Surveying Science may be awarded by the Council to a candidate who has satisfactorily completed a program of advanced study.

Qualifications

2.(1) A candidate for the degree shall have ben awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Higher Degree Committee of the Faculty of Engineering (hereinafter referred to as the Committee).

(2) In exceptional cases an applicant who submits evidence of such other academic and professional qualifications as may be approved by the Committee may be permitted to enrol for the degree.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribe, before permitting enrolment.

3.(1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar two calendar months before the commencement of the session in which the enrolment is to begin.

Enrolment and Progression

(2) A candidate for the degree shall:

(a) undertake such formal subjects and pass such assessment as prescribed, or

(b) demonstrate ability to undertake research by the submission of a thesis embodying the results of an original investigation of an approved topic, or

(c) undertake an approved combination of the above in which case the thesis component shall be referred to as a project report.

(3) The program of advanced study shall total a minimum of 30 credits. The number of credits allocated for each subject shall be determined by the Committee on the recommendation of the appropriate head of school*.

(4) A candidate's proposed program shall be approved by the appropriate head of school* prior to enrolment. For the purposes of this requirement the appropriate head of school shall normally be the head of the school* providing the major field of study.

*'School' is used here and elsewhere in these conditions to mean any teaching unit authorised to enrol research students and includes a department where that department is not within a school, a centre given approval by the Academic Board to enrol students, and an interdisciplinary unit within a faculty and under the control of the Dean of the Faculty. Enrolment is permitted in more than one such teaching unit.

(5) The progress of a candidate shall be reviewed at least once annually by the Committee and as a result of its review the Committee may cancel enrolment or take such other action as it considers appropriate.

(6) No candidate shall be awarded the degree until the lapse of two academic sessions from the date of enrolment in the case of a full-time candidate or four sessions in the case of a part-time candidate. The maximum period of candidature shall be four academic sessions from the date of enrolment for a full-time candidate and eight sessions for a part-time candidate. In special cases an extension of these times may be granted by the Committee

18 Credit Project Report

4.(1) A candidate who undertakes an 18 credit project shall carry out the work on an approved topic under the direction of a supervisor appointed from the full-time academic members of the University staff.

(2) The candidate shall give in writing to the Registrar two months notice of intention to submit a project report.

(3) The project report or thesis shall present an account of the candidate's own research. In special cases work done conjointly with other persons may be accepted, provided the Committee is satisfied about the extent of the candidate's part in the joint research.

(4) The candidate may also submit any work previously published whether or not such work is related to the thesis.

(5) Three copies of the project report or thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of project reports and theses for higher degrees.

(6) It shall be understood that the University retains the three copies of the project report or thesis submitted for examination and is free to allow the project report or thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the project report or thesis in whole or in part, in microfilm or other copying medium.

Examination of 18 Credit Project Report

5.(1) There shall be not fewer than two examiners of the project report, appointed by the Academic Board on the recommendation of the Committee, at least one of whom shall be external to the University unless the Committee is satisfied that this is not practicable.

(2) At the conclusion of the examination each examiner shall submit to the Committee a concise report on the project report and shall recommend to the Committee that:

(a) the project report be noted as satisfactory; or

(b) the project report be noted as satisfactory subject to minor corrections being made to the satisfaction of the head of the school; or

(c) the project report be noted as unsatisfactory but that the candidate be permitted to resubmit it in a revised form after a further period of study and/or research; or

(d) the project report be noted as unsatisfactory and that the candidate be not permitted to resubmit it.

(3) The Committee shall, after considering the examiners' reports and the candidate's results of assessment in the prescribed formal subjects, recommend whether or not the candidate may be awarded the degree. If it is decided that the project report in unsatisfactory the Committee shall determine whether or not the candidate may resubmit it after a further period of study and/or research.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Information Science (MInfSc)

1. The degree of Master of Information Science may be awarded by the Council to a candidate who has satisfactorily completed a program of advanced study.

Qualifications

2.(1) A candidate for the degree shall have ben awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Higher Degree Committee of the Faculty of Engineering (hereinafter referred to as the Committee).

(2) In exceptional cases an applicant who submits evidence of such other academic and professional qualifications as may be approved by the Committee may be permitted to enrol for the degree.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribe, before permitting enrolment.

Enrolment and Progression

3.(1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar two calendar months before the commencement of the session in which the enrolment is to begin.

(2) A candidate for the degree shall:

(a) undertake such formal subjects and pass such assessment as prescribed, or

(b) undertake an approved combination of the above and demonstrate ability to undertake research by the submission of a project report embodying the results of an original investigation of an approved topic.

(3) The program of advanced study shall total a minimum of 36 credits. The number of credits allocated for each subject shall be determined by the Committee on the recommendation of the appropriate head of school.

(4) A candidate's proposed program shall be approved by the head of the Department of Computer Science prior to enrolment.

(5) The progress of a candidate shall be reviewed at least once annually by the Committee and as a result of its review the Committee may cancel enrolment or take such other action as it considers appropriate.

(6) No candidate shall be awarded the degree until the lapse of three academic sessions from the date of enrolment in the case of a full-time candidate or four sessions in the case of a part-time candidate. The maximum period of candidature shall be six academic sessions from the date of enrolment for a full-time candidate and eight sessions for a part-time candidate. In special cases an extension of these times may be granted by the Committee

18 Credit Project Report

4.(1) A candidate who undertakes an 18 credit project shall carry out the work on an approved topic under the direction of a supervisor appointed from the full-time academic members of the University staff.

(2) The candidate shall give in writing to the Registrar two months notice of intention to submit a project report.

(3) The project report or thesis shall present an account of the candidate's own research. In special cases work done conjointly with other persons may be accepted, provided the Committee is satisfied about the extent of the candidate's part in the joint research.

(4) The candidate may also submit any work previously published whether or not such work is related to the thesis.

(5) Three copies of the project report or thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of project reports and theses for higher degrees.

(6) It shall be understood that the University retains the three copies of the project report or thesis submitted for examination and is free to allow the project report or thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the project report or thesis in whole or in part, in microfilm or other copying medium.

Examination of 18 Credit Project Report

5.(1) There shall be not fewer than two examiners of the project report, appointed by the Academic Board on the recommendation of the Committee, at least one of whom shall be external to the University unless the Committee is satisfied that this is not practicable.

(2) At the conclusion of the examination each examiner shall submit to the Committee a concise report on the project report and shall recommend to the Committee that:

(a) the project report be noted as satisfactory; or

(b) the project report be noted as satisfactory subject to minor corrections being made to the satisfaction of the head of the school*; or

(c) the project report be noted as unsatisfactory but that the candidate be permitted to resubmit it in a revised form after a further period of study and/or research; or

(d) the project report be noted as unsatisfactory and that the candidate be not permitted to resubmit it.

(3) The Committee shall, after considering the examiners' reports and the candidate's results of assessment in the prescribed formal subjects, recommend whether or not the candidate may be awarded the degree. If it is decided that the project report in unsatisfactory the Committee shall determine whether or not the candidate may resubmit it after a further period of study and/or research.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Surveying (MSurv)

1. The degree of Master of Surveying by research may be awarded by the Council on the recommendation of the Higher Degree Committee of the Faculty of Engineering (hereinafter referred to as the Committee) to a candidate who has demonstrated ability to undertake research by the submission of a thesis embodying the results of an original investigation.

Qualifications

2.(1) A candidate for the degree shall have been awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Committee.

(2) In exceptional cases an applicant who submits evidence of such other academic and professional qualifications as may be approved by the Committee may be permitted to enrol for the degree.

(3) When the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant, before being permitted to enrol, to undergo such examination or carry out such work as the Committee may prescribe.

Enrolment and Progression

3.(1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least one calendar month before the commencement of the session in which enrolments is to begin.

(2) In every case, before permitting a candidate to enrol, the Head of the School of Surveying (hereinafter referred to as the head of the school) shall be satisfied that adequate supervision and facilities are available.

(3) An approved candidate shall be enrolled in one of the following categories:

(a) full-time attendance at the University;

(b) part-time attendance at the University;

(c) external - not in regulars attendance at the University and using research facilities external to the University.

(4) A candidate shall be required to undertake an original investigation on an approved topic. The candidate may also be required to undergo such examination and perform such other work as may be prescribed by the Committee.

(5) The work shall be carried out under the direction of a supervisor appointed from the full-time members of the University staff.

(6) The progress of a candidate shall be reviewed annually by the Committee following a report by the candidate, the supervisor and the head of the school and as a result of such review the Committee may cancel enrolment or take such other action as it considers appropriate.

(7) No candidate shall be granted the degree until the lapse of three academic sessions in the case of a full-time candidate or four academic sessions in the case of a part-time or external candidate from the date of enrolment. In the case of a candidate who has been awarded the degree of Bachelor with Honours or who has had previous research experience the Committee may approve remission of up to one session for a full-time candidate and two sessions for a part-time or external candidate.

(8) A full-time candidate for the degree shall present for examination not later than six academic sessions from the date of enrolment. A part-time or external candidate for the degree shall present for examination not later than ten academic sessions from the date of enrolment. In special cases an extension of these times may be granted by the Committee.

Thesis

4.(1) On completing the program of study a candidate shall submit a thesis embodying the results of the original investigation.

(2) The candidate shall give in writing two months notice of intention to submit the thesis.

(3) The thesis shall present an account of the candidate's own research. In special cases work done conjointly with other persons may be accepted, provided the Committee is satisfied about the extent of the candidate's part in the joint research.

(4) The candidate may also submit any work previously published whether or not such work is related to the thesis.

(5) Three copies of the thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses.

(6) It shall be understood that the University retains the three copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

Examination

5.(1) There shall be not fewer than two examiners of the thesis, appointed by the Academic Board on the recommendation of the Committee, at least one of whom shall be external to the University unless the Committee is satisfied that this is not practicable.

(2) At the conclusion of the examination each examiner shall submit to the Committee a concise report on the merits of the thesis and shall recommend to the Committee that:

(a) the candidate be awarded the degree without further examination, or

(b) the candidate be awarded the degree without further examination subject to minor corrections as listed being made to the satisfaction of the head of the school; or

(c) the candidate be awarded the degree subject to a further examination on questions posed in the report performance in this further examination being to the satisfaction of the Committee; or

(d) the candidate be not awarded the degree but be permitted to resubmit the thesis in a revised form after a further period of study and/or research; or

(e) the candidate be not awarded the degree and be not permitted to resubmit the thesis.

(3) If the performance at the further examination recommended under (2)(c) above is not to the satisfaction of the Committee, the Committee may permit the candidate to re-present the same thesis and submit to a further oral, practical or written examination within a period specified by it but not exceeding eighteen months.

(4) The Committee shall, after consideration of the examiners' reports and the reports of any oral or written or practical examination, recommend whether or not the candidate may be awarded the degree. If it is decided that the candidate be not awarded the degree the Committee shall determine whether or not the candidate may resubmit the thesis after a further period of study and/or research.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Surveying *without supervision* (MSurv)

See Master of Engineering.

Master of Surveying Science (MSurvSc)

See Master of Engineering Science.

Graduate Diploma

1. A Graduate Diploma may be awarded by the Council to a candidate who has satisfactorily completed a program of advanced study.

Qualifications

2.(1) A candidate for the diploma shall have been awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Higher Degree Committee of the appropriate faculty (hereinafter referred to as the Committee).

(2) An applicant who submits evidence of such other academic or professional attainment as may be approved by the Committee may be permitted to enrol for the diploma.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribe before permitting enrolment.

Enrolment and Progression

3.(1) An application to enrol as a candidate for the diploma shall be made on the prescribed form which shall be lodged with the Registrar at least two calendar months before the commencement of the session in which enrolment is to begin.

(2) A candidate for the diploma shall be required to undertake such formal subjects and pass such assessment as prescribed.

(3) The progress of a candidate shall be reviewed at least once annually by the Committee and as a result of its review the Committee may cancel enrolment or take such other action as it considers appropriate.

(4) No candidate shall be awarded the diploma until the lapse of two academic sessions* from the date of enrolment in the case of a full-time candidate or four sessions in the case of a part-time candidate. The maximum period of candidature shall be four academic sessions from the date of enrolment for a full-time candidate and six sessions for a part-time candidate. In special cases an extension of these times may be granted by the Committee.

Fees

4. A candidate shall pay such fees as may be determined from time to time by the Council.

*for the Graduate Diploma in Computer Science no candidate shall be awarded the diploma until a lapse of three academic sessions from the date of enrolment.

Scholarships and Prizes

The scholarships and prizes listed below are available to students whose courses are listed in this book. Each faculty handbook contains in its **Scholarships and Prizes** section the scholarships and prizes available with that faculty. The **General Information** section of the Calendar contains a comprehensive list of scholarhips and prizes offered throughout the University.

Scholarships

Undergraduate Scholarships

Listed below is an outline only of a number of scholarships available to students. Full information may be obtained from the Student Centre located on the Lower Ground Floor of the Chancellery.

Unless otherwise indicated in footnotes, applications for the following scholarships should be made to the Registrar and Deputy Principal by 14 January each year. Please note that not all of these awards are available every year.

Donor	Value	Year/s of Tenure	Conditions
General			
Australian Development Cooperation Scholarship	Tuition fees only	1992 and 1993 only	Applicants must complete their studies by the end of the 1993 academic year. Scholarships may only be offered in 1992. Only students from specified countries and in certain fields of study can apply. Applications from the Student Centre. The closing date is well before 1 October 1991.
Equity and Merit Scholarship Scheme	Tuition fees. Some students may be eligible for air fares and a stipend.	Determined by normal course duration	Information should be obtained from Australian Diplomatic Posts. Conditions and entitlements vary depending on the home country.
Sam Cracknell Memorial	Up to $3000 pa payable in fortnightly instalments	1 year	Prior completion of at least 2 years of a degree or diploma course and enrolment in a full-time course during the year of application; academic merit; participation in sport both directly and administratively; and financial need.

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
Girls Realm Guild	Up to $1500 pa	1 year with the prospect of renewal subject to satisfactory progress and continued demonstration of need	Available only to female students under 35 years of age who are permanent residents of Australia enrolling in any year of a full-time undergraduate course on the basis of academic merit and financial need.
W.S. and L.B. Robinson*	Up to $6500 pa	1 year renewable for the duration of the course subject to satisfactory progress	Available only to students who have completed their schooling in Broken Hill or whose parents reside in Broken Hill; for a course related to the mining industry. Includes courses in mining engineering, geology, electrical and mechanical engineering, metallurgical process engineering, chemical engineering and science.
Alumni Association	Up to $1500 pa	1 year with the possibility of renewal	Available to students enrolled in any year of a full-time course. Candidates must be the children of Alumni of the University of NSW and may be either permanent residents of Australia or overseas students.
Sporting Scholarships	$2000 pa	1 year with possibility of renewal	Available to students who are accepted into a course of at least two years duration. Prospective applicants should have an outstanding ability in a particular sport and are expected to be an active member of a UNSW Sports Club. Apply directly to Sport and Recreation Section, PO Box 1, Kensington 2033.

*Applications close 30 September each year. Apply directly to PO Box 460 Broken Hill NSW 2880

Engineering			
Proctor and Gamble Australia Pty Ltd	Up to $2500	1 year	Permanent residence in Australia and in the final year of a degree course in Electrical, Computer, Mechanical, or Industrial Engineering
Computer Science and Engineering			
Proctor and Gamble Australia Pty Ltd	Up to $2500	1 year	Permanent residence in Australia and in the final year of the Computer Science program of the Bachelor of Science degree course
Electrical Engineering			
The Tyree Westinghouse Electrical Company Pty Ltd	Up to $6720 over 4 years	1 year renewable for the duration of the course, subject to satisfactory progress	Eligibility for admission to the full-time degree course in Electrical Engineering
OTC Ltd-Women in Electrical Engineering	Up to $2000 pa	1 year	Available to female students enrolled in Year 1 of the electrical Engineering degree course. Candidates must be residents of Australia.
Environmental Engineering			
Rankine and Hill	$1500	1 year only	Available to students enrolled in Year 1 of the degree course in Environmental Engineering

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
Mechanical and Manufacturing Engineering			
Rheem Australia Ltd	Up to $2500 pa	1 year renewable for the duration of the course, subject to satisfactory progress	Permanent residence in Australia for a second and later year student enrolled in degree course in Mechanical or Manufacturing Engineering
Surveying			
The Institution of Surveyors NSW, Incorporated	Up to $500 pa	1 year renewable for the duration of the course, subject to satisfactory progress	Permanent residence in Australia and eligibility for admission to the full-time degree course in Surveying. Selection is based on academic merit, personal qualities and financial need.
NSW Department of Lands – Women in Surveying	Up to $2000 pa	1 year	Available to female students entering Year 1 of the degree course in Surveying course, Candidates must be residents of Australia.

The UNSW Co-op Program

The University of New South Wales has industry-linked education scholarships to the value of $9300 per annum in the following areas: Accounting (and Economics, Finance, Information Systems or Japanese Studies); Business Information Technology, Aeronautical, Ceramic, Chemical, Civil, Computer, Electrical, Environmental, Materials, Mechanical, Metallurgical, Mineral, Mining and Petroleum Engineering; Applied Geology, Industrial Chemistry, Manufacturing Management, Textile Management, Textile Technology, and Wool and Pastoral Science.

Graduate Scholarships

Application forms and further information are available from the Student Centre, located on the Ground Floor of the Chancellery unless an alternative contact address is provided. Information is also available on additional scholarships which may become available from time to time, mainly from funds provided by organizations sponsoring research projects.

The following publications may also be of assistance: **1.** *Awards for Postgraduate Study in Australia and Awards for Postgraduate Study Overseas,* published by the Graduate Careers Council of Australia. PO Box 28, Parkville, Victoria 3052;* **2.** *Study Abroad,* published by UNESCO;* **3.** *Scholarships Guide for Commonwealth Postgraduate Students, published by the Association of Commonwealth Universities.**

Details of overseas awards and exchanges administered by the Department of Employment, Education and Training can be obtained from: Awards and Exchanges Section, Department of Employment, Education and Training, PO Box 826, Woden, ACT 2606.

Where possible, the scholarships are listed in order of faculty.

*Available for reference in the University Library.

Donor	Value	Year/s of Tenure	Conditions
General			
University Postgraduate Research Scholarships	Living allowance of $13,504 pa. Other allowances may also be paid. Tax free.	1-2 years for a Masters and 3-4 years for a PhD degree	Applicants must be honours graduates or equivalent. A limited number of scholarships are offered subject to the availbility of funds. Information should be obtained from the Faculty office.
Australian Postgraduate Research Awards	$13,504 to $17,427		Applicants must be honours graduates or equivalent or scholars who will graduate with honours in current academic year, and who are domiciled in Australia. Applications to Registrar by 31 October.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
Australian Postgraduate Course Awards	Living allowance of $10,903 pa. Other allowances may also be paid. Tax free.	1-2 years; minimum duration of course	Applicants must be graduates or scholars who will graduate in current academic year, and who have not previously held a Commonwealth Postgraduate Award. Applicants must be domiciled in Australia. Preference is given to applicants with employment experience. Applications to the Registrar by 28 September.
Australian Development Cooperation Scholarship	Tuition fees only	1992 and 1993 only	Applicants must complete their studies by the end of the 1993 academic year. Scholarships may only be offered in 1992. Only students from specified countries and in certain fields of study can apply. Applications from the Student Centre. The closing date is well before 1 October 1991.
Equity and Merit Scholarship Scheme	Tuition fees. Some students may be eligible for air fares and a stipend.	Determined by normal course duration	Information should be obtained from Australian Diplomatic Posts. Conditions and entitlements vary depending on the home country.
Overseas Postgraduate Research Scholarships	Tuition fees only	2 years for a Masters and 3 years for a PhD degree	Eligibility is confined to postgraduate research students who are citizens of overseas countries excluding citizens of countries which are covered by the Equity and Merit Scholarship Scheme (EMSS). Applications to the Registrar by 28 September.
Special Oversas Postgraduate Fund	Tuition fees only	1 year for a Post-graduate Diploma, 2 years for Masters degree and 3 years for Doctorate	Eligibility is confined to postgraduate students who are citizens of overseas countries excluding citizens of countries which are covered by the Equity and Merit Scholarhsip Scheme (EMSS). Applications to the Registrar by 28 September.
Australian American Educational Foundation Fulbright Award	Travel expenses and $A2000 as establishment allowance	1 year, renewable	Applicants must be graduates who are domiciled in Australia and wish to undertake research or study for a higher degree in America. Applications close 30 September with The Secretary, DEET, AAEF Travel Grants, PO Box 826, Woden, ACT 2606.
Australian Federation of University Women	Amount varies, depending on award	Up to 1 year	Applicants must be female graduates who are members of the Australian Federation of University Women
Commonwealth Scholarship and Fellowship Plan	Varies for each country. Generally covers travel, living, tuition fees, books and equipment, approved medical expenses. Marriage allowance may be payable.	Usually 2 years, sometimes 3	Applicants must be graduates who are Australian citizens and who are not older than 35 years of age. Tenable in Commonwealth countries other than Australia Applications close with the Registrar in September or October each year.
The English-Speaking Union (NSW Branch)	$7000	1 year	Applicants must be residents of NSW or ACT. Awarded to young graduates to further their studies outside Australia. Applications close mid-April with The Secretary, Ground Floor, Sydney School of Arts, 275c Pitt Street, Sydney, NSW 2000.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
Frank Knox Memorial Fellowships tenable at Harvard University	Stipend of $US7000 pa plus tuition fees	1, sometimes 2 years	Applicants must be British subjects and Australian citizens, who are graduates or near graduates of an Australian university. Applications close with the Academic Registrar mid October.
Robert Gordon Menzies Scholarship to Harvard	Up to $US 15,000	1 year	Tenable at Harvard University. Applicants must be Australian citizens and graduates of an Australian tertiary institution. Applications close 31 December with the Registrar, A.N.U., GPO Box 4, Canberra, ACT 2601
Gowrie Scholarship Trust Fund	$6000 pa. Under special circumstances this may be increased.	2 years	Applicants must be members of the Forces or children of members of the Forces who were on active service during the 1939-45 War. Applications close with the Academic Registrar by 31 October.
Harkness Fellowships of the Commonwealth Fund of New York	Living and travel allowances, tuition and research expenses, health insurance, book and equipment and other allowances for travel and study in the USA	12 to 21 months	Candidates must be Australian citizens and **1.** Either members of the Commonwealth or a State Public Service or semi-government Authority. **2.** Either staff or graduate students at an Australian university. **3.** Individuals recommended for nomination by the Local Correspondents. The candidate will usually have an honours degree or equivalent, or an outstanding record of achievement, and be not more than 36 years of age. Applications close 29 August with the Academic Registrar. Forms available from Mr J Larkin, Bureau of Agriculture and Resource Economics, GPO Box 1563, Canberra, ACT 2601.
The Packer, Shell and Barclays Scholarships to Cambridge University	Living and travel allowances, tuition expenses	1-3 years	Applicants must be Australian citizens who are honours graduates or equivalent, and under 26 years of age. Applications close 15 October with The Secretary, Cambridge Commonwealth Trust, PO Box 252, Cambridge CB2 ITZ, England.
The Rhodes Scholarship to Oxford University	Approximately £4862 stg pa	2 years, may be extended for a third year.	Unmarried Australian citizens aged between 19 and 25 who have an honours degree or equivalent. Applications close in August each year with The Secretary, University of Sydney, NSW 2006.
Engineering			
Australian Institute of Nuclear Science and Engineering Studentships	Basic stipend $11,103 pa plus allowances and some University expenses	1-3 years	Applicants must be honours graduates in Science or Engineering. At least one quarter of the period of tenure must be spent at the Institute at Lucas Heights, NSW. Applications close late October with the Registrar.
Harold G. Conde Memorial Fellowship	$5000 pa	Maximum of 3 years	Applicants should be honours graduates permanently domiciled in Australia. The Fellowship is a supplementary award to be held in conjunction with another scholarship and is for graduate study or research in a field related to the electricity industry. Applications close with the Registrar by 10 April.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
Engineering (continued)			
IBM Research Scholarship in Microelectronics	$12000 pa where only scholarship held. $5000 pa where it supplements another scholarship.	Up to 3 years	To enable a suitable graduate to undertake a research degree in the Joint Microelectronics Research Centre. Applications close 31 October with the Registrar.
The Joseph Barling Fellowship	Not less than $8500	Maximum of 3 years	Candidates should be electrical engineering graduates of the University of New South Wales in special circumstances mechanical and industrial engineering graduates may apply. The Fellowship is for full-time study for the award of the degree of Master of Business Administration or Doctor of Philosophy at the University. Applications close 31 December with the Registrar.
Medical Engineering Research Association	Variable	1-3 years	Awarded for graduate study or research in the field of Biomedical Engineering. Applications to The Secretary, MERA, PO Box 218, Lindfield, NSW 2070.
Water Industry Research Award	$21,000 pa	2-4 years	Applications close with the Registrar 20 June
Australian Telecommunications and Electronics Research Board	$9000 intended as a supplement to other awards	1 year for a Masters and up to 3 years for a PhD degree	Applicants must be first class honours graduates or equivalent or scholars who will graduate with honours in the current academic year, who are Australian citizens or permanent residents and who are aged under 25 years at 1 January. Applications close November 2 with ATERB, PO Box 76, Epping, NSW 2121.
Shell Scholarship in Science or Engineering	Adequate funds for living allowance tuition and travel expenses	2 years, sometimes 3	Applicants must be Australian citizens, under 25 years of age, with at least 5 years' domicile in Australia and who are completing the requirements for an honours degree in Science or Engineering. The successful candidate will attend a British university to pursue a higher degree. Applications close 30 September with Shell Australia, 140 Phillip Street, Sydney, NSW 2000.

Prizes

Undergraduate University Prizes

The following table summarizes the undergraduate prizes awarded by the University. Prizes which are not specific to any School are listed under General. All other prizes are listed under the Faculty or Schools in which they are awarded.

Information regarding the establishment of new prizes may be obtained from the Examinations Section located on the Ground Floor of the Chancellery.

Donor/Name of Prize	Value $	Awarded for
General		
The Sydney Technical College Union Award	$400.00 and Bronze Medal	Leadership in student affairs combined with marked academic proficiency by a graduand
The University of New South Wales Alumni Association Prize	Statuette	Achievement for community benefit by a student in the final or graduating year
Faculty of Engineering		
The Institution of Engineers Australia Award	$200.00 and medal.	The best performance by a final or equivalent year student in the BE or BSc(Eng) degrees offered by the Schools of Civil Engineering, Electrical Engineering and Computer Science, Mechanical and Industrial Engineering, Chemical Engineering and Industrial Chemistry, and the Departments of Mining Engineering and Textile Technology (Engineering option only)
The John Fraser Memorial Award	$130.00	The best performance in Year 1 or part-time equivalent of a Bachelor degree offered by the Faculty of Engineering
School of Civil Engineering		
The Association of Consulting Structural Engineers of New South Wales Prize	$225.00	Best performance in CIVL4203 Structural Engineering in the Bachelor of Engineering degree course in Civil Engineering
The Association of Consulting Structural Engineers of New South Wales Prize	$175.00	The best performance in CIVL3303 Structural Design 3 in the Bachelor of Engineering degree course in Civil Engineering
The Australian Conservation Foundation Prize	$50.00	The best performance in the subjects which develop environmental management concepts for the Civil Engineer
The Australian Institute of Traffic Planning and Management Prize	$150.00	The best performance in CIVL4844 Transport major in the Bachelor of Engineering degree course in Civil Engineering
The Australian Welding Institute Prize	Books to the value of $100.00 1 year membership of the institute.	The best design which incorporates a welding process for students in Years 2 to 4 of the Bachelor of Engineering degree course in Civil Engineering
The Baulderstone Hornibrook Prize	$500.00	The best performance in Engineering Construction and Management in the Bachelor of Engineering degree course in Civil Engineering
The Crawford Munro Memorial Prize	$300.00	The best performance in CIVL3705 Water Resources in the Bachelor of Engineering degree course in Civil Engineering

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Civil Engineering (continued)		
The GAA Engineering Award	$500.00	The best performance in CIVL3303 Structural Design in Bachelor of Engineering degree course in Civil Engineering
The GAA Engineering Award	$500.00	The best essay on a topic relating to galvanising by a student proceeding to the degree of Bachelor of Engineering in Civil Engineering
The Hardie's Pipeline Award	$250.00 and plaque	The best performance in CIVL4605 Water Supply and Wastewater Disposal in the Bachelor of Engineering degree course in Civil Engineering
The James Hardie Co Pty Ltd Prize	$225.00	The best performance in CIVL2505 Hydraulics 1 in the Bachelor of Engineering degree course in Civil Engineering
The Jeffery and Katauskas Prize	$500.00	The best performance in CIVL4822 Geotechnical Major in the Bachelor of Engineering degree course.
School of Computer Science and Engineering		
The Logica Pty Limited Prize	$1000.00	The best performance by a graduand in a Computer Science Honours degree course. at honours level
The Telecom Australia Prize	$300.00	The best telecommunications related thesis by a final year student proceeding to the award of the degree of Bachelor of Engineering in Electrical Engineering or Computer Engineering.
School of Electrical Engineering		
The Austral Crane Prize	$37.50	The best performance in Year 3 of the Bachelor of Engineering degree course in Electrical Engineering.
The Austral Crane Prize	$37.50	The best performance in a Power or Control elective in the Bachelor of Engineering degree course in Electrical Engineering
The Electricity Supply Engineers' Association of New South Wales Prize	$100.00	The best overall performance including proficiency in electric power distribution in Year 3 full-time or equivalent part-time stages of the Bachelor of Engineering degree course in Electrical Engineeering
The Institution of Electrical Engineers Prize	$100.00	The best performance in Year 3 studies of the Bachelor of Engineering degree course in Electrical Engineering
The Institution of Electrical Engineers Prize	$100.00	The best performance in the final year thesis/project by a student proceeding to the award of the degree of Bachelor of Electrical Engineering
The J. Douglas Maclurcan Prize	$60.00 book order	Outstanding performance in the field of Control Systems in the final year of the Bachelor of Engineering course in Electrical Engineering
Centre for Photovoltaic Devices and Systems		
The Photovoltaics Prixe (Applied Photovoltaics)	$500.00	The best performance in ELEC4540 Applied Photovoltaics in the Bachelor of Engineering degree course
The Photovoltaics Thesis Prize	$500.00	The best performance for an undergraduate thesis in the area of photovoltaics in the Bachelor of Engineering degree course
The Photovoltaics Prize (Advanced Photovoltaics)	$500.00	The best performance in ELEC9505 Solar Cells leading to the award of the Bachelor of Engineering or Master of Engineering Science or Doctor of Philosophy degrees

Undergraduate University Prizes continued)

Donor/Name of Prize	Value $	Awarded for
School of Mechanical and Manufacturing Engineering		
The Ansett Airlines of Australia Prize	$200.00 and Bronze Medal	The best overall performance in the Bachelor of Engineering degree course in Aeronautical Engineering
The Atlas Copco Prize	$125.00	The best overall performance in the Bachelor of Engineering degree course in Mechanical Engineering.
The Austral Crane Prize	$75.00	The best overall performance in full-time Year 3 of the Bachelor of Engineering degree course in Mechanical Engineering
The Australian Institute of Refrigeration, Air Conditioning and Heating Prize	Student membership of the Institute for one year, and Design Aid and Data book	The best performance in a subject selected by the Head of School
The Babcock Australia Limited Prize	Books to the value of $100.00	The best performance in a subject selected by the Head of School at the beginning of each academic year
The Carrier Air Conditioning Pty Limited Prize	$250.00	The best performance in a subject selected by the Head of School
The Computer-based Engineering Design Prize	$100.00	The best undergraduate or postgraduate thesis making a contribution to computer-based Engineering design in the School of Mechanical and Industrial Engineering
The David Carment Memorial Prize	$500.00 and Bronze Medal	The best overall performance in the final year of the Bachelor of Engineering degree course in Naval Architecture
The Electricity Commission of NSW Award	$250.00	The best performance in MECH4740 Thermal Power Plants
The Hawker de Havilland Ltd Prize	$500.00	The best thesis in the Bachelor of Engineering degree course in Aeronautical Engineering
The Hawker de Havilland Victoria Limited Prize	$300.00 and Silver Medal	The best overall performance in the final year of the Bachelor of Engineering degree Course in Aeronautical Engineering
The Jeremy Hirschhorn Prize in Mechanical Engineering	$100.00	The best performance by a final year student in Mechanics of Machines
The John Harrison Prize	$100.00	The best performance in Mechanics of Machines in Year 3 of the Bachelor of Engineering degree course in Mechanical Engineering
The R.A.A. Bryant Prize	$1,000.00 (indexed per year since 1989)	A student graduating with first class honours and the University Medal in Mechanical Engineering.
The R.E. Jeffries Memorial Prize	$500.00	The best overall performance in the final year of the Bachelor of Engineering degree course in Industrial Engineering
The Royal Institution of Naval Architects (Australian Division) Prize	$250.00	The best ship design by a student in the final year of the Bachelor of Engineering degree course in Naval Architecture
The Shell Refining (Australia) Pty Ltd Prize	$100.00	The best performance in a first year mechanical engineering subject to be selected by the Head of School at the beginning of each academic year
The Shell Refining (Australia) Pty Ltd Prize	$100.00	The best undergraduate thesis by a student in the final year of the Bachelor of Engineering degree course in Mechanical Engineering
The Shell Refining (Australia) Pty Ltd Prize	$100.00	The best performance in the subject MANF3619 Management/Economics by a student in the Bachelor of Engineering degree course.
The Shell Refining (Australia) Pty Ltd Prize	$100.00	The best performance in a subject selected by the Head of School
The Spruson and Ferguson Prize	$250.00	The best performance in MECH3100 Mechanical Engineering Design 3 by a student in the Bachelor of Engineering degree course in Mechanical Engineering

Undergraduate University Prizes continued)

Donor/Name of Prize	Value $	Awarded for
School of Mechanical and Manufacturing Engineering (continued)		
The Staedtler (Pacific) Pty Ltd Prize	Products to the value of $350.00	The best overall performance by a student in Year 2 of the Bachelor of Engineering degree course in Mechanical Engineering
The TRW Products Limited Prize	$1000.00	The best overall performance in the Bachelor of Engineering degree course in Manufacturing Engineering

Graduate University Prizes

The following table summarizes the graduate prizes awarded by the University.

Donor/name of Prize	Value $	Awarded for
School of Chemical Engineering and Industrial Chemistry		
The Clean Air Society of Australia and New Zealand Prize in Atmospheric Pollution Control	$100.00	The highest aggregate in FUEL5910 Atmospheric Pollution and Control and FUEL5920 Practical aspects of Air pollution Measurement and Control in a graduate course in the School of Chemical Engineering and Industrial Chemistry
School of Civil Engineering		
The Institute of Advanced Motorists Prize	$50.00	The best performance in Traffic Planning and Control
The Maunsells Project Report Prize	$500.00	The best performance in • CIVL8909 or CIVL9909 Project Report (9 credits) OR • GEOL 9504 or GEOL9604 Project Report (18 credits) by a student in the Master of Engineering Science of Master of Applied Science courses
The Maunsells Waste Management Prize	$500.00	The best aggregate performance by a Stage 1 student in • CIVL9884/8884 Environmental Enginnering Science 1 • CIVL9872/8872 Solid Waste Management • CIVL9881/8881 Hazardous Waste Management
School of Mechanical and Manufacturing Engineering		
The Computer-based Engineering Design Prize	$100.00	The best undergraduate or postgraduate thesis making a contribution to computer-based Engineering design in the School of Mechanical and Manufacturing Engineering.

NOTES

The University of New South Wales Kensington Campus

Theatres

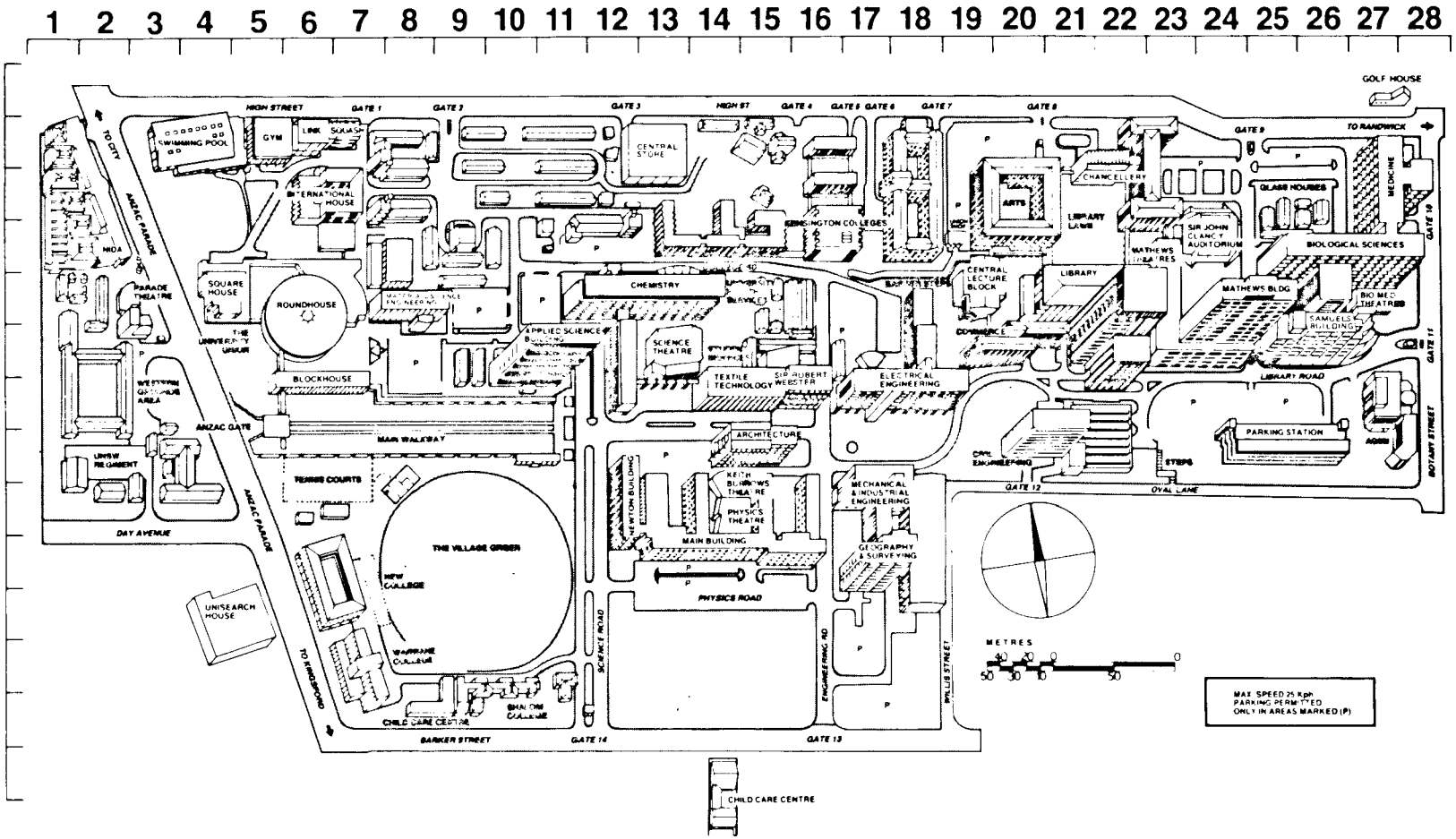
Biomedical Theatres **E27**
Central Lecture Block **E19**
Chemistry Theatres *(Dwyer, Mellor, Murphy, Nyholm, Smith)* **E12**
Classroom Block *(Western Grounds)* **H3**
Fig Tree Theatre **B14**
Io Myers Studio **D9**
Keith Burrows Theatre **J14**
Mathews Theatres **D23**
Parade Theatre **E3**
Physics Theatre *(Main Building)* **K14**
Rex Vowels Theatre **F17**
Science Theatre **F13**
Sir John Clancy Auditorium **C24**

Buildings

Barker Street Gatehouse **N11**
Basser College *(Kensington)* **C18**
Central Store **B13**
Chancellery **C22**
Dalton *(Chemistry)* **F12**
Goldstein College *(Kensington)* **D16**
Golf House **A27**
Gymnasium **B5**
International House **C6**
John Goodsell *(Commerce and Economics)* **F20**
Kensington Colleges *(Office)* **C17**
Library *(University)* **E21**
Link **B6**
Maintenance Workshop **B13**
Mathews **F23**
Menzies Library **E21**
Morven Brown *(Arts)* **C20**
New College **L6**
Newton **J12**
NIDA **D2**
Parking Station **H25**
Philip Baxter College *(Kensington)* **D14**
Robert Heffron *(Chemistry)* **E12**
Sam Cracknell Pavilion **H8**
Samuels Building **F26**
Shalom College **N9**
Sir Robert Webster **G14**
Unisearch House **L5**
University Regiment **J2**
University Union *(Roundhouse)* **E6**
University Union *(Blockhouse)* **G6**
University Union *(Squarehouse)* **E4**
Wallace Wurth School of Medicine **C27**
Warrane College **M7**

General

Aboriginal Student Centre
47 Botany St, Randwick
Accommodation *(off-campus)* **F15**
Accounting **F20**
Admissions **C22**
Adviser for Prospective Students **C22**
Anatomy **C27**
Applied Bioscience **D26**
Applied Economic Research **G14**
Applied Geology **F10**
Applied Science *(Faculty Office)* **F10**
Architecture *(Faculty Office)* **H14**
Archives, University **E21**
Arts and Social Sciences *(Faculty Office)* **C20**
Asia-Australia Institute
34 Botany St, Randwick
Audio Visual Unit **F20**
Australian Graduate School of Management **G27**
Banking and Finance **F20**
Biochemistry and Molecular Genetics **D26**
Biological and Behavioural Sciences *(Faculty Office)* **D26**
Biomedical Engineering **F26**
Biomedical Library **F23**
Biotechnology **F26**
Cashier's Office **C22**
Chaplains **E15**
Chemical Engineering and Industrial Chemistry **F10**
Chemistry **E12**
Civil Engineering **H20**
Co-op Bookshop **G17**
Commerce and Economics *(Faculty Office)* **F20**
Communications Law Centre **C15**
Community Medicine **D26**
Computer Science and Engineering **G17**
Computing Services Department **F26**
Cornea and Contact Lens Research Unit
22-32 King St, Randwick
Counselling and Careers/Loans **F15**
Economics **F20**
Education Studies **G2**
Educational Testing Centre **E15D**
Electrical Engineering **G17**
Energy Research, Development & Information Centre **F10**
Engineering *(Faculty Office)* **K17**
English **C20**
Examinations **C22**
Fees Office **C22**
Fibre Science and Technology **G14**
Food Science and Technology **B8**
French **C20**
Geography **K17**
German and Russian Studies **C20**
Graduate Office and Alumni Centre **E4**
Graduate School of the Built Environment **H14**
Groundwater Management and Hydrogeology **F10**
Health Service, University **E15**
Health Services Management **C22**
History **C20**
House at Pooh Corner *(Child Care)* **N8**
Industrial Design **G14**
Industrial Relations and Organizational Behaviour **F20**
Information Systems **F20**
Institute of Languages
14 Francis St, Randwick
International Student Centre **F16**
IPACE **F23**
Japanese Economic and Management Studies **F20**
Kanga's House *(Child Care)* **O14**
Landscape Architecture **K15**
Law *(Faculty Office)* **F21**
Law Library **F21**
Legal Studies & Taxation **F20**
Liberal and General Studies **C20**
Librarianship **F23**
Lost Property **C22**
Marine Science **D26**
Marketing **F20**
Materials Science and Engineering **E8**
Mathematics **F23**
Mechanical and Manufacturing Engineering **J17**
Medical Education **C27**
Medicine *(Faculty Office)* **B27**
Membrane and Separation Technology **F10**
Microbiology and Immunology **D26**
Mines **K15**
Minor Works and Maintenance **B14A**
Music **B11**
News Service **C22**
New South Wales University Press
22-32 King St, Randwick
Optometry **J12**
Pathology **C27**
Patrol and Cleaning Services **C22**
Performing Arts **B10**
Petroleum Engineering **D12**
Philosophy **C20**
Physics **K15**
Physiology and Pharmacology **C27**
Political Science **C20**
Printing Section **C22**
Professional Development Centre **E15**
Professional Studies *(Faculty Office)* **G2**
Property and Works **C22**
Psychology **F23**
Publications Section **C22**
Remote Sensing **K17**
Safety Science
32 Botany Street, Randwick
Science *(Faculty Office)* **F23**
Science and Technology Studies **C20**
Social Science and Policy **C20**
Social Policy Research Centre **F26**
Social Work **G2**
Sociology **C20**
Spanish and Latin American Studies **C20**
Sport and Recreation Centre **B6**
Squash Courts **B7**
Staff Office **C22**
Student Centre *(off Library Lawn)* **C22**
Swimming Pool **B4**
Students' Union **E4, C21**
Surveying **K17**
Textile Technology **G14**
Theatre and Film Studies **B10**
Town Planning **K15**
WHO Regional Training Centre **C27**
Wool and Animal Sciences **G14**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A B C D E F G H J K L M N O
HIGH STREET
GATE 1
GATE 2
GATE 3
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GATE 5
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GATE 7
GATE 8
GATE 9
GATE 10
GATE 11
GATE 12
GATE 13
GATE 14
TO RANDWICK
GOLF HOUSE
SWIMMING POOL
GYM
LINK
SQUASH
INTERNATIONAL HOUSE
CENTRAL STORE
KENSINGTON COLLEGES
ARTS
CHANCELLERY
LIBRARY LANE
GLASS HOUSES
MEDICINE
SIR JOHN CLANCY AUDITORIUM
MATHEWS THEATRES
BIOLOGICAL SCIENCES
CENTRAL LECTURE BLOCK
LIBRARY
MATHEWS BLDG
BIO MED THEATRE
SAMUELS BUILDING
COMMERCE
CHEMISTRY
APPLIED SCIENCE
SCIENCE THEATRE
TEXTILE TECHNOLOGY
SIR ROBERT WEBSTER
ELECTRICAL ENGINEERING
LIBRARY ROAD
PARKING STATION
ROTARY STREET
NIDA
SQUARE HOUSE
ROUNDHOUSE
THE UNIVERSITY UNISHOP
PARADE THEATRE
BLOCKHOUSE
ANZAC GATE
MAIN WALKWAY
TENNIS COURTS
ARCHITECTURE
NEWTON BUILDING
KEITH BURROWS THEATRE
PHYSICS THEATRE
MAIN BUILDING
MECHANICAL & INDUSTRIAL ENGINEERING
GEOGRAPHY & SURVEYING
CIVIL ENGINEERING
STEPS
OVAL LANE
DAY AVENUE
ANZAC PARADE
TO CITY
TO KINGSFORD
THE VILLAGE GREEN
NEW COLLEGE
UNISEARCH HOUSE
WARRANE COLLEGE
SHALOM COLLEGE
CHILD CARE CENTRE
BARKER STREET
SCIENCE ROAD
PHYSICS ROAD
ENGINEERING RD
PHILLIS STREET
METRES
50 40 30 20 10 0 50
MAX SPEED 25 Kph
PARKING PERMITTED
ONLY IN AREAS MARKED (P)
CHILD CARE CENTRE

122

This Handbook has been specifically designed as a source of reference for you and will prove useful for consultation throughout the year.

For fuller details about the University – its organization, staff membership, description of disciplines, scholarships, prizes, and so on, you should consult the Calendar.

The Calendar and Handbooks also contain a summary list of higher degrees as well as the conditions for their award applicable to each volume.

For detailed information about courses, subjects and requirements of a particular faculty you should consult the relevant Faculty Handbook.

Separate Handbooks are published for the Faculties of Applied Science, Architecture, Arts, Commerce and Economics, Engineering, Law, Medicine, Professional Studies, Science (including Biological and Behavioural Sciences and the Board of Studies in Science and Mathematics), and the Australian Graduate School of Management (AGSM).

The Calendar and Handbooks, which vary in cost, are available from the Cashier's Office.