

ENGINEERING



THE UNIVERSITY OF NEW SOUTH WALES HANDBOOK UNIVERSITY OF 23 DEC 1993 B NEW SOUTH WALES 1994 **ENGINEERING**

Subjects, courses and any arrangements for courses including staff allocated as stated in this Handbook are an expression of Intent only. The University reserves the right to discontinue or vary arrangements at any time without notice. Information has been brought up to date as at 1 November 1993, but may be amended without notice by the University Council.

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It is University policy to promote equal opportunity in education (refer to EOE Policy Statement, The University of New South Wales Calendar (Summary Volume) and Student Guide 1994).

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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 UNSW Groundwater Centre and the Centre for Remote Sensing and Geographic Information Systems both of which are joint multidisciplinary enterprises with the Faculty of Applied Science, and the Centre for Advanced Numerical Computation in Engineering and Science which is a joint enterprise with the Faculty of Science. The Faculty is also actively involved with seven Cooperative Research Centres (CRCs) established under the Commonwealth Government's program of CRCs announced in 1991.

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. Schools within the Faculty offer undergraduate courses leading to the award of the degree of Bachelor of Engineering (BE) and Bachelor of Surveying (BSurv). There are also a number of combined degree courses available which lead to the award of two degrees. Through its schools and centres, the Faculty offers an active graduate program through formal graduate courses both at degree and graduate diploma level, and research degrees.

The Faculty has a commitment to developing in students the technical, scientific and creative skills required to solve all aspects of engineering problems, and to direct and manage engineering activities. Critical to this is an understanding of human interaction with the environment so that the impact of engineering activity can be assessed together with the ability to communicate with other members of the profession, with industrial personnel, administrators and with members of the public.

Other important attributes for a successful engineer include the desire and ability for continuing self-education and reappraisal of current practice including the ability to innovate. Concomitant with this is the ability to evaluate independently and to criticise constructively their own work and the work of other engineers.

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

Calendar of Dates

Semester 1 begins - AGSM Graduate Diploma in

The Academic year is divided into two sessions each containing 14 weeks 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.

All Faculties (other than Medicine)

	1994	1995
Session 1		
(14 weeks)	28 February to 31 March	27 February to 13 April
	11 April to 10 June	24 April to 9 June
Recess:	1 April to 10 April	14 April to 23 April
Study Period:	11 June to 16 June	10 June to 15 June
Examinations:	17 June to 5 July	16 June 4 July
Midyear Recess:	6 July to 24 July	5 July to 23 July
Session 2		
(14 weeks)	25 July to 23 September	24 July to 22 September
	4 October to 4 November	3 October to 3 November
Recess:	24 September to 3 October	23 September to 2 October
Study Period:	5 November to 10 November	4 November to 9 November
Examinations:	11 November to 29 November	10 November to 28 November

Management

Important Dates for 1994

New Year's Day Public Holiday

January М 3

M	3	New Year's Day Public Holiday			Management
М	10	Term 1 begins - Medicine IV			Term 1 begins - AGSM MBA Program, Year 1 classes
М	17	Term 1 begins - Medicine V	F	25	Last day for acceptance of enrolment by new
W	26	Australia Day - Public Holiday			and re-enrolling students.
••		/ totalia bay / abile frontag			(Late fee payable thereafter if enrolment approved.)
			М	28	Session 1 begins - all courses except Medicine IV, V, VI
E۵	bruar	w			Session 1 begins - University College, Australian
	Di uai	•			Defence Force Academy
Т	1	Enrolment period begins for new undergraduate			Term 1 begins - AGSM MBA Program, Year 2 classes
		students and undergraduate students repeating first			Term I Degins - ACIONI MIDA FTOGRAM, Teal 2 Classes
		year.			
М	7	Re-enrolment period begins for second and later year		irch	
		undergraduate and graduate students enrolled in	М	7	Term 1 begins - Australian Graduate School of
		formal courses. Students should consult the			Management
		Re-enrolling 1994 leaflets applicable to their courses			Term 2 begins - Medicine IV
		for details.	F	11	Last day applications are accepted from students to
м	14	Semester 1 begins - AGSM Graduate Management			enrol in Session 1
IAI	14	Qualification			or whole year subjects.
		Qualification	Su	13	Term 1 ends - Medicine IV
				. •	

M 21

	14	Term 2 begins - Medicine VI		gust	1
	20	Term 1 ends - Medicine V	F	5	Last day applications are accepted from students to
	28 31	Term 2 begins - Medicine V Last day for students to discontinue without failure			enrol in Session 2 subjects.
111	31	subjects which extend over Session 1 only.			Last day for students to discontinue without failure subjects which extend over the whole academic year.
		HECS Census Date for Session 1			Term 2 ends - AGSM MBA Program, all classes
			Su	7	Term 4 ends - Medicine IV
Ap	ril			•	Term 3 ends - Medicine V
F	1	Good Friday - Public Holiday			Term 4 ends - Medicine VI
		Mid-session Recess begins	M	8	Exam week begins - AGSM MBA Program, all classes
S	2	Easter Saturday - Public Holiday	М	15	Term 5 begins - Medicine IV
	4	Easter Monday - Public Holiday			Term 4 begins - Medicine V
	10	Mid-session Recess ends			Term 5 begins - Medicine VI
	17 24	Term 2 ends - Medicine VI	M	29	Term 3 begins - AGSM MBA Program, all classes
	2 4 25	Term 2 ends - Medicine IV	W	31	HECS Census Date for Session 2 Last date for students to discontinue without failure
S	30	Anzac Day - Public Holiday May Recess begins - University College			subjects which extend
3	30	way recess begins - Ornversity College			over Session 2 only.
Ma	V				Over Gession 2 only.
	2	Term 3 begins - Medicine IV	Se	ptemi	per
		Term 3 begins - Medicine VI	S	24	Mid-session Recess begins
F	6	Term 1 ends - AGSM MBA Program, all classes	_		September Recess begins - University College
М	9	Examination week begins - AGSM MBA Program, all	Su	25	Term 5 ends - Medicine IV
		classes			Term 5 ends - Medicine VI
T	10	Publication of provisional timetable for June	М	26	Term 6 begins - Medicine IV
_		examinations.			Term 6 begins - Medicine VI
S	14	Examination - AGSM Graduate Management	F	30	Closing date for applications to the Universities
٥	4-	Qualification			Admission Centre.
Su	15	May Recess ends - University College, Australian Defence Force Academy	^-	tober	
w	18	Last day for students to advise of examination clashes.	M		
	29	Term 2 ends - Medicine V	IVI	3	Labour Day Public Holiday Mid-session Recess ends
М	30	Term 2 begins - AGSM MBA Program, all classes			September Recess ends - University College,
T	31	Publication of timetable for June examinations.			Australian Defence Force Academy
			T	4	Publication of provisional timetable for the November
Ju	ne				examinations.
S	4	Final examination - AGSM Graduate Management	W	12	Last day for students to advise of examination clashes.
		Qualification	S	15	Examination - AGSM Graduate Diploma in
		Semester 1 ends - AGSM Graduate Management	_		Management
		Qualification	Su	16	Term 4 ends - Medicine V
M F	6 10	Term 3 begins - Medicine V Session 1 ends	F	21	Session 2 ends - University College, Australian Defence
-	10	Semester 1 ends - AGSM Graduate Management	М	24	Force Academy Examinations begin - University College, Australian
		Qualification	141	24	Defence Force Academy
S	11	Study recess begins	Т	25	Publication of timetable for November examinations.
		College of Fine Arts assessment week begins	-		
Su	12	Term 3 ends - Medicine IV	No	vemb	er
		Term 3 ends - Medicine VI	F	4	Session 2 ends
M	13	Queen's Birthday Public Holiday			Term 3 ends - AGSM MBA Program, all classes
Т	14	Term 4 begins - Medicine IV	S	5	Study recess begins
T L	40	Term 4 begins - Medicine VI			College of Fine Arts assessment week begins
	16 17	Study Recess ends Examinations begin			Final examination - AGSM Graduate Management
F	"	Session 1 ends - University College, Australian			Qualification Semester 2 ands - AGSM Graduate Management
		Defence Force Academy			Semester 2 ends - AGSM Graduate Management Qualification
		College of Fine Arts assessment week ends			Examination - AGSM Graduate Diploma in
S	18	Mid-year Recess begins - University College,			Management
		Australian Defence Force Academy			Semester 2 ends - AGSM Graduate Diploma in
М	20	Examinations begin - University College, Australian			Management
		Defence Force Academy	Su	6	Term 6 ends Medicine - IV
	. .			_	Term 6 ends Medicine - VI
Ju		Francisco and Debrasit Orlina		7	Exam week begins - AGSM MBA Program, all classes
S	2 5	Examinations end - University College Examinations end	F	10	Study Recess ends
w	6	Mid-year Recess begins	F	11	Examinations begin College of Fine Arts assessment week ends
	11	Semester 2 begins - AGSM Graduate Diploma in			Examinations end - University College, Australian
•••		Management			Defence Force Academy
Su	17	Mid-year Recess ends - University College, Australian	т	29	Examinations end
		Defence Force Academy	•		
М	18	Semester 2 begins - AGSM Graduate Management	De	cemb	er
		Qualification	Th	22	Last day for acceptance of applications by the
		Session 2 begins - University College, Australian			Admissions Section for transfer to another
_	0.4	Defence Force Academy			undergraduate course within the University.
	24	Mid-year Recess ends	M	26	Christmas Day Holiday
ΙVI	25	Session 2 begins - all courses except Medicine IV, V, and VI	Т	27	Boxing Day Holiday
		reg egunde er			

Comprises Schools of Civil Engineering, Computer Science and Engineering, Electrical Engineering, Mechanical and Manufacturing Engineering (incorporating Aerospace Engineering and Naval Architecture), Surveying, the Graduate School of Engineering and Centres for Biomedical Engineering, Photovoltaic Devices and Systems, Advanced Numerical Computation in Engineering and Science, Manufacturing and Automation, Wastewater Treatment, the Munro Centre for Civil and Environmental Engineering and the Centre for Remote Sensing and Geographic Information Systems. The Faculty is also associated with the UNSW Groundwater Centre, and the Co-operative Research Centres for Waste Management and Pollution Control, and Aerospace Structures.

Dean

Mark Sebastian Wainwright, MAppSc Adel., PhD McM., CPEng, FTS, FRACI, FIEAust

Presiding Member and Head of the Graduate School of Engineering Professor C. Patterson

Associate Dean (International Programs)
Anthony John Robinson

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School of Civil Engineering

Professor of Transport Engineering and Head of School

John Andrew Black, BA *Manc.*, MTCP *Syd.*, PhD *Brad.*, CEng, FIEAust

Professor of Civil Engineering and Head of Department of Engineering Construction and Management

David Gordon Carmichael, BE MEngSc Syd., PhD Cant., CPEng, FIEAust, MASCE, AlArbA

Professor of Civil Engineering and Head of Department of Geotechnical Engineering Robin Fell, BE MEngSc Qld., CPEng, FIEAust

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Professor of Civil Engineering and Head of Department of Water Engineering

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Helen Elizabeth Prior
Angela Rita Spano

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Department of Engineering Construction and Management

Includes Systems Engineering, Engineering Economy, Project Planning and Management, Construction Management, Engineering Management.

Visiting Fellows

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Computer Systems Officer

Jong Hwai Perng, BE N.T.U., ME T.K.U.

Department of Geotechnical Engineering

Includes Foundation Engineering, Soil Mechanics, Rock Mechanics, Concrete Technology, Pavement Engineering.

Associate Professors

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Somasundaram Valliappan, BE Annam., MS Northeastern, PhD DSc Wales, CPEng, FIEAust, FASCE William Otho Yandell, ME PhD UNSW, CPEng, MIEAust

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Lecturer

Gareth Edward Swarbrick, BE Adel., PhD UNSW, GradlEAust

Professional Officer

Peter Kenneth Maguire, BS N.E., GradDip UNSW

Department of Structural Engineering

Includes Structural Analysis, Structural Design, Stress Analysis and Solid Mechanics.

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Peter Walder Kneen, BE Melb., PhD Wat, CPEng, MIEAust, IASS

Victor Andrada Pulmano, BSCE Philippines, MEng A.I.T., PhD Northwestern

Francis Shay Khiet Tin Loi, BE PhD Monash, CPEng, MIEAust

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lan James Somervaille, BE PhD *UNSW*, ASTC

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Department of Transport Engineering

Lecturers

Michael Clarence Dunne, BSc PhD Adel.
Peter Hidas, MCEng DipArch PhD Bud.
Upali Vandebona, BSc Eng Ceylon, MEng A.I.T., PhD Monash

Professional Officer

Tu That Ton, BE Saigon Polytech., BE C.I.T., MEngSc UNSW

Department of Water Engineering

Includes Environmental Engineering, Hydraulics, Hydrology, Public Health Engineering, Water Resources Engineering, and the Water Research Laboratory.

Professor of Civil Engineering and Director of Environmental Studies

David Lyon Wilkinson, BE Syd., PhD UNSW, CPEng, MIEAust

Associate Professor and Director, Water Research Laboratory

Ronald John Cox, BE PhD UNSW

Associate Professor

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Senior Lecturers

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George John Harris

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Professor and Head of Department of Systems and Control

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Associate Professor T.B. Vu

Professor and Head of Department of Electronics
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Department of Communications

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lain Murray Skinner, BSc Qld., PhD A.N.U.
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UNSW Groundwater Centre

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Handbook Guide

This handbook is divided into separate sections for each School/Unit, identified by a four-letter code (e.g. CIVL, School of Civil Engineering). This code appears on the top right corner of each page relating to the School/Unit. Each School/Unit section is divided into Undergraduate and Graduate Study and includes course outlines and subject descriptions.

Read the opening sections of the handbook first, and then read the information contained under **Course Outlines** (Undergraduate or Graduate as appropriate). These sections cover all degrees and diplomas offered by the Faculty. Detailed information on each subject then appears under **Subject Descriptions**, which includes session/s offered, pre/corequisite details, class hours, credit/unit value, etc.

You will find that almost any course of study you wish to undertake has subjects from other Schools, and even other Faculties. This means that in your engineering course, subjects are listed from other Schools in the Faculty of Engineering, each with their own identifying code, as well as from the School in which you are planning to do a course. If, for example, this is Mechanical and Manufacturing Engineering Engineering (MECH), all the subjects for Mechanical and Manufacturing Engineering are described in the section for that School. As Mechanical and Manufacturing Engineering also includes Aerospace Engineering (AERO), Manufacturing Management (MANF) and Naval Architecture (NAVL) these subjects are also included with the School. If they are Electrical Engineering (ELEC), Computer Science and Engineering (COMP), Civil Engineering (CIVL) or Surveying (SURV) subjects, then descriptions for these subjects will be located in the appropriate School section which has that particular identifying number.

Any subject which is not an Engineering subject (i.e. a subject offered by another Faculty, but included in a course), appears under the **Servicing Subject Descriptions** section.

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.

Undergraduate Study

It is most important that you read the opening sections of the Handbook for general information on the Faculty of Engineering, **Faculty Information**, and **Undergraduate Study, Course Outlines**. Both of these contain specific information relating to undergraduate degrees, including Enrolment Procedures, Conditions for the Award of Degrees, Honours, Professional Practice, Course Transfers and a number of other details that you should be familiar with.

Once you have determined which course you want to do, you must read the course outlines and then the subject descriptions for all subjects to find out what each one entails.

Graduate Study

No matter which graduate degree course you plan to undertake you must read the general summary of graduate courses in the section, **Graduate Study, Course Outlines**. This covers both research degrees and course work programs. Information relating to the various Masters degrees by course work and Graduate Diplomas is detailed in the appropriate School sections. The Centre for Biomedical Engineering is the only Centre in the Faculty of Engineering with its own code number (BIOM) and it located at the end of the section on Centre. The Graduate School of Engineering (GSOE) also has its own identifier and is located at the end of the Graduate Study section.

You will also need to read the **Conditions for the Award of Degrees** at the back of the Handbook for the formal rules governing each degree.

Most importantly, staff in the Faculty of Engineering are only too happy to help you with any queries you might have or problems that need to be sorted out. As a first step, contact the School Office, or there is a list of people who can help you at the beginning of **Faculty Information**. You can then be directed to other staff members who can assist you if there are very specific matters that need to be solved.

Information Key

The following key provides a guide to abbreviations used in this book:

C F HPW L P/T	credit points full year (Session 1 plus Session 2) hours per week lecture part-time
S1	Session 1
S2	Session 2
SS	single Session, but which Session taught is not known at time of publication
T	tutorial/laboratory
U	unit value
WKS X	weeks of duration external

Prefixes

The identifying alphabetical prefixes for each organizational unit offering subjects to students in the Faculty of Engineering follow.

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Prefix	Organizational Unit	Faculty/Board
ACCT	School of Accounting	Commerce & Economics
AERO	School of Mechanical and Manufacturing Engineering	Engineering
ANAT	School of Anatomy	Medicine
ANCE	Centre for Computational Engineering and Science	Engineering/Science
BIOM	Centre for Biomedical Engineering	Engineering
BIOS	School of Biological Science	Biological & Behavioural Sciences
BIOT	Department of Biotechnology	Applied Science
CEIC	School of Chemical Engineering & Industrial Chemistry	Applied Science
CHEM	School of Chemistry	Science
CHEN	Department of Chemical Engineering	Applied Science
CIVL	School of Civil Engineering	Engineering
COMP	School of Computer Science & Engineering	Engineering
ECON	School of Economics, Departments of Econometrics and Economics	Commerce & Economics
ELEC	School of Electrical Engineering	Engineering
FUEL	Department of Fuel Technology	Applied Science
GEOG	School of Geography	Applied Science
GEOL	Department of Applied Geology	Applied Science
GSOE	Graduate School of Engineering	Engineering
INDC	Department of Industrial Chemistry	Applied Science
IROB	School of Industrial Relations & Organizational Behaviour	Commerce & Economics
LAWS	School of Law	Law

Prefix	Organizational Unit	Faculty/Board
LIBS	School of Information, Library & Archive Studies	Professional Studies
MANF	School of Mechanical & Manufacturing Engineering	Engineering
MATH	School of Mathematics	Science
MATS	School of Materials Science & Engineering	Applied Science
MECH	School of Mechanical & Manufacturing Engineering	Engineering
MINE	Department of Mining Engineering	Applied Science
NAVL	School of Mechanical and Manufacturing Engineering	Engineering
PHPH	School of Physiology & Pharmacology	Medicine
PHYS	School of Physics	Science
PLAN	School of Town Planning	Architecture
POLS	School of Political Science	Arts & Social Sciences
POLY	Department of Polymer Science	Applied Science
SAFE	Department of Safety Science	Applied Science

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 Blomedical Engineering: Associate Professor K. Schindhelm, 5th Floor, Samuels Building.

UNSW Groundwater Centre: Dr I. Acworth, Room 309, Civil Engineering Building

Centre for Advanced Numerical Computation in Engineering and Science: Prof. C.A.J.Fletcher, Room 106A, Mechanical and Manufacturing Engineering Building.

Centre for Remote Sensing: Dr A.K. Skidmore, Room 235, 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 Prerequisites

Mathematics 2u (60-100) 3u (1-50) 4u (1-100)

Additional subject prerequisites

English 2u Contemporary (60-100) 2uG (53-100) 2u (49-100) 3u (1-50)

and

Science 2u Physics (57-100) or 2u Chemistry (60-100) 3u (90-150) 4u (1-50) and

Mathematics 2u (67-100)

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, Chemistry or Physics. It should be noted that inclusion of these subjects in first-year programs could extend the duration of a course.

Enrolment Procedures

All students re-enrolling in 1994 or enrolling in graduate course should obtain a copy of the free leaflet Re-Enrolling 1994 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.

Re-enrolment forms must be lodged with the appropriate 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

Faculty of Engineering Library

admission to the degree.

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 Student Services, Quadrangle Builling.

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 management 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, Misons 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.

Summary of Courses

Undergraduate Study

The Faculty of Engineering offers the following courses:

Bachelor of Engineering ·BE

Aerospace Engineering 3610 Civil Engineering 3620 Computer Engineering 3645 Electrical Engineering 3640 **Environmental Engineering 3625** Manufacturing Management 3663 Mechanical Engineering 3680 Naval Architecture 3700

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 in Civil Engineering and Environmental Engineering.

Bachelor of Surveying BSurv

in:

Surveying 3740

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 3611 Civil Engineering 3730 Computer Engineering 3726 Electrical Engineering 3720 Manufacturing Management 3664 Mechanical Engineering 3681 Naval Architecture 3701

Bachelor of Engineering Bachelor of Arts BE BA

(5 years' duration) in: Aerospace Engineering 3612 Computer Engineering 3722 Electrical Engineering 3611 Manufacturing Management 3665 Mechanical Engineering 3682 Naval Architecture 3702

Bachelor of Engineering Bachelor of Laws BE LLB

(6 years' duration) in: Civil Engineering 4775

Bachelor of Engineering (Civil) and Bachelor of Engineering (Mining)

BE BE :

(5 years' duration) in: Civil Engineering 3146

Bachelor of Surveying Bachelor of Science in Computer Science **BSurv BSc**

(5 years' duration) in: Surveying 3745

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, Manufacturing Management, Mechanical Engineering 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

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.

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.

Please note, however, that due to enrolment quotas in undergraduate courses the number of places available for transfer is limited and offeres will be made on a competitive basis.

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 year 2 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 year 2 of the above courses 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 (years 1 and 2 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. (Years 1 and 2 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 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.

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. Students are not permitted to enrol in subjects with clashing timetables.
- 2. Students must satisfy the rules governing re-enrolment: in particular, these require students enrolled in the year 1 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 corequisite 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. Previously failed subjects must be included, except that a failed elective may be replaced by another elective.
- 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.

Honours

In the Bachelor of Engineering degrees courses 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.

In the cases of combined degrees, such as the BE BA or the BE BSc, the award of the BA or BSc degree at honours level requires two additional sessions of study.

Students wishing to gain a degree at Honours level in Arts or in Science as part of their combined degree program must meet all the relevant requirements of the Faculty of Arts or the Board of Studies in Science and Mathematics and of the appropriate School concerned. Students may enrol for the Honours year only on the recommendation of the Head of their School in the Faculty of Engineering and with the approval of the Head of the appropriate Arts or Science School, and the Faculty of Engineering, For an Honours in Science, approval must also be sought from the Board of Studies in Science and Mathematics, AUSTUDY support is available for the combined degree program including the Honours level.

Prerequisites and Corequisites

- A prerequisite unit is one which must be completed prior to enrolment in the unit for which it is prescribed.
- A corequisite 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 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 and Subject Descriptions should be consulted for details of subject requirements.

Students will formally enrol in the Industrial Training 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.

Practical Experience Requirements (Surveying Students)

All students in BSurv course must gain at least 60 days of recognized 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.

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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.

There are differing requirements for general education for students commencing before, in, and after 1988. Students must complete a progam 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 program requires students to undertake studies in three categories of the program: The key questions addressed by the Program are:

Category A: The External Context: An introduction in non-specialist terms to an understanding of the environments in which humans function.

Course Requirement: 56 hours

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

Category B: The Internal Context of Assumptions and Values: An introduction to, and a critical reflection upon, the cultural bases of knowledge, belief, language, identity and purpose.

Course Requirement: 56 hours

- 1. The Self and Society. How do we define ourselves in relation to the larger human community?
- 2. Changing Conceptions of Human Nature and Well-Being. How do our conceptions of human nature and well being influence both individual and social behaviour?
- 3. The Pursuit of Human Rationality. What are the prevailing conceptions of and challenges to human rationality?
- 4. The Use of Language, Images and Symbols. How do language, images and symbols function as means and media of communication?
- 5. The Computer: Its Impact, Significance and Uses. What is the impact of the computer on human society and culture?
- 6. Beliefs, Values and the Search for Meaning. Which systems of belief and configurations of values are most conducive to the survival and enhancement of the human species and the planet earth?

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

future: An introduction to 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.

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:

- · in a creative and innovative way?
- to widen the circle of human participation in the benefits they bring?
- to break down the barriers of exclusion and discrimination?
- to enhance the prospects for survival of the human species to enhance the capacity of the planet earth to sustain life?

The way in which the Category C requirement of the Program will be met 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

- 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 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 II, Division II Honours Class II, Division II

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

Graduate Study

The Faculty awards eleven higher degrees as follows: Research — Doctor of Philosophy, Master of Engineering, Master of Surveying and Master of Science; Course Work Masters — Master of Biomedical Engineering, Master of Cognitive Science, Master of Computer Science, Master of Engineering Science (available in a number of areas of specialization), 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 Graduate School of Engineering is responsible for the MBT Program which is a joint initiative of the Faculties of Applied Science and Engineering. The two courses offered through this special unit are the Master of Business and Technology, and the Graduate Diploma in Industrial Management (see Graduate School of Engineering section in this Handbook).

Conditions governing the award of higher degrees and graduate diplomas are set out later in this handbook in Conditions for the Award of Degrees. However, conditions for the award of the degree of Doctor of Science may be found in the University Calendar.

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. A pass in the writing component of the tests listed below is strongly recommended.

Minimum Acceptable Score

- 1. The Test of English as a Foreign Language (TOEFL) 550
- 2. International English Language Testing Service (IELTS) 6.0
- 3 .Combined Universities Language Test (CULT) 65%
- Indonesia-Australia Language Foundation (IALF)* Cat 1 or 2. Cat 3 may be accepted if current English program available
- 5. English for Academic Purposes C+.
- * Research students must have a writing score of 5 as well as 550 in TOEFL.

Research Degrees

Research degrees may be undertaken in the Faculty of Engineering as follows:

PhD

Biomedical Engineering 1710
Civil Engineering 1630
Computer Science and Engineering 1650
Electrical Engineering 1640
Mechanical and Manufacturing Engineering 1662
Surveying 1680

ME

Biomedical Engineering 2675 Civil Engineering 2650 Computer Science and Engineering 2665 Electrical Engineering 2660 Mechanical and Manufacturing Engineering 2692

MSurv Surveying 2720

Biomedical Engineering 2795 Civil Engineering 2750 Computer Science and Engineering 2765 Electrical Engineering 2760 Mechanical and Manufacturing Engineering 2781

Doctor of Philosophy

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. 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.

Concurrent Coursework: All new PhD candidates in the Faculty of Engineering must complete and pass three subjects as approved by the Head of School, normally in the final year of candidature.

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. 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 three 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.

Concurrent Coursework: All new Masters research candidates in the Faculty of Engineering must complete and pass three subjects as approved by the Head of School. normally in the final year of candidature.

Course Work Masters Degrees

Course work programs: Detailed information on course work programs is available from the schools offering the courses and can be found in this Handbook under the appropriate School section.

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 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.

Applicants for admission to a course of study leading to the award of a Masters degree by course work commencing in first session should apply to the Registrar on the prescribed form by the 31st October of the year before the year in which enrolment is to begin. Where application is for registration commencing in the second session, applicants should apply at least two months before the commencement of session. It may be necessary to limit entry to formal courses due to quota restrictions. In such cases, applications may be placed on a reserve list and considered subject to the availability of places. If a firm offer of admission is made, it will be subject to acceptance within three weeks.

Courses of study leading to the award of course work Masters degrees may be undertaken in the Faculty as follows:

MBiomedE

Biomedical Engineering 8660

MEngSc

Biomedical Engineering 8665 Civil Engineering 8612 Electrical Engineering 8501 Industrial Engineering 8531 Mechanical Engineering 8541 Remote Sensing 8641 Waste Management 8612 (Internal), 8614 (External)

MCogSc

Cognitive Science 8155

MCompSc

Computer Science and Engineering 8680

MEnvEngSc

Civil Engineering 8615

MInfSc

Computer Science and Engineering 8508

MSurvSc

Surveying 8651

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).

Master of Biomedical Engineering MBioMedE

Information is detailed under Centre for Biomedical Engineering, Graduate Study.

Master of Engineering Science MEngSc **Master of Environmental Engineering Science MEnvEngSc** Master of Surveying Science MSurvSc

The Master of Environmental Engineering Science allows for a degree to be taken in a specific area of specialization. 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 specialization in certain areas and further information is available under each School section in this handbook.

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,

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.

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 Cognitive Science MCogSc Master of Computer Science MCompSc Master of Information Science MInf

Information is detailed under School of Computer Science and Engineering, Graduate Study.

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 the Graduate Diploma specialization in Computer Science which requires 36. In this 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 specializations 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.

Applicants for admission to a course of study leading to the award of a Graduate Diploma commencing in first session should apply to the Registrar on the prescribed form by 31 October of the year before the year in which enrolment is to begin. Where application is for registration commencing in the second session, applicants should apply at least two months before the commencement of session. It may be necessary to limit entry to formal courses due to quota restrictions. In such cases, applications may be placed on a reserve list and considered subject to the availability of places. If a firm offer of admission is made, it will be subject to acceptance within three weeks.

Courses of study leading to the award of a graduate diploma may be undertaken in the Faculty of Engineering as follows:

School/Course

Graduate Diploma in Engineering:
Biomedical Engineering 5445
Civil Engineering 5459
Waste Management 5459 (Internal) 5498 (External)
Electrical Engineering 5458
Electric Power Engineering 5435
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

Further details of the recommended programs of study may be obtained from the course authorities concerned.

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 at the end of each School section. 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.

Graduate Diploma Subjects

Graduate Diploma programs in all schools of the Faculty may include subjects from the graduate study lists at the end of each School section in this handbook, subject to the approval of the Head of School responsible for the subject.

School of Civil Engineering

Head of School Professor J.A. Black

First Year Management Committee Mr V. J. Summersby (Chair) Assoc. Professor P.W. Kneen Dr A.C. Heaney

Senior Administrative Officer Mr G.J. Harris

The School consists of five departments: Engineering Construction and Management (civil engineering systems, engineering economy, project planning and management and civil engineering construction); Geotechnical Engineering (foundation engineering, soil mechanics, rock mechanics, materials, and pavement engineering); Structural Engineering (structural analysis, concrete technology, 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.

The Centre for Wastewater Treatment and the Munro Centre for Civil and Environmental Engineering are also located within the School. In addition to extensive laboratory facilities on the Kensington campus, the School operates laboratories at King Street, Randwick and 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 data collection for arid zone hydrology.

The School is also involved in the **UNSW Groundwater Centre** which is a joint enterprise with Schools in the Faculty of Applied Science.

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.

A five-year full-time combined course (3146) leading to the award of the degrees of Bachelor of Engineering (Civil) and Bachelor of Engineering (Mining) is offered.

Five-year full-time combined courses (3730) leading to the award of the degrees of Bachelor of Engineering (Civil) and Bachelor of Science are offered.

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.

There are formal graduate courses leading to the award of the degree of Master of Engineering Science 8612, Master of Environmental Engineering Science 8615, and also the Graduate Diploma in Engineering 5459. These courses are available in specialist areas including engineering construction and management, geotechnical engineering, public health engineering, structural engineering, transport engineering and water engineering. In addition, and within the Master of Engineering Science and Graduate Diploma courses structures, courses are offered in the area of waste management. They can be taken internally on a full or part-time basis or externally. These courses are designed to provide engineers and scientists with the background necessary to design treatment, handling and disposal processes for a wide range of waste streams, solve existing waste problems, and understand pertinent waste legislation. Within the Master of Engineering Science and Graduate Diploma courses, students may undertake engineering construction and management externally. Fees are payable for the distance learning/external courses.

Opportunities are provided for graduate research leading to the award of the degrees of Master of Engineering 2650 and Doctor of Philosophy 1630.

Undergraduate Study

Course C	Dutlings					H	IPW
	outilities			Year 2 CIVL2106 CIVL2203 CIVL2301	Systems Engineering Engineering Mechanics 2 Engineering Construction	S1 2 4 2	S2 3 4 2
3620 Civil Engin	eering – Full-time Course			CIVL2402 CIVL2505 MATH2009 MATH2869	Materials Engineering 1 Hydraulics 1 Engineering Mathematics 2 Statistics SC	4 2 4 2	4 2 4 0
Bachelor of BE (Civil)	Engineering			SURV0441 SURV0491	Surveying for Engineers Survey Camp (1 week equival to 3 HPW in S2)	0	4.5
		Н	PW	General Educ Totalling		4 24	0 26.5
Year 1 CHEM1808 CIVL1106 CIVL1203 CIVL1301 GEOL5100 MATH1032 PHYS1989 Totalling	Chemistry 1CE Computing and Graphics Engineering Mechanics 1 Civil Engineering Practice Geology for Civil and Environmental Engineers Mathematics 1 Physics	S1 0 3 4 3 3 6 4 23	\$2 6 3 4 2 0 6 3 24	Year 3 CIVL3106 CIVL3203 CIVL3303 CIVL3402 CIVL3505 CIVL3601 CIVL3705 CIVL3804 General Educ	Engineering Computations Structural Analysis Structural Design Geotechnical Engineering 1 Hydraulics 2 Engineering Management 1 Water Resources Transport Engineering cation Cat.B	2 3 4 3 2 3 2 2 2	2 3 4 3 2 3 2 2 2

			PW
Year 4		S1	S2
CIVL4006	Industrial Training	0	0
CIVL4101	Engineering Management 2	2	0
CIVL4203	Structural Engineering	4	0
CIVL4306	Engineering and the Environme	ent*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
Totalling		23	24
*Connect Education Cot C			

*General Education Cat.C.

3625 **Environmental Engineering – Full-time Course**

Bachelor of Engineering BE (Environmental)

Note: The General Education requirements Category C for this course are still to be determined.

		н	PW
Year 1		S1	S2
CHEM1002	Chemistry 1	6	6
CIVL1007	Engineering Practice	2	2
CIVL1203	Engineering Mechanics	4	4
GEOG1031	Environmental Processes	0	4
GEOL5100	Geology for Civil and	3	0
	Environmental Engineers		
MATH1032	Mathematics I	6	6
PHYS1989	Physics 1	4	3
Totalling		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 Educ	ation Cat.A	4	0
Totalling		24	24

		н	PW
Year 3		S1	S2
BIOS3111	Population and Community	_	_
CEIC0010	Ecology Mass Transfer and Material	0	6
CEICOOTO	Balance	2	2
CIVL3007	Environmental Fluid Mechanics	3	3
CIVL3017	Management for Environmental	•	•
	Engineers 1	2	2
CIVL3106	Engineering Computations	2	2
CIVL3402	Geotechnical Engineering	3	3 3
CIVL3705	Water Resources	3	3
CIVL3804	Transport Engineering	2	2
GEOL9110	Hydro and Environmental	_	
0	Geology	0	4
General Educa	ition Cat.B	4	0
Totalling		21	27
Year 4			
CEIC0020	Fluid/Solid Separation	2	0
INDC3070	Instrumentation and Process		
	Control	3	0
CIVL4006	Industrial Training	0	0
CIVL4007	Waste Management	3	0
CIVL4037	Communications and Ethics	0	2
CIVL4057	Management for Environmental	_	_
CIVL4605	Engineers 2	2	0
CIVL4605	Water Supply and Wastewater	•	^
CIVL4907	Engineering Project/Thesis	3 1	0 6
GEOG3042	Environmental Impact	'	0
alouou+2	Assessment	4	0
GEOL9120	Groundwater Contaminant	•	•
	Transport	4	0
LAWS3410	Environmental Law	0	4
SURV0752	Remote Sensing Techniques		
	and Applications	4	0
Plus two of the	following four elective majors:		
CEIC0030	Environmental Protection in the	_	_
00.0.404=	Process Industries	.0	6
CIVL4017	Water Engineering	0	6
CIVL4027	Geotechnical Engineering	0	6
CIVL4047 Totalling	Transport Engineering	0 26	6 24
i otaliniy		20	24

Combined Courses

Programs for combined degree courses offered in the Faculty of Engineering are listed below. In all cases material not in italic typeface refers to the BE degree component of the combined course.

3730

BE BSc in Civil Engineering - Full-time Course

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 CHEM1002 for Year 2 Chemistry subjects will be waived for students in Course 3730

Approved Programs

Geography and Environmental Chemistry

Year 1 **CHEM1808**

CIVL1106, CIVL1203, CIVL1301 GEOL5100

MATH1032

PHYS1989

Year 2

CHEM2011, CHEM2031, CHEM2041 CIVL2203, CIVL2301, CIVL2402

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

*General Education Cat. C.

Physics with Mathematics

Year 1

CHEM1808 CIVL1106, CIVL1203, CIVL1301 GEOL5100 MATH1032 PHYS1002

Year 2

CIVL2203, CIVL2301, CIVL2402 MATH2510, MATH2520, MATH2100, MATH2120 **MATH2869**

PHYS2011. PHYS2021, PHYS2031

One 56-hr or two 28-hr General Education subject/s (Cat A)

Year 3

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

Year 4

CIVL3402, CIVL3505, CIVL3601, CIVL3705, CIVL3804 **PHYS3030**

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:1

CIVL4811, CIVL4822, CIVL4833, CIVL4844, CIVL4855 Choose 1 unit from Table 1 in the Sciences Handbook at Level 11 or higher.

*General Education Cat. C.

Computing with some Mathematics

Year 1

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

Year 2

CIVL2106, CIVL2203, CIVL2301, CIVL2402 COMP1011, COMP1021 MATH2501+, MATH2510+, MATH2520+, MATH2869 One 56-hr or two 28-hr General Education subject/s Cat.A

Year 3

CIVL2505, CIVL3203, CIVL3303 COMP2011, COMP2021, COMP2031 MATH2100+, MATH2120+ SURV0441, SURV0491

One 56-hr or two 28-hr General Education subject/s Cat.B Choose .5 Level II or Level III Mathematics unit from the Sciences Handbook.

Year 4

CIVL3402, CIVL3505, CIVL3601, CIVL3705, CIVL3804 COMP3121

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 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 the Sciences Handbook at Level II or hiaher.

*General Education Cat. C.

+Students are encouraged to select higher level Mathematics units where applicable.

3146 BE(Civil) BE(Mining) in Civil Engineering and Mining Engineering - Full-time Course

The Civil Engineering component of this course is administered by the School of Civil Engineering, the Mining Engineering component is administered by the School of Mines in the Faculty of Applied Science.

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

Year 2

CIVL2106, CIVL2203, CIVL2301, CIVL2402, CIVL2505 MATH2009, MATH2869 SURV0441, SURV0491

Year 3

CIVL3106, CIVL3203, CIVL3303, CIVL3402, CIVL3505, CIVL3601, CIVL3705, CIVL3804

Year 4

CIVL4006, CIVL4203, CIVL4306, CIVL4502, CIVL4605. CIVL4704, CIVL4822, CIVL4906 **GEOL5311** MINE1320. MINE1231. MINE1420. MINE1630. SURV0580

Year 5

FLEC0802

MINE1330, MINE1131, MINE1132, MINE1140, MINE1530, MINE1740, MINE1830, MINE1940, MINE2141, MINE3040, MINE7342, MINE7440 PHYS2920

4775

BE (Civil Engineering) LLB in Civil Engineering and Law - Full-time Course

This course is administered by the School of Law.

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

Year 2

CIVL2106, CIVL2203, CIVL2402, CIVL2505 LAWS1120, LAWS7410 MATH2009, MATH2869 SURV0441, SURV0491

Year 3

CIVL3106, CIVL3203, CIVL3303, CIVL3402, CIVL3505, CIVL3601, CIVL3705, CIVL3804 LAWS1410

Year 4

CIVL4006, CIVL4203, CIVL4502, CIVL4605, CIVL4704, CIVL4306 taken concurrently with LAWS3410 LAWS1610, LAWS2160, LAWS3010 Plus one of the following elective majors: CIVL4811, CIVL4822, CIVL4833, CIVL4844, CIVL4855

Year 5

LAWS1010, LAWS8320, LAWS8820, LAWS2150, LAWS6210, LAWS7420, LAWS7430 (The research component is taken in conjunction with or after) Law electives to value 9 credit points.

Year 6

Law electives to value 24 credit points.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

CIVL0616

Structures

Staff Contact: A/Prof V. A. Pulmano

S1 L1 T2

Note/s: This is a servicing subject for courses offered by other schools and faculties.

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. Strain energy. Deflections at a single load. Shock loads. Theory of centrally loaded column and eccentrically loaded columns.

CIVL0626

Civil Engineering for Electrical Engineers

Staff Contact: A/Prof P.W. Kneen

S1 L2 T2

Note/s: This is a servicing subject for courses offered by other schools and faculties.

Includes an introduction to the various branches of civil engineering, the nature and organization 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

Staff Contact: Prof R.I. Gilbert

F L1 T1

Note/s: This is a servicing subject for courses offered by other schools and faculties.

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

Staff Contact: Dr B.S. Jenkins

S1 L1.5 T1.5

Note/s: This is a servicing subject for courses offered by other schools and faculties.

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

Staff Contact: A/Prof S. Valliappan

S2 L3

Note/s: This is a servicing subject for courses offered by other schools and faculties.

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.

CIVL0696

Mechanical Properties of Materials

Staff Contact: A/Prof P.W.Kneen

S1 L1.5

Prerequisite: MATH1032

Corequisites: MECH1400, MECH2401

Mechanical properties of materials, materials testing, tensile and compressive behaviour, modes of failure, flexural behaviour, hardness testing, ductility and impact testing, testing machines.

CIVL1007

Engineering Practice

Staff Contact: Prof D.L. Wilkinson

F L1 T1

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

Note/s: 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; organization 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

Staff Contact: A/Prof P.W. Kneen

F L1 T2

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 Staff Contact: Prof R.I. Gilbert F L2 T2

Corequisite: 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**

Staff Contact: Mr V.J. Summersby

S1 L2 T1 S2 L1.5 T.5

Prerequisites: HSC Exam Score Range Required - 2 unit English (General) 53-100, 2 unit English 49-100, 3 unit English 1-50 or 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; organization 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

Staff Contact: Dr F.S.K. Tin Loi

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 Staff Contact: Dr D.A. Luketina

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

Staff Contact: Dr R.R. Wakefield

S1 L1 T1 S2 L2 T1

Prerequisites: CIVL1106, MATH1032

Corequisite: 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 Staff Contact: Dr A.C. Heaney

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

Staff Contact: Mr V.J. Summersby

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

Staff Contact: Dr N. Gowripalan

F L2.5 T1.5

Prerequisites: CIVL1203, GEOL5002, CHEM1808

Corequisite: 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**

Staff Contact: Dr B.S. Jenkins

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

Staff Contact: Prof D.L. Wilkinson

F L2 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.

CIVL3017

Management for Environmental Engineers 1

Staff Contact: Mr V.J. Summersby

F 1.5 T.5

Prerequisites: CIVL1007, CIVL2006

Basic techniques used in the management of engineering works; purpose and principles of management. Planning techniques used in management networks, critical path method, and PERT. Operations research in management methodologies for problem solving. Theory of the management of humans. Theory of the management of organizations. Use and management of information systems.

CIVL3106

Engineering Computations

Staff Contact: Dr I.J. Somervaille

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.

Structural Analysis

Staff Contact: Dr R.E. Lawther

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

Staff Contact: Dr S.J. Foster

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

Staff Contact: Mr G. R. Mostyn

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**

Staff Contact: Dr D.A. Luketina

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

Staff Contact: Dr R.R. Wakefield

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 organizations. Use and management of information systems. Law and the law of contract.

CIVL3705

Water Resources

Staff Contact: Dr J.E. Ball F L2 T1

Prerequisite: MATH2869 Corequisite: 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

Staff Contact: Dr M.C. Dunne

FL1T1

Prerequisites: CIVL2106, MATH2869

Definitions, properties and measurements over space and time of traffic flow, traffic concentration and traffic speed. Relationships between flow, concentration and speed including definitions of mean free speed, jam concentration and maximum flow. Definition of time and space headways. Collection and analysis of headway and counting data. Overtaking rates. Capacities and delays at unsignalized intersections and roundabouts.

Definitions and concepts relating to land use-transport systems. Equations of state, traffic assignment. Traffic generation. Trip distribution. Mode choice. The concept of generalized cost. Economic evaluation.

Introduction to the nature and assessment of environmental and community impacts.

CIVL4006

Industrial Training

Staff Contact: Mr G. Nawar

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.

Waste Management

Staff Contact: Prof T.D. Waite

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

Staff Contact: Prof T.D. Waite

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.

Hvdrology

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 Engineering

Staff Contact: Prof R. Fell

S2 L4 T2

Prerequisite: CIVL3402

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

Geotechnical Engineering: Influence of geology on geotechnical behaviour, drilling, sampling, in-situ testing, testing for shear strength of soils; landslides and slope stabilization; liquefaction of soils; critical state soil mechanics, and finite element methods in geomechanics.

Field Trip: A two and a half day field trip is included as part of the subject.

CIVL4037

Communications and Ethics

Staff Contact: Prof D.L. Wilkinson

S2 L.5 T1.5

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

CIVL4047

Transport Engineering

Staff Contact: Dr P. Hickis

S2 L4 T2

Prerequisite: CIVL3804

The subject comprises 4 strands. Students must take strands A and B, each of which extends over 7 weeks (21 contact hours). In addition they must take either strand C or strand D, both of which extend over 14 weeks (42 contact hours).

A: Geometric Design of Transport Elements (i)

B: Environmental Impact of Transport (ii)

C: Transport Operations

D: Traffic Management and Control

(i): First half of session

(ii): Second half of session

CIVL4057

Management for Environmental Engineers 2

Staff Contact: Prof D.G. Carmichael

S1 L1.5 T.5

Prerequisite: CIVL3017

Introduction to industrial relations, aspects of law for environmental engineers involved in management, contract law and the administration of contracts. Business and financial management, corporate entities, basic accounting techniques, preparation and interpretation of important financial statements. Accounting for fixed assets. Local and international funding of engineering projects.

CIVL4101

Engineering Management 2

Staff Contact: Mr J.B. O'Brien

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

Staff Contact: Prof R.I. Gilbert

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.

Engineering and the Environment Staff Contact: Prof D.L. Wilkinson

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

Staff Contact: Dr A.C. Heaney

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 Staff Contact: Mr G. R. Mostvn

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

Staff Contact: Ms P.A. FitzGerald

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

Staff Contact: A/Prof B. Shackel

S1 L2 T1

Prerequisites: CIVL3402, CIVL3804

History and development of roads. Introduction to road design: elements, terminology, vehicle and driver influences. Urban roads, intersections and freeway interchanges, Road liahtina.

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

Staff Contact: Mr J.B. O'Brien

Prerequisites: CIVL2301, CIVL4101, CIVL4306

Professional level constsruction and project management skills and techniques: advanced construction technology topics and topics in the planning, design, organization, coordination, staffing, administration, control and management of construction and allied projects. State-of-the-art work associated with selected advanced topics in construction and project management.

Geotechnical Major

Staff Contact: Mr G.R. Mostyn

S2 L6 T3

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

Staff Contact: Professor R. I. Gilbert

S2 L6 T3

Prerequisites: CIVL4203, CIVL4403

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

CIVL4844

Transport Major

Staff Contact: Dr P. Hidas

S2 L6 T3

Prerequisite: CIVL4306, CIVL4704

Analytical and computer adied 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 Maior

Staff Contact: Dr J.E. Ball

S2 L6 T3

Prerequisites: CIVL3505, CIVL3705, CIVL4605

specialization 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

Staff Contact: A/Prof W.O. Yandell

S1 1 S2 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 1 S2 6

Staff Contact: A/Prof W.O. Yandell 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.

Graduate Study

There are formal graduate courses leading to the award of the degree of Master of Engineering Science 8612, Master of Environmental Engineering Science 8615, and also the Graduate Diploma in Engineering 5459. These courses are available in specialist areas including engineering construction and management, geotechnical engineering, public health engineering, structural engineering, transport engineering and water engineering. In addition, and within the Master of Engineering Science and Graduate Diploma course structures, courses are offered in the area of waste management. They can be taken internally on a full or part-time basis or externally. These courses are designed to provide engineers and scientists with the background necessary for design, treatment, handling and disposal processes for a wide range of waste streams, solve existing waste problems, and understand pertinent waste legislation. Within the Master of Engineering Science and Graduate Diploma courses, students may undertake engineering construction and management or waste management externally. Fees are payable for these distance learning courses.

Opportunities are provided for graduate research leading to the award of the degrees of Master of Engineering 2650 and Doctor of Philosophy 1630.

Course Work Programs

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
- environmental engineering
- geotechnical engineering
- public health engineering
- structural engineering
- · transport engineering
- waste management
- · water engineering

MEngSc students undertake a 9 credit project to make 30 credits. GradDip students undertake 24 credits of coursework. Full details of preferred programs in the various specialist areas are available from the School. All subjects for the Masters degrees are also offered in the Graduate Diploma programs.

8612 **Civil Engineering**

Master of Engineering Science MEngSc

Waste Management 8612 Internal 8614 External

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.

Internal Program Compulsory Subjects

Compulsory S	Subjects	C
CIVL9872	Solid Waste Management	3
CIVL9881	Hazardous Waste Management	3
CIVL9884	Environmental Engineering Science 1	3
CIVL9886	Environmental Engineering Science 3	3
FUEL5880	Unit Operations in Wastewater Sludge	
	and Solids Management	3
Project (MEng	jSc)	
CIVL9909		9
Elective Subjective		
	ing for MEngSc, 3 for GradDip)	
CEIC5630	Industrial Water and Wastewater	
	Engineering	3
CIVL9799	Environmental Geomechanics	3
CIVL9855	Water and Wastewater Analysis and	
	Quality Requirements	3
CIVL9857	Sewage Treatment and Disposal	3
CIVL9870	Hydraulics and Design of Water and	
	Wastewater Treatment Plants	3
CIVL9887	Advanced Topics in Waste Management	3
FUEL5910	Atmospheric Pollution Control	3
GEOG3042	Environmental Impact Assessment	3
GEOL9011	Hydrology	3
GEOL9012	Contaminant Hydrogeology	3 3 3
GEOL9060	Environmental Geology	3
MINE1524	Mining Conservation	3
MINE5355	Mine Fill Technology	
SAFE9242	Human Behaviour and Safety Science	3
SAFE9543	Management of Dangerous Materials	3
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Other subjects may be approved as electives by the course co-ordinator.

External Prog	ram	С
CIVL8702	Project Planning and Control	
CIVL8731	Construction/Project Management	
CIVL8855	Water and Wastewater Analysis and	
	Quality Requirements	3
CIVL8857	Sewage Treatment and Disposal	3
CIVL8872	Solid Waste Management	3
CIVL8881	Hazardous Waste Management	3
CIVL8884	Environmental Engineering Science 1	3
FUEL5881	Unit Operations in Wastewater, Sludge	
	and Solids Management	3
GEOL9012	Contaminant Hydrogeology	3
Project		
CIVL8909		9
Project		
CIVL8803		3
Note/s: MFng	Sc students undertake a 9 credit project	to

make 30 credits and external GradDip students may 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. External MEngSc students choose either CIVL8702 or CIVL8731.

8021

Master of Applied Science

MAppSc

The Master of Applied Science degree is undertaken through the Department of Applied Geology, School of Mines, in the Faculty of Applied Science. Full details are available in the Faculty of Applied Science handbook.

8615 **Master of Environmental Engineering Science**

MEnvEngSc

CIVL9884

Compulsory Subjects

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.

Environmental Engineering Science 1

CIVL9885	Environmental Engineering Science 2	3
CIVL9888	Environmental Management	3
CIVL9889	Environmental Law and Economics	3
CIVL9909	Project	9
Elective Sub	ject Groupings	
Waste Manag	gement (Liquids)	
CEIC5630	Industrial Water and	
	Wastewater Engineering	3
CIVL9851	Unit Operations in Public Health	
	Engineering	3
CIVL9857	Sewage Treatment	3
CIVL9858	Water Quality Management	3

Waste Manag	rement (Solids)	С
CIVL9872	Solid Waste Management	3
CIVL9881	Hazardous Waste Treatment	3
CIVL9887	Advanced Topics in Waste Management	3
SAFE9543	Management of Dangerous Materials	3
Elective Subj	ect Groupings	
Water Engine	ering	
CIVL9835	Coastal Engineering 1	3
CIVL9836	Coastal Engineering 2	
CIVL9858	Water Quality Management	3 3
CIVL9875	Hydrological Processes	3
CIVL9876	Water Resource Modelling	3
CIVL9880	Groundwater Modelling	3
Geotechnical	Engineering	
CIVL9788	Site Investigation	3
GEOL9030	Geological Engineering	
GEOL9060	Environmental Geology	3
GEOL9080	Groundwater Geophysics	3 3 3
GEOL9320	Geopollution Management	3
Transport Eng	_	
CIVL9407	Transport Systems Design (Non-Urban)	3
CIVL9408	Transport Systems Design (Urban)	3
CIVL9420	Special Topic in Transport Engineering	3
Management	, , , , , , , , , , , , , , , , , , , ,	_
CIVL9701	Economic Decision Making in	
···	Engineering	3
CIVL9702	Project Planning and Control	
CIVL9705	Project Management Through People	3 3 3 3 3
CIVL9706	Human Resources Management	3
CIVL9710	Engineering Risk Management	3
CIVL9725	Engineering Financial Management	3
CIVL9726	Legal Studies and Professional Practice	3
CIVL9731	Construction/Project Management	3
Land and Rive	er Management	
GEOG9310	River Management	
GEOG9320	Soil Degradation and Conservation	
GEOG9300	Vegetation Management	
Subjects offere	ed within the MEngSc degree program as	-ρ

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.

8617 Engineering Construction and Management

Master of Engineering Science (External)

MEngSc

C

3

Subjects offered are the same as those for the Graduate Diploma (External). See following.

Graduate Diplomas in Civil Engineering

Details of the recommended programs of study may be obtained from the Head of School. All subjects offered in the Masters programs can also be taken in the Graduate Diploma programs subject to the approval of the course coordinator.

5454 **Engineering Construction and Management**

Graduate Diploma (External) GradDip

Subjects are selected from the following list. All subjects are not offered each year. All subjects are worth 3 credits.

CIVL8701	Economic Decision Making in Engineering
CIVL8702	Project Planning and Control
CIVL8703	Quality and Quality Systems
CIVL8705	Project Management through People
CIVL8706	Human Resources Management
CIVL8707	Contracts Management
CIVL8710	Engineering Risk Management
CIVL8714	Special Topic in Engineering Management
CIVL8723	Construction Design
CIVL8724	Construction Engineering and Technoogy
CIVL8725	Engineering Financial Management
CIVL8726	Legal Studies and Professional Practice
CIVL8727	Construction Estimating and Tendering
CIVL8728	Special Topic in Construction
CIVL8731	Construction /Project Management
CIVL8909	Project

Subjects starting with 8 are the external equivalents of the

Subject Descriptions

internal subjects starting with a 9.

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

CIVL8803 Project (external) GradDip

A critical review of literature on a selected topic or a minor design project.

5459 Waste Management

Graduate Diploma 5459 Internal 5498 External

Department of Transport Engineering

Transport, Environment, Community Staff Contact: Dr S.E. Samuels

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.

Theory of Land Use Transport Interaction

Staff Contact: Dr S.E. Samuels
C3 SS

Note/s: Not offered in 1994

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

Staff Contact: Dr S.E. Samuels

SS C3

Note/s: Not offered in 1994

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)

Staff Contact: Dr S. E. Samuels

C3 SS

Note/s: Not offered in 1994

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)

Staff Contact: Dr S.E. Samuels

C3 SS

Note/s: Not offered in 1994

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 Staff Contact: Assoc. Prof B. Shackel

C3 S1

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

Staff Contact: Prof J.A. Black

C3 SS

Note/s: Not offered in 1994

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

Staff Contact: Dr U. Vandebona

C3 S1

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

Staff Contact: Dr U. Vandebona

C3 S2

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

Staff Contact: Dr M.C. Dunne

CAF

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

Staff Contact: Prof J.A. Black

C6 F

Note/s: Not offered in 1994

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.

Statistics for Transport Studies Part 1

Staff Contact: Prof J.A. Black C3 SS

Note/s: Not offered in 1994

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

Staff Contact: Prof J.A. Black

C3 SS

Prerequiste: Assumed knowledge CIVL9418

Note/s: Not offered in 1994

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

Staff Contact: Prof J.A. Black C3 SS

Note/s: Not offered in 1994

This syllabus changes to allow presentation of a special topic of current interest particularly by visitors with recognized expertise in the topic.

Department of Engineering Construction and Management

CIVL9701/8701

Economic Decision Making in Engineering Staff Contact: Dr R. R. Wakefield

C3 S1

Project initiation and development, feasibility studies, planning; review of practical engineering decision-making problems and relevant techniques; engineering economics, benefit/cost analysis, methods of ec onomic appraisal; consideration of inflation and taxation in investment decisions; management decision processes, decision theory, utility; micro economic theory; life-cycle costing, asset management; maintenance management; models and techniques to assist the manager; modelling and regression, forecasting; optimization (linear programming, non-linear programming, dynamic programming), inventory models, transportation, assignment and allocation, heuristic techniques, multiple and single objectives, applications; multiple objective planning; BOOT and related project delivery systems.

CIVL9702/8702 Project Planning and Control Staff Contact: Dr R. R. Wakefield

Staff Contact: Dr R. R. Wakefield C3 S2

The planning process; the link between planning and control; short term field planning and management strategies; control systems; 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; procurement, inventory, supply management and control.

CIVL9703/8703

Quality and Quality Systems

Staff Contact: Dr R. R. Wakefield

C3 S2

Quality management principles, practice and responsibilities; applications; quality systems documentation, manuals, implementation and procedures; quality assurance; quality control; relevant codes on quality; total quality management, quality circles and related approaches; quality requirements in contracts; continuous improvement.

CIVL9705/8705

Project Management through People

Staff Contact: Prof D. G. Carmichael
C3 SS

Note/s: Not offered in 1994

The role of people in the management and execution of projects. Responsibilities, authorities and accountabilities. Staffing; the selection and sources of project personnel; their interaction, roles, duties and communications. Personnel skills.

CIVL9706/8706

Human Resources Management

Staff Contact: Mr J. B. O'Brien

C3 S2

The development of skills for the management of people and their workplaces; industrial system, relations, management and relevant history; current issues and practices in the construction industry (multiskilling, enterprise agreements), health and safety issues, statutes and management; the recognition of people as the basic unit of engineering productivity; the structure and function of organizations, management of group action; work delegation across organizational boundaries; interpersonal skills, conflict management; learning curves; motivation.

CIVL9707/8707

Contracts Management

Staff Contact: Prof D. G. Carmichael C3 S1

Elements of contract law and a contract; construction contracts; contract documents including specifications; procurement methods (contract or project delivery strategies); tendering; time in contracts; variations; payments; rights and obligations of the superintendent; planning and programming; risk management and insurance; dispute resolution and dispute avoidance; claims.

CIVL9710/8710 Engineering Risk Management Staff Contact: Mr G. Nawar

C3 S1

Introduction to the concept of risk and decision making under conditions of uncertainty; project objectives and planning, risk/factors affecting project performance; risk identification in engineering processes; human error,

natural hazards and unforeseen risks; risk evaluation and quantification methods; relevant statistical techniques; risk avoidance and minimisation; financial risk, portfolio theory, risk sharing and financing; ambient and acceptable risk levels; insurances.

CIVL9714/8714

Special Topic in Engineering Management

Staff Contact: Prof D.G. Carmichael

C3 SS

Note/s: Not offered in 1994.

A series of lectures from industry experts or visiting specialists in current and advanced engineering management. This subject is only given when an appropriate specialist is available, and is not offered every year.

CIVL9723/8723

Construction Design

Staff Contact: Dr R.R. Wakefield

C3 SS

Note/s: Not offered in 1994.

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; queueing and simulation models; work study (method study and work measurement) procedures; productivity; job planning, layout planning, capacity planning; planning and design of production systems (construction oriented); reliability, availability, applications.

CIVL9724/8724

Construction Engineering and Technology

Staff Contact: Mr J.B. O'Brien

C3 S2

Structure of the construction industry; 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.

CIVL9725/8725

Engineering Financial Management

Staff Contact: Mr V.J. Summersby

C3 S1

Engineering financial planning, control of labour, plant and materials. Insurances. Financial accounting. Project finance and taxation. Management accounting techniques and cost controls.

CIVL9726/8726

Legal Studies and Professional Practice

Staff Contact: Prof D.G. Carmichael

C3 SS

Note/s: Not offered in 1994

Nature and sources of law, court procedures, interpretation of documents, evidence, technical opinions, expert witness; company law; duties of an engineer; tort, professional liability; trade practices and consumer legislation; ethics.

CIVL9727/8727

Construction Estimating and Tendering

Staff Contact: Prof D.G. Carmichael

C3 S2

Estimating procedures, estimating cost of labour plant and materials, indirect costs and overheads, profit; preparation of cost estimates for a engineering projects; the conversion of an estimate into a tender; bidding strategies and models; the tendering process; marketing.

CIVL9728/8728

Special Topic in Construction

Staff Contact: Mr V.J. Summersby

C3 SS

Note/s: Not offered in 1994

A construction topic presented in depth by industry experts or visiting specialists. This subject is only given when an appropriate specialist is available, and is not offered every year.

CIVL9731/8731

Construction Project Management

Staff Contact: Mr J.B. O'Brien

C3 S1

An overview of construction/project management; the nature of engineering and construction projects; the project life cycle; the project team, organizational and behavioural aspects; the construction/project manager; behavioural aspects of construction/project management; the organization and management of project resources; project success evaluation techniques; project delivery including fast track projects; management information and decision support systems; case studies in construction/project management; value management/engineering; management theory and processes; relationship to general management; functions of construction/project management.

CIVL9732

Masonry Construction, Design and Materials

Staff Contact: Mr G. Nawar

C3 SS

Note/s: Not offered in 1994

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.

Department of Geotechnical Engineering

CIVL9776

Rock Mechanics

Staff Contact: A/Prof S. Valliappan

C3 SS

Note/s: Not offered in 1994.

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

Staff Contact: A/Prof S. Valliappan

C3 S1

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.

CIVL9783

Pavement Materials

Staff Contact: A/Prof W.O. Yandell

C3 S2

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

Staff Contact: A/Prof B. Shackel

C3 S1

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 characterization 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

Staff Contact: A/Prof W.O. Yandell

C3 S2

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

Staff Contact: A/Prof B. Shackel

C3 SS

Note/s: Not offered in 1994

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

Staff Contact: Prof R. Fell

C3 S1

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

Staff Contact: Prof R. Fell

C3 S2

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

Staff Contact: Mr G.R. Mostyn

C3 S1

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.

Foundation Engineering 2

Staff Contact: A/Prof S. Valliappan

C3 S2

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

Staff Contact: Dr N. Khalili

C3 S1

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.

Department of Structural Engineeering

CIVI 9799

Environmental Geomechanics

Staff Contact: Mr G.E. Swarbrick

C3 S2

Dispersive soils, hydrological cycle, partly saturated flow through soils, advective-dispersive transport, acid mine drainage, leachate plumes, design and construction of waste dump covers and liners, site remediation and leachate collection and treatment.

CIVL9802

Elastic Stability 1

Staff Contact: Dr R.E. Lawther

C3 S2

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

Staff Contact: Dr R.E. Lawther

C3 SS

Note/s: Not offered in 1994.

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

Staff Contact: Dr F. Barzegar

C3 S2

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

Staff Contact: Prof R.I. Gilbert

C3 SS

Note/s: Not offered in 1994.

Vibration of buildings. Earthquake and blast loading. Bridges under moving loads. Vibration effects in foundations. Generalized dynamics and Lagrange's equations.

CIVL 9806

Prestressed Concrete 1

Staff Contact: Dr M.M. Attard

C3 S

Basic concepts. Methods of prestressing. Design for serviceability. Design for flexural and shear strength. Time analysis of concrete structures. Losses of prestress. Anchorage zones. Design procedures.

CIVL9807

Prestressed Concrete 2

Staff Contact: Prof R.I. Gilbert

C3 S2

Analysis and design of statically indeterminate beams and frames. Methods of securing continuity. Composite structures. Two-way slab systems. Compression and tension members.

CIVL9809

Reinforced Concrete 1

Staff Contact: Dr S.J. Foster

C3 S1

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

Staff Contact: Prof R.I. Gilbert

C3 S2

Detailing of members and connections for strengthened serviceability. Strut and tie modelling. Applications of limit theorems to structural concrete. Collapse methods of design of slabs. Upper and lower bound methods. Deep beams and corbels. Joints. Temperature effects.

CIVL9814

Analysis of Plates and Shells

Staff Contact: A/Prof V.A. Pulmano

C3 SS

Note/s: Not offered in 1994.

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

Staff Contact: Prof R.I. Gilbert

C3 SS

Note/s: Not offered in 1994.

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

Staff Contact: A/Prof F.S.K. Tin Loi

C3 S1

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**

Staff Contact: A/Prof F.S.K. Tin Loi

C3 S2

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

Staff Contact: Dr I.J. Somervaille

C3 S1

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

Staff Contact: AProf P.W. Kneen

C3 S2

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

Staff Contact: A/Prof M.A. Bradford

C3 S1

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

Staff Contact: A/Prof M.A. Bradford

C3 SS

Note/s: Not offered in 1994.

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.

Department of Water Engineering

CIVL9824

Advanced Concrete Technology

Staff Contact: Dr N. Gowripalan

Basic structure of concrete. Morphology of the products of different cementitious materials. Fresh concrete properties. Code and special criteria for acceptance and rejection of concrete. Quality control of concrete. Deterioration mechanisms and durability of concrete. Non-destructive testing. High strength concrete and special concretes. Special cements and mixtures. Long-term effects in concrete. Mix design theories and practical applications. Placing of concrete.

CIVL9830

Hydromechanics

Staff Contact: Dr D.A. Luketina

C3 S2

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

Staff Contact: A/Prof R.J. Cox

C3 SS

Note/s: Not offered in 1994

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

Staff Contact: Dr B.S. Jenkins

C3 SS

Note/s: Not offered in 1994

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

Staff Contact: Dr B.S. Jenkins

C3 S2

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

Staff Contact: A/Prof R.J. Cox

C3 S1

Theory of periodic waves as applied to tides and wind generated waves in water of varying depths. Wave and tide prediction.

Coastal Engineering 2

Staff Contact: A/Prof R.J. Cox

C3 S2

Wave forces on structures, shore processes and beach erosion. Estuarine hydraulics, wave and tide models.

CIVL9847

Water Resources Policy

Staff Contact: Dr J.E. Ball

C3 SS

Note/s: Not offered in 1994

Resource economics, water supply, water demand, multiple objective planning, multiple purpose projects, water law, water administration, case studies.

CIVL9848

Water Resource System Design

Staff Contact: Prof T.D. Waite

C3 SS

Note/s: Not offered in 1994

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

Environmental Hydrology

Staff Contact: A/Prof I. Cordery

C3 S1

Total catchment management; water policy; low flows and interaction between hydrology and water quality; land use effects; erosion processes; introduction to pollutant loading estimation (sources); quality models; rainfall impacts on water quality, accuracy of data; introduction to water quality treatment processes.

CIVI 9851

Unit Operations in Public Health Engineering

Staff Contact: Mr P.J. Bliss

C3 S1

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

Staff Contact: Mr P.J. Bliss

C3 SS

Note/s: Not offered in 1994

Water collection, transmission and distribution systems – layout design and analysis, reservoirs, pumping. Sewage collection design and analysis – capacities, corrosion, pumping.

CIVL9855/8855

Water and Wastewater Analysis and Quality Requirements

Staff Contact: Ms P.A. FitzGerald

C3 S1

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

Staff Contact: Ms P.A. FitzGerald

C3 S2

Note/s: Students specializing in Public Health Engineering normally study BIOT7100 Biological Principles.

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

CIVL9857/8857

Sewage Treatment and Disposal

Staff Contact: Mr P.J. Bliss

C3 S2

Note/s: Students specializing in Public Health Engineering normally study BIOT7100 Biological Principles.

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

Staff Contact: Ms P.A. FitzGerald

C3 SS

Note/s: Not offered in 1994

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

Staff Contact: Dr R.I. Acworth

C3 SS

Occurrence and extraction of groundwater, investigation and drilling methods, systems approach, optimization techniques, conjunctive use studies, quality of groundwater.

CIVL9861

Environmental and Engineering Geophysics

Staff Contact: Dr R.I. Acworth

C3 S1

Introduction to available geophysical techniques. Electrical properties of water, soils, rocks and contaminants over the frequency range 1 Hz to GHz. Electrical conductivity profiling methods - resistivity and electromagnetic; electrical resistivity soundings; 2-D electrical resistivity field methods and FD modelling. Time domain electromagnetic methods; borehole logging using electrical, electromagnetic, nuclear, caliper and fluid logs. Use of ground probing radar; gravity methods; seismic refraction-field techniques and the generalised reciprocal interpretation methods; time domain reflectometry and nuclear methods for soil mositure determination and contaminant investigation. Case studies from groundwater resource, salinity, engineering and contamination fields.

Fluvial Hydraulics

Staff Contact: Dr B.S. Jenkins

C3 S1

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

Staff Contact: Prof D.L. Wilkinson

C3 SS

Note/s: Not offered in 1994

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

Staff Contact: Ms P.A. FitzGerald

C3 SS

Note/s: Not offered in 1994

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

Staff Contact: Mr P.J. Bliss

C3 SS

Corequisites: CIVL9856, CIVL9857 or equivalent

Note/s: Not offered in 1994

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 Staff Contact: Prof T.D. Waite

C3 SS

Prerequiste: CIVL9851, CIVL9855, CIVL9868 or equivalent

Note/s: Not offered in 1994

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.

CIVL9872/8872

Solid Waste Management

Staff Contact: Mr S.J. Moore

C3 S2

Characterization of municipal solid waste; collection; transfer stations; waste minimization 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

Staff Contact: A/Prof I. Cordery

C3 S1

Introduction to hydrological cycle and energy balance: meteorology; precipitation processes, interception and infiltration, storm runoff processes, groundwater flow, E-T.

CIVL9876

Water Resource Modelling

Staff Contact: A/Prof I. Cordery

C3 S1

Water resources data - sources, errors, corrections; introduction to storage-yield relationships for reservoir design; extension of records; stochastic models; stochastic reservoir analysis; deterministic catchment models; model calibration and verification; application of conjunctive use systems; social interactions-economics, politics, public participation.

CIVL9877

Flood Design

Staff Contact: Dr J.E. Ball

C3 S1

Introduction to flood estimation; frequency analysis of hydrological data; flood frequency analysis; design rainfall data; hydrograph analysis; loss models; regional flood methods; rational methods; time-area methods; UH methods: extreme floods.

CIVL9878

Flood Modelling

Staff Contact: AProf I. Cordery

C3 S1

Introduction to modelling; introduction to flood routing, nonlinear catchment models; kinematic wave models; application and calibration of models; urban hydrology.

CIVL9880

Groundwater Modelling

Staff Contact: Dr R.I. Acworth

C3 S1

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.

CIVL9881/8881

Hazardous Waste Management

Staff Contact: Mr S.J. Moore

C3 S2

Waste audits and characterization 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.).

CIVL9884/8884

Environmental Engineering Science 1 Staff Contact: Ms P.A. FitzGerald

C3 S1

Water chemistry: Basic concepts in aqueous chemistry: pH buffering, alkalinity, chemical equilibrium, kinetics of chemical reactions, neutralisation and precipitation, Henry's Law.

Introduction to Microbiology: Structure and metabolism of cells and micro-organisms; monitoring methods for pathogens and indicator organisms; impact of water and wastewater treatment on disease transmission.

CIVL9885

Environmental Engineering Science 2

Staff Contact: Prof D.L. Wilkinson

C3 S1

Classification of soils and improvement of the engineering properties of soils. Aspects of soil chemistry relevant to contaminant behaviour of soild.

Fundamentals of dispersion common to all environmental media (air,water,soil).

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 soils.

CIVL9887

Advanced Topics in Waste Management

Staff Contact: Mr S.J. Moore

C3 SS

Prerequisites or corequisites: CIVL9872, CIVL9881

Note/s: Not offered in 1994

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 characterization and remediation; topics of interest to visiting academics; case studies by way of assignments.

CIVL9888

Environmental Management and Economics

Staff Contact: Prof D.L. Wilkinson

C3 S2

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

Staff Contact: Prof D.L. Wilkinson

C3 S2

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.

CIVL9901

Special Topic in Civil Engineering

C3 SS

Note/s: Not offered in 1994

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

C3 S2

Note/s: Not offered in 1994

This syllabus changes to allow presentation of a special topic of current interest particularly by visitors with recognized expertise in the topic.

CIVL9909/8909

Project

C9

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

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. The School of Computer Science and Engineering and the restructured School of Electrical Engineering have 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.

The School, together with the School of Electrical Engineering, jointly administers the BE Computer Engineering 3645. It also offers a major in Computer Science in the BSc (Science and Mathematics) 3970, combined BE BSc degree courses 3681, 3725, 3726, combined BA BE course 3722 and combined BSc LLB course 4770.

The formal graduate courses offered are the Master of Cognitive Science 8155, Master of Computer Science 8680, Master of Information Science 8508. Graduate Diploma in Computer Science 5452, Graduate Diploma in Information Science 5453 and Graduate Diploma in Computer Education 5464. Opportunities are provided for graduate research leading to the award of the degree of Master of Engineering 2665 and Doctor of Philosophy 1650.

Summary of Undergraduate Courses

Normal full-time

Course and Degree(s)	Duration
3645 BE in Computer Engineering	4 years
3722 BE BA in Computer Engineering	5 years
3725 BE BSc in Electrical Engineering	5 years
3726 BE BSc in Computer 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

Course and Degree 3970 BSc

Duration

 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. The BSc degree course is described in the Science Handbook. Majors are offered in Computer Science and Psychology, and Computer Science and Philosophy; for the BA and BSocSc degree courses, see the Arts and Social Sciences Handbook and for the BSc LLB course, see the Law Handbook.

Undergraduate Study

Course Outlines

3645 Computer Engineering – Full-time Course

Bachelor of Engineering BE

Whilst jointly administered by 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.

		н	IPW
Year 1		S1	S2
ACCT9001	Introduction to Accounting A	1.5	0
ACCT9002	Introduction to Accounting B	0	1.5
COMP1011	Computing 1A	6	0
COMP1021	Computing 1B	0	6
ELEC1011	Electrical Engineering 1	0	6
MATH1032	Mathematics 1 or	6	6
MATH1042	Higher Mathematics 1	0	0
MATH1081	Discrete Mathematics	6	0
PHYS1969	Physics 1 (Electrical Engineeri	ng) 6	6
Totalling		25.5	25.5
Year 2			
COMP2011	Data Organization	5	0
COMP2021	Digital System Structures	5	0
COMP2031	Concurrent Computing	0	5
ECON1103	Microeconomic Principles	3.5	0
ELEC2011	Systems Theory	0	2.5
ELEC2030	Circuit Theory + Laboratory	3.5	0
ELEC2033	Analog Electronics + Laborato	ry 0	4.5
ELEC4532	Integrated Digital Systems	0	5

		H	PW
Year 2		S1	S2
MATH2400	Finite Mathematics	2	0
MATH2510	Real Analysis or		
MATH2610	Real Analysis	2.5	0
MATH2520	Complex Analysis or		
MATH2620	Complex Analysis	2.5	0
MATH2849	Statistics SE1	0	2
MATH3150	Transform Methods	0	2
PHYS2959	Introductory Semiconductor		
	Physics	1.5	0
General Education Cat. A		0	4
Totalling		25.5	25

LIDNA

Students must attain a mark of 70CR or better in MATH1032 or MATH1042 in order to do Higher Level MATH subjects.

Year 3			
COMP3111	Software Engineering	5	0
COMP3121	Algorithms and Programming		
	Techniques	0	5
COMP3211	Computer Organization and		
	Design	4	0
COMP3221	Microprocessors and Interfacing	0	5
ELEC3032	Signals, Spectra and Filter +		
	Lab.	3.5	0
MATH2601	Linear Algebra or		
MATH2501	Linear Algebra	4.5	0
MATH2859	Statistics SE2	2.5	0
MATH3141	Numerical and Mathematical		
	Methods	0	3.5
COMP0001	Total Quality Management	0	3
Option A		5	0
Option B		0	5
General Education Cat. B		0	4
Totalling		24	25.5
Recommended Options for the four streams		are	listed

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

Note: COMP3131 Parsing and Translation, COMP3231 Operating Systems and COMP3331 Computer Networks and Applications must be taken either in year 3 or year 4

Students undertaking computing electives only must complete at least two Level 4 Computer Science subjects in year 3 and/or year 4.

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

HDW

			nrw	
Year 4		S1	S2	
5 Professional Electives		15	10	
COMP4903	Industrial Training	0	0	
COMP4910	Thesis Part A	7	0	
COMP4911	Thesis Part B	0	14	
IROB2721	Managing People (General			
	Education Cat.C)	4	0	
Totalling	·	26	24	

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.

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
Electronics S	tream

ELEC4351	Digital Communication and Computer Networks
ELEC4503	Advanced Electronic Circuits
ELEC4512	Semiconductor Devices
Electronics St	ream
ELEC4042	Signal Processing
ELEC4503	Advanced Electronic Circuits
ELEC4512	Semiconductor Devices
ELEC4522	Microelectronics Design and Technology
ELEC4540	Applied Photovoltaics
COMP4215	VLSI Systems Architecture and Design
Systems and	Control Stream
EÍ ECANA2	Signal Processing

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

Computing Stream

Level 3 Comp	uter 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 (Computer Engineering)
COMP4012	Occasional Elective (Computer Engineering)
COMP4121	Parallel Algorithms and Architectures
COMP4131	Programming Language Semantics
COMP4141	Theory of Computation
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
COMP4415	Artificial Intelligence: Foundations
COMP4416	Artificial Intelligence: Machine Learning
COMP4444	Neural Networks

Combined Courses

Students in Computer 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 Computer Science and 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 average (a creditable performance, ie 65%) 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 3726 should contact the School of Computer Science and Engineering before completing the Year 2 enrolment. Students may opt to join the BE BA course (3722) in year 1, whereas transfer to 3726 normally occurs after year 2.

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 Computer Science and 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 3722 and 3726 each year is arranged by the School of Computer Science and Engineering.

3722 BE BA in Computer Engineering

With this combined degree course students can add their choice of Arts program to the standard, professionally accredited engineering course offered by the School of Computer Science & Engineering. The full range of Arts programs is available.

Because the engineering and arts programs have common content, such as mathematics and physics, only one more year of study is normally required to gain the additional qualification of Bachelor of Arts.

Eligibility

Anyone who meets the entry requirements for both Engineering and Arts is eligible for the combined course. Students may enter directly in first year or may apply to transfer from the normal engineering course later, although with late transfer it might not be possible to complete the course in minimum time.

Organization

The BE BA course is administered by the School of Computer Science & Engineering.

Students should start discussing their program with representatives of the School and the Faculty of Arts and Social Sciences as soon as possible - preferably well before enrolment. Enquiries should be directed to the Executive Assistant to the Head of School of Computer Science & Engineering and the Executive Assistant to the Dean of the Faculty of Arts and Social Sciences.

Students should work out for themselves the Arts program they would like to add to their chosen engineering course. The Arts & Social Sciences Faculty Handbook describes the options, and the School of Computer Science & Engineering can supply sample programs showing what previous students have arranged.

There are no special rules on what to include in each year. Students should schedule the arts and engineering components to suit their preferences while meeting the constraints of timetables and pre-requisites. The sample programs can help here too.

The Arts component must be approved by the Faculty of Arts and Social Sciences.

The final program and schedule must be approved by the School of Computer Science & Engineering.

Rules

1. In addition to the BE course, students must complete a major sequence offered within the BA course and meet the additional requirements listed below:

Faculty which provides the chosen major

Faculty of Arts and Social Sciences:

Arts Credit Points required (minimum) 48 total, including major sequence

Other Faculties:

Major sequence plus at least 12 Credit Points from Schools of the Faculty of Arts and Social Sciences

Mathematics majors are not usually permitted. BE BSc combined degrees are more appropriate for this.

2. The requirements of the General Education Program must be met. In some cases subjects within the combined course may satisfy the Category A and/or Category B guidelines. Students should consult the Centre for Liberal and General Studies for advice.

Note that exemption from the General Education Category A and Category B requirements for the BE BA program will not be available to students who withdraw from the combined program and revert to the BE or BA course.

The Category C General Education requirement is satisfied as part of the final year BE Computer Engineering program.

- 3. There will be a testamur for each part of the combined degree course.
- 4. Students who complete the BE program first may proceed to graduation with the degree of Bachelor of Engineering in the usual way, subject to the satisfaction of the General Education requirement.
- Students who complete the requirements for their Arts program and the first two years of the BE program may proceed to graduation with the degree of Bachelor of Arts.

3726 BE BSc in Computer Engineering

Students who achieve a creditable performance in the first two years of their Computer Engineering course many apply to transfer to the combined Bachelor of Engineering/Bachelor of Science BE BSc course. The combined degree course normally requires an additional year of study and enables students to complete a major sequence in Mathematics or Physics in the Faculty of Science while completing their studies in Computer Engineering.

Students wishing to enrol in the combined course may do so only on the recommendation of the Head of School and with the approval of the Board of Studies in Science and Mathematics. Because of the need to include appropriate pre-requisites, students considering course 3726 should contact the School of Computer Science & Engineering before completing their Year 2 enrolment. Application to transfer to the combined degree course must be made in writing to the Head of School at the end of Year 2.

After completing Years 1, 2 and 3 (modified where necessary as indicated below) of the Computer Engineering course, students in their fourth year complete a specific program consisting of four Level III Science units from related disciplines, the appropriate General Education electives and no less than four other Level II or Level III units. The subjects chosen should be in accord with the rules of the BSc course 3970 leading to a major in Mathematics or Physics. In their fifth year students

Year 1 (Standard Program for course 3645)

The program below outlines the course of study:

ACCT9001, ACCT9002 COMP1011, COMP1021, ELEC1011. MATH1042 or MATH1032, MATH1081, PHYS1969

General Education (Category A).

Year 2

COMP2011, COMP2021, COMP2031, ECON1103. ELEC2011, ELEC2030, ELEC2033, ELEC4532, MATH2400, MATH2610, MATH2620, MATH2849, MATH3150. PHYS2959.

complete Year 4 of the Computer Engineering course 3645.

For Physics majors the 1.5 hour subject PHYS2959 must be replaced by the 4.5 hour subject PHYS2989 Solid State Physics. Mathematics subjects may be taken at the ordinary level.

Year 3

COMP3111, COMP3121, COMP3211, COMP3221, ELEC3032. MATH2601, MATH2859, MATH3141

Elective subjects in Computer Science and/or Electrical Engineering, General Education (Category B).

Mathematics majors should take the higher level subject MATH2601 and are required to add MATH2110 Vector Analysis to their program, as a Mathematics pre-requisite, in place of General Education which will be taken in Year

Physics majors are required to add the following subjects to their program in place of General Education and a five hour Computer Science subject in Session 1 (these will be taken in Year 4):

PHYS2979 Electromagnetic Theory

PHYS2999 Mechanics and Thermal Physics

MATH2100 Vector Calculus

Year 4

Mathematics

56-hour General Education subject (Category B).

Choose at least 5 Mathematics units, 4 of which are Level

Choose 3 Level II or Level III units from those available in Program 1000 of course 3970 (see Sciences handbook for details).

Physics

or

56-hour General Education subject (Category B).

Choose 7 Level II or Level III units from those available in program 0100 of course 3970 of which four must be Level III Physics units chosen to include PHYS3010, PHYS3021, PHYS3030 and PHYS3060.

Computer Science subject deferred from Year 3 of the Computer Engineering course.

Year 5

Year 4 of the Computer Engineering course.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

COMP0001

Total Quality Management for Computer Engineering Staff Contact: Prof G. Hellestrand

S2 HPW3

Prerequisites: MATH2859

Presentation of the relevant statistical methods underlying quality management. Understanding processes. Instrumenting processes. Identifying indicators for hardware and software. Implementing a quality program relevant to computer engineering. Experimenting with processes: principles of experiment design, analysis of data from experimentation. Presentation of industrial experiences and best practice.

A group project is undertaken by students to demonstrate the practical application of TQM in both hardware and software design and manufacture.

COMP1011

Computing 1A

Staff Contact: Dr N. Parameswaran

S1 or S2 HPW6

Prerequisites: as for MATH1032

Corequisites: MATH1032 or MATH1042 Note/s: Excluded COMP1811, 6.611, 6.600

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

COMP1021 Computing 1B

Staff Contact: Dr J. Shepherd

S1 or S2 HPW5

Prerequisites: COMP1011

Note/s: Excluded COMP1821, 6.621, 6.021D

Introduction to procedural programming style and comparison with functional programming. Control structures: selection, recursion and iteration. Abstract Data Types: lists, stacks, queues, trees. Implementation in a procedural language (Modula-2) using linked structures. Searching and sorting. The layered model of a computer. instruction set, execution cycle, data storage, assembly language programming.

COMP2011

Data Organization

Staff Contact: Dr G. Whale

S1 or S2 HPW5

Prerequisites: COMP1021 or COMP1821

Note/s: Excluded 6.641

Data types and data structures: abstractions and implementations. Data Representation: logical and physical. Files: access methods, implementation, external data structures. Primary and secondary memory: performance, management policies. Data encapsulation and information hiding; introduction to object orientation.

COMP2021

Digital System Structures

Staff Contact: Dr G. Heiser

S1 or S2 HPW5

Prerequisites: COMP1021 or COMP1821

Note/s: Excluded ELEC2012

Digital Systems: switches and gates, boolean algebra, minimisation techniques, combinational and sequential design, timing analysis, finite state machines; analysis, design and realisation of modest digital subsystems, understanding major subsystems in a model computer. Assembly language programming: translation of higher level programming abstractions and data structures to a real computer using an assembler as a target; study of the relationships between the programming model and the hardware model of a computer; understanding of instruction execution.

COMP2031

Concurrent Computing

Staff Contact: Dr J. Olszewski

S1 or S2 HPW5

Prerequisites: COMP1021 or COMP1821

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 deadlock, detection of termination. Protocols for data transfer.

COMP3111

Software Engineering

Staff Contact: Mr K. Robinson

S1 or S2 HPW5

Prerequisites: COMP2011

Note/s: 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 is undertaken.

COMP3121

Algorithms and Programming Techniques

Staff Contact: Dr A. Goswami S2 HPW5

Prerequisites: COMP2011

Note/s: Excluded 6.642, 6.660G, COMP9101

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

Staff Contact: Mr K. Robinson

Prerequisites: COMP2011

Note/s: Excluded 6.643, 6.664G, COMP9102

Syntax-directed parsing and translation of well-structured objects encountered in computing. 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, attributed-grammars, abstract syntax, unparsing. Lexical analysis: finite-state grammars, finite-state machines, regular expressions, lexical analyzer generators.

COMP3211

Computer Organization and Design

Staff Contact: Prof G. Hellestrand

S1 HPW4

Prerequisites: COMP2021 or ELEC2021

Note/s: Excluded 6.654G, COMP9211

Combinational and sequential circuit design: synchronisation, communication and arbitration; register transfer specification (Modal). Arithmetic Design Strategies. Memory Organization: physical and virtual address space; 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; coding theory.

COMP3221

Microprocessors and Interfacing

Staff Contact: Dr S. Matheson

S2 HPW5

Prerequisites: COMP2021

Note/s: Excluded 6.0318, 6.060G, 6.613, 6.732E,

ELEC3020, COMP9221

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

Staff Contact: Mr S. Russell

S1 or S2 HPW5

Prerequisites: COMP2011, COMP2031 or ELEC3020

Note/s: Excluded 6.632, 6.672, COMP9201

Operating system organization and services. *Process management:* scheduling, synchronisation and communication. *Memory management:* segmentation, paging and virtual memory. Storage management. File systems. Protection and security. Distributed operating systems and file systems. Case studies: UNIX and Mach.

COMP3311

Database Systems

Staff Contact: Dr A. Ngu

S1 HPW5

Prerequisites: COMP2011

Note/s: Excluded 6.005G, 6.633, 6.659G, 19.608,

COMP9311.

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

COMP3321

Business Systems Organization

Staff Contact: School Office

S2 HPW5

Prerequisites: COMP2011

Note/s: Excluded 6.647, 6.661G. Not offered 1994.

Review of the organization 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 system is undertaken as a group project.

COMP3331

Computer Networks and Applications

Staff Contact: Dr K. Burston

S2 HPW5

Prerequisites: COMP2011

Note/s: Excluded 6.633, 6.659G, COMP9331

History of digital communication and early computer networks. Circuit and packet switching. *Digital data transmission:* Protocols. Error detection and recovery. The seven layer OSI model local area networks. *Internetworking:* repeaters, bridges, gateways; TCP/ICP. Data encoding, compression, encryption. *Applications:* file transfer, electronic mail, remote procedure calls, distributed file systems, distributed graphics, multi-media communications.

COMP3411

Artificial Intelligence

Staff Contact: Dr C. Sammut

S2 HPW5

Prerequisites: COMP2011

Note/s: Excluded 6.666G, COMP9414

Machine intelligence. *Principles*: knowledge representation, automated reasoning, machine learning. *Tools*: All 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

Staff Contact: Dr T. Lambert

S1 HPW5

Prerequisites: COMP2011

Note/s: Excluded 6.668G, COMP9415

Graphics hardware: scan conversion of lines and polygons. 2D transformations: windowing, clipping, viewports. User interfaces. 3D transformations: perspective transformation, 3D clipping, hidden surface removal, lighting and texture maps. Hierarchical modelling of objects, modelling curves and surfaces with splines and fractals. Graphics standards.

COMP3511

Human-Computer Interaction

Staff Contact: Dr C. Quinn

S1 HPW5

Prerequisites: COMP2011

Note/s: Excluded 6.006G, COMP9511

Introduces analysis and design of user-system interactions. A cognitive approach focuses on user goals and enabling technologies, progressing from principles to process. *Topics:* human information processing system, interaction devices and components, communication models, the design cycle, and evaluation.

COMP4011

Occasional Elective S1 (Computer Engineering)

Staff Contact: School Office

S1 HPW5

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 S2 (Computer Engineering)

Staff Contact: School Office

S2 HPW!

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

Staff Contact: School Office SS HPW4

Prerequisites: COMP3121 or COMP9101

Note/s: Not offered in 1994

Analysis of 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 combinational problems. Vector architectures and algorithms, pipelining and chaining, multiple functional units, sparse operations, gather/scatter, data dependencies.

COMP4131

Programming Language Semantics

Staff Contact: Mr K. Robinson

S2 HPW4

Prerequisites: Any 4 level 3 Computer Science subjects

Formal methods for specifying the semantics of programming languages and that of programs expressed in those languages. Denotational Semantics: application to language design and the implementation of translators and compilers. Axiomatic semantics, weakest-precondition, refinement. Concrete and abstract syntax, the lambda calculus, semantic functions, denotations, recursion.

COMP4141

Theory of Computation

Staff Contact: Dr A. Sharma S1 HPW4

Prerequisites: Two level 3 Computer Science subjects or

equivalent

Computability: primitive recursive functions, computable functions, universal programs, undecidability, Church-Turing thesis, Turing machines, recursively enumerable sets and elementary recursive function theory; Complexity: the sets P and NP, NP-completeness and Cook's theorem. Logic: predicate logic and its unsatisfiability problem.

COMP4211

Advanced Architectures and Algorithms

Staff Contact: Dr S. Matheson

SS HPW4

Prerequisites: COMP3211 Note/s: 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, Al machines, fault tolerance, vector architectures and supercomputing.

COMP4215

VLSI Systems Architecture and Design

Staff Contact: Prof G. Hellestrand

Prerequisites: ELEC4532, COMP3221 or ELEC3020

Note/s: Excluded COMP9215

Review of electronics and technology. Integrated digital subsystems. 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 Architectures Staff Contact: Dr G. Heiser

S2 HPW4

Prerequisites: COMP3211, COMP3231, COMP3331

Note/s: 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: Naming and Security: Cryptographic authentication and capability-based protection schemes 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 and inheritance models. Fault Tolerance.

COMP4411

Artificial Intelligence: Knowledge-Based Systems

Staff Contact: Dr C. Sammut

SS HPW4

Prerequisites: COMP3411

Note/s: Excluded COMP9414, COMP9416.

Not offered in 1994

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

Staff Contact: Dr A. Sowmya

SS HPW4

Prerequisites: COMP3411

Note/s: Excluded COMP9414, COMP9416

Topics 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.

COMP4415

Artificial Intelligence: Foundations Staff Contact: Dr A. Hoffmann

S1 HPW4

Prerequisites: COMP3411 and one other Level 3 Computer

Science subject.

Note/s: Excluded COMP4412

Knowledge level, first order logic, theorem proving, foundations of logic programming, reasoning under uncertainty and vagueness, non-monotonic reasoning, abductive reasoning, temporal reasoning, and spatial reasoning.

COMP4416

Artificial Intelligence: Machine Learning

Staff Contact: Dr A. Sharma

S2 HPW4

Prerequisites: COMP3411 and one other Level 3 Computer

Science subject.

Note/s: Excluded COMP4411

A tour of machine learning systems based on propositional logic and a discussion of their limitations, theoretical issues in identification of computer programs from graphs of computable functions, learning by enumeration, theoretical issues in identification of grammars from positive data and from both positive and negative data, machine learning systems employing inductive logic programming, probably approximately correct (PAC) learning and illustration of its use in analyzing connectionist learning algorithms.

COMP4444

Neural Networks

Staff Contact: Dr T. Gedeon

S1 HPW4

Prerequisites: Any 4 level 3 Computer Science subjects or equivalent

Network architectures: perceptrons, Hopfield nets, Kohonen nets, ART models, back-propagation trained feed-forward nets, weightless nets; hardware based neural networks; practical applications of neural networks; input and output coding: selecting the right model; designing successful applications of neural networks.

COMP4903

Industrial Training

Staff Contact: School Office

Students enrolled in courses 3645, 3722 and 3726 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 2000 words long, summarising the work done and training received. Experience claimed as an industrial elective covers requirements for this subject.Industrial Experience

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.

COMP4910 Thesis Part A

COMP4911 Thesis Part B

This is done in the last two sessions of the BE degree course. For full-time students, seven hours per week in the first session and fourteen 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. Generally, the thesis involves the design and construction of experimental apparatus or software, or both, together with appropriate 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.

Graduate Study

The formal graduate courses offered are the Master of Cognitive Science 8155, Master of Computer Science 8680, Master of Information Science 8508. Graduate Diploma in Information Science 5453, Graduate Diploma in Computer Science 5452, and Graduate Diploma in Computer Education 5464. Opportunities are provided for graduate research leading to the award of the degree of Master of Engineering 2665, Master of Science 2765, and Doctor of Philosophy 1650.

Course Work Programs

8155 Master of Cognitive Science

MCogSc

For course details see School Office, School of Computer Science and Engineering.

8508/8680 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 specialization 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.

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 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 subjects failed totals more than six.

8508

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 S	Subjects	C
At least one of		
COMP9314	Advanced Data Base Management A	3
COMP9315 and	Advanced Data Base Management B	3
COMP9511	Human Interface Computing	3
COMP9514	Advanced Decision Theory for	
	Information Science	3
Students will ta	ake at least one of:	
GEOG9240	Geographic Information Systems	3
GEOG9290	Image Analysis in Remote Sensing	3
LIBS0817	Information Storage and Retrieval	3
SURV9604	Land Information Systems	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) COMP9596 Advanced Topics in Information Science

ELEC9336 Digital Communication Networks 1

The remaining three subjects may be chosen from subjects offered in the specializations:

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.

Students should note that the decision to take Coursework or Project options will not be made until the first 12 credits of coursework has been completed. The Project option will not be available to all students and high grades in the first four subjects will be needed to obtain approval to select that option.

8680 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 specializations 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

COMP9008	Software Engineering
COMP9101	Design and Analysis of Algorithms
COMP9102	Compiling Techniques and Programming Languages
COMP9201	Operating Systems
COMP9211	Computer organization and Design
COMP9221	Microprocessor Systems
COMP9231	Integrated Digital Systems
COMP9331	Computer Networks and Applications
COMP9414	Artificial Intelligence
COMP9415	Computer Graphics
COMP9416	Expert Systems and Deductive Data Bases

Level 3 Subjects

COMP9114Formal Specification

COMP9115Programming Languages: Fundamental

Concepts

COMP9214Computer Architecture

COMP9215VLSI Systems Architecture and Design

5452

Graduate Diploma in Computer Science

GradDip

5453

Graduate Diploma in Information Science

GradDip

5464

Graduate Diploma in Computer Education

GradDip

For Graduate Diploma course details of recommended programs of study may be obtained from the School Office. Subjects offered in the Masters programs may be taken in the Graduate Diploma programs subject to the approval of the course coordinator. The following extra subjects are offered for the Graduate Diploma in Computer Education:

		C
COMP9011	Literacy and Programming	3
COMP9012	Software Engineering and Tools	3
COMP9013	Data Bases and Expert Systems	3
COMP9014	Computer organization and Interfacing	3
COMP9015	Issues in Computing	3
COMP9018	Computer Graphics and Applications	3

^{*} Note that the Course Structure is currently under review.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

COMP9008

Software Engineering

Staff Contact: Mr K.Robinson

C3 S1 HPW4

Prerequisite: Assumed knowledge COMP9024

Note/s: Excluded COMP3111

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 project is undertaken.

COMP9011

Literacy and Programming

Staff Contact: School Office

C3 S1 HPW3

Note/s: Not offered in 1994.

Introduction 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 to both procedural and functional programming.

COMP9012

Software Engineering and Tools

Staff Contact: School Office

C3 S1 HPW3

Note/s: Not offered in 1994.

Introduction to 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

Software Tools: 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

Staff Contact: School Office

C3 S1 HPW3

Note/s: Not offered in 1994.

Introduction to some basic material on data structures. 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 organization and Interfacing

Staff Contact: School Office C3 HPW3

Note/s: Not offered in 1994.

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

Staff Contact: School Office

C3 HPW3

Note/s: Not offered in 1994.

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 organizational 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.

Computer Graphics and Applications

Staff Contact: School Office

C3 HPW3

Note/s: Not offered in 1994.

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.

Introduction to Computer Science

Staff Contact: Prof G. Hellestrand

C3 HPW3

Defining and recognizing problem classes. Reasoning about problems: specification, analysis, design, and refinement of computing solutions. Procedural programming. Data types and abstractions. Control structures, functions, procedures, and modules. Data structures, lists, queues, trees. Implementation in Modula-2 programs. Introduction to problem solving using the functional Programming language Miranda.

COMP9022

Digital System Structures

Staff Contact: Dr G. Heiser

C3 S1 HPW3

Prerequisite: Assumed knowledge COMP9021 or

COMP1021

Note/s: Excluded COMP2021.

Digital Systems: switches and gates, boolean algebra, minimization techniques, combinational and sequential design, timing analysis, finite state machines; analysis, design and realization of modest digital subsystems, understanding major subsystems in a model computer.

Assembly language programming: translation of higher level programming abstractions and data structures to a real computer using an assembler as a target; study of the relationships between the programming model and the hardware model of a computer; understanding of instruction execution.

COMP9023

Concurrent and Functional Programming

Staff Contact: Dr J. Olszewski

C3 S2 HPW3

Prerequisite: Assumed knowledge COMP9021 or COMP1021

Note/s: Excluded 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

Staff Contact: Dr A. Amin

C3 S2 HPW3

Prerequisites: Assumed knowledge COMP9021 or

COMP1021

Note/s: 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 Modula-2 and Miranda. Internal (memory) and external (file system) representation of information. Structured policies for packaging information (data bases (sets, hierarchy, network, relations), knowledge bases and frames). Efficiency and complexity of representation. Introduction to data bases and query languages. The manipulation of knowledge. Prolog as a query language.

COMP9101

Design and Analysis of Algorithms

Staff Contact: Dr A. Goswami

C3 S1 HPW3

Prerequisite: Assumed knowledge COMP9024 or COMP2011

Note/s: Excluded COMP3121

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 Staff Contact: Mr P. Ho

C3 S2 HPW3

Prerequisite: Assumed knowledge COMP9024 or COMP2011

Note/s: 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: finite state recognizers. Syntax analysis: top-down compilation for LL(1) grammars using syntax graph driven analysers or recursive descent. Bottom-up compilation LR(k) grammars. Semantic analysis, program translation and code generation, attributed grammars. Compiler generators: Code optimization. Run-time organization; activation record stacks heap management.

COMP9114

Formal Specification

Staff Contact: Mr K. Robinson

C3 SS HPW3

Prerequisite: Assumed knowledge; background to final year Computer Science level, equivalent to subjects COMP9008, COMP9101 and COMP9102

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 Staff Contact: Mr K. Robinson

C3 SS HPW3

Prerequisite: Assumed knowledge; background to final year Computer Science level, equivalent to subjects COMP9008, COMP9101, COMP9102

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

Staff Contact: Mr S. Russell

C3 S2 HPW3

Prerequisite: Assumed knowledge, COMP9023 and

COMP9024

Note/s: 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

Staff Contact: Prof G. Hellestrand

C3 S1 HPW4

Prerequisites: Assumed knowledge ELEC2012 or COMP9022

Note/s: 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

Staff Contact: Dr S. Matheson

C3 S1 HPW3

Prerequisite: Assumed knowledge, ELEC2021 or

COMP9022

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

Staff Contact: Prof G. Hellestrand

C3 S1 HPW4

Prerequisite: Assumed knowledge, background in electronic design equivalent to ELEC4532 or COMP9231

Note/s: Excluded COMP4215

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

Staff Contact: School Office

C3 SS HPW3

Prerequisite: Assumed knowledge, background to final year Computer Science level, equivalent to subjects

COMP3111, COMP3121 and COMP3131

Note/s: Not offered in 1994.

Parallelism concurrency in functionally coupled and distributed communicationally coupled, computing systems. Topics 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. Object based systems; Languages with communication and processes; CSP, ADA C; Locally and geographically distributed systems: Failure tolerant computer systems.

COMP9231

Integrated Digital Systems

Staff Contact: Prof G. Hellestrand

C3 S2 HPW4

Prerequisite: Assumed knowledge ELEC2012 or

COMP9022.

Note/s: 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

Staff Contact: Dr I. Gorton

C3 S1 HPW4

Prerequisite: Assumed knowledge COMP9021,

COMP9022

Note/s: 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 microrocessor-based systems.

COMP9311

Data Base Systems

Staff Contact: Prof J. Hiller

C3 S1 or S2 HPW3

Prerequisites: Assumed knowledge, familiarity with storage

structures

Note/s: 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 A

Staff Contact: Ms L. Quinn

C3 S1 HPW3

Prerequisite: Assumed knowledge COMP9311

Examination in detail of 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 B

Staff Contact: Ms L. Quinn

C3 S2 HPW3

Prerequisite: Assumed knowledge corresponds to the treatment in COMP9311

Examination in detail of 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

Staff Contact: Dr K. Burston

C3 S2 HPW3

Prerequisite: Assumed knowlege COMP9024

Note/s: Excluded COMP3331.

Introduction: applications, LANs, MANs, and WANs, topologies. Protocol Layers: ISO Model. Physical Layer. transmission media and line codes. Data Link Layer. Functions, frames, error control, flow control, performance. Network Layer. routing. Transport Layer. connection control. 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

Staff Contact: Mr P. Staines, School of Philosophy **C3 S1 HPW3**

Prerequisite: Assumed knowledge COMP9024

Note/s: Excluded COMP3411

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

Staff Contact: Dr T. Lambert

C3 S1 HPW3

Prerequisite: Assumed knowledge, background to final year Computer Science levels, equivalent to subjects COMP9101, COMP9102

Graphics hardware: scan conversion of lines and polygons. 2D transformations, windowing, clipping, viewports, user interfaces. 3D transformations: perspective transformation. 3D clipping, hidden line surface removal, lighting and texture maps. Hierarchical modelling of objects, modelling curves and surfaces with splines and fractals. Graphics standards will be examined.

COMP9416

Expert Systems and Deductive Data Bases

Staff Contact:

C3 S2 HPW3

Prerequisites: COMP9311, and some familiarity with 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

Staff Contact: Dr C. Quinn

C3 S2 HPW3

Corequisites: Knowledge of data base query languages Note/s: Excluded 55.821G.

Introduces theories and models of user-system interaction. A scientific approach emphasizes the literature and methodological issues in HCl design, using a cognitive engineering framework. Topics: models of mind, interaction formalisms and tools, and theories of design.

COMP9514

Advanced Decision Theory for Information Science

Staff Contact: Prof J. Hiller

C3 SS HPW3

Prerequisites: Assumed knowledge, a graduate level in expert systems or 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

Staff Contact: Prof J. Hillier

C6 \$1 or \$2 HPW6

Prerequisite: Assumed knowledge 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

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 Photovoltalc 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 specialized groups (such as Digital Systems, Biomedical Engineering, Measurement, Microelectronics, etc.) are also active.

Summary of Courses	Usual Duration (years
3640 BE	4 full-time
3645 BE	4 full-time
3720 BE and BA	5 full-time
3725 BE and BSc	5 full-time

Course 3645 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.

The formal graduate courses offered are: Master of Engineering Science in Electrical Engineering 8501; Graduate Diploma in Electrical Engineering 5458. Opportunities are provided for graduate research leading to the award of the degrees of Master of Engineering 2660, Master of Science 2760 and Doctor of Philosophy 1640.

Recognition

The degree of Bachelor of Engineering (BE) is recognized 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.

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.

Undergraduate Study

Course C	Dutlings					H	IPW
Course	outines .			Year 2 COMP1021 ELEC2010 ELEC2011	1994 only Computing 1B Circuit Theory System Theory	S1 6 2.5	S2 0 0
3640 Electrical I	Engineering - Full-time C	Course		ELEC2012 ELEC2015 ELEC2016 ELEC2020	Digital Circuits Electromagnetic Applications Electrical Design and Practice Analog Electronics	0 0 0 2	2.5 2.5 2.5 5 2.5
BE	Engineering			MATH2110 MATH3150 MATH2610 MATH2620	Higher Vector Calculus Transform Methods Higher Real Analysis Higher Complex Analysis	2.5 0 2.5 0	0 2 0 2.5
Course 3640	is being revised and is showr		PW	MATH2849 PHYS2979	Statistics SE 1 Electromagnetic Theory	0 3.5	2 0
Year 1 (Revi CHEM1806 COMP1011 ELEC1010	sed) Chemistry 1EE Computing 1A Introduction to Electrical	S1 3 0	S2 0 6	PHYS2989 One 56-hr or subject/s (Ca Totalling	Solid State Physics two 28-hr General Education t A)	4.5 0 23.5	0 4 25.5
ELEC1011 MATH1032	Engineering Electrical Engineering 1 Mathematics 1	1.5 6 6	0 0 6	Science, Ma	nts who plan to specialize in thematics or Physics in a BE/ d consult the School before enroll	BSc d	egree
MATH1090 ELEC1041 PHYS1969 Totalling	Discrete Mathematics Digital Circuits Physics 1	0 0 6 22.5	3 3 6 24	Year 3 ELEC3010 ELEC3011 ELEC3012 ELEC3013 ELEC3014	1994 and 1995 only Introduction to Electrical Energ Integrated Electronics Signals, Spectra and Filters Communication Systems 1 Systems and Control 1	gy 2.5 2.5 2.5 0	0 0 0 4 4
				ELEC3020	Microprocessors and Interfacing	2.5	0

ELEC3110

Electrical Engineering Laboratory 3

6

0

			HPW		
Year 3		S1	S2		
MATH2501	Linear Algebra	5	0		
MATH2859	Statistics SE 2	2	0		
MATH3141	Numerical and Mathematical				
	Methods	0	3.5		
and two from-	++:				
ELEC3015	Electrical Energy	0	4		
ELEC3016	Electronic Signal Processing	0	4		
Technical Ele and:	ctive+	0	4		
One 56-hr or	two 28-hr General Education				
subject/s (Cat	t B)	0	4		
Totalling `	•	23	23.5		

Note: Students who intend to major in particular disciplines should note that certain subjects are prerequisites for the Professional Electives they choose in Year 4.

- +See list of Technical Electives later this section.
- ++Students who wish to take all three of the year 3 elective subjects may do so by substitution for one Professional Elective in year 4

Year 4			
5 Professiona	al Electives	15	10
ELEC4010	Introduction to Management to Electrical Engineers (Gen. Ed		
	Cat.C)	4	0
ELEC4011	Ethics and Electrical Enginee	ring	
	Practice (Gen.Ed. Cat.C)	0	2
ELEC4903	Industrial Training	0	0
ELEC4910	Thesis Part A	6	0
ELEC4911	Thesis Part B	0	12
Totalling		25	24

Normally 3 electives are taken in Session 1 and 2 in Session 2. See list of Professional Electives later in this section.

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

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 Flectives – all courses

		HPW	
		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	ng	
	for Electrical Engineers	0	4
MECH0760	Mechanical Engineering	4	0
PHYS2999	Mechanics and Thermal Physics	2	2
SAFE9533	Electrical Safety	0	3

Electrical Engineering Professional Electives - all courses

Signal Processing

ELEC4042

Professional Elective subjects in the Computer Science area require either COMP2011 or COMP2031 as a prerequisite. A free choice may not be possible. 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.

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 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.

3720 BE BA in Electrical Engineering

With this combined degree course students can add their choice of arts program to the standard, professionally accredited engineering course offered by the School of Electrical Engineering. The full range of Arts programs is available.

Because the engineering and arts programs have common content, such as mathematics and physics, only one more year of study is normally required to gain the additional qualification of Bachelor or Arts.

Eligibility

Anyone who meets the entry requirements for both Engineering and Arts is eligible for the combined course. Students may enter directly in first year or may apply to transfer from the normal engineering course later, although with late transfer it might not be possible to complete the course in minimum time.

Organization

The BE BA course is administered by the School of Electrical Engineering.

Students should start discussing their program with representatives of the School and the Faculty of Arts and Social Sciences as soon as possible - preferably well before enrolment. Enquiries should be directed to the Executive Assistant to the School and the Executive Assistant to the Dean of the Faculty of Arts and Social Sciences.

Students should work out for themselves the arts program they would like to add to their chosen engineering course. The Arts and Social Sciences Faculty Handbook describes the options, and the School of Electrical Engineering can supply sample programs showing what previous students have arranged.

There are no special rules on what to include in each year. Students should schedule the arts and engineering components to suit their preferences while meeting the constraints of timetables and prerequisites. The sample programs can help here too.

The Arts component must be approved by the Faculty of Arts and Social Sciences.

The final program and schedule must be approved by the School of Electrical Engineering.

Rules

1. In addition to the BE course, students must complete a major sequence offered within the BA course and meet the additional requirements listed below:

Faculty which provides the chosen major

Faculty of Arts and Social Sciences: (minimum) 48 credit points total, including major sequence Other Faculties:

Major sequence plus at least 12 Credit Points from Schools of the Faculty of Arts and Social Sciences.

Mathematics majors are not usually permitted. BE BSc combined degrees are more appropriate for this.

- 2. The requirements of the General Education Program must be met. In some cases subjects within the combined course may satisfy Category A and/or Category B guidelines. Students should consult the Centre for Liberal and General Studies for advice.
- 3. There will be a testamur for each part of the combined degree course.
- Students who complete the BE program first may proceed to graduation with the degree of Bachelor of Engineering in the usual way.
- 5. Students who complete the requirements for their Arts program and the first two years of the BE program may proceed to graduation with the degree of Bachelor of Arts.

3725 BE BSc in Electrical Engineering

As noted above students wishing to transfer to the combined degree should contact the Electrical Engineering School Office before completing their Year 2 enrolment. After completing Years 1,2 and 3 (modified where necessary as indicated below) of the Electrical Engineering course, students in their fourth year complete a specific program consisting of four Level III Science units chosen from related disciplines, the appropriate General Education electives and three or four other Level III or Level III units. The subjects chosen should be in accord with the rules of the BSc course 3970 leading to a major in Computer Science, Mathematics or Physics. In their fifth year students complete year 4 of the Electrical Engineering course.

Students may open up a wider choice of subjects in their Science year by including additional Computer Science (viz COMP2011 and COMP2031), in Years 2 and 3 or Physics (viz PHYS299) in years 2 or 3 of their Electrical Engineering program. Any Electrical Engineering subject omitted will have to be taken later in the course. The extra subject in year 2 may be credited towards either the BE or the BSc requirements but not both.

Students who plan to specialize in Computer Science, Mathematics or Physics in a BE/BSc degree course should consult the School before enrolling in year 2.

Year 1(Revised) Standard program for course 3640) CHEM1806, COMP1011, ELEC1010, ELEC1011, ELEC1041

MATH1032/MATH1042, MATH1090, PHYS1969

Year 2

COMP1021.

ELEC2010, ELEC2011, ELEC2012, ELEC2015, ELEC2016, ELEC2020.

MATH2110, MATH2610, MATH2620, MATH2849, MATH3150,

PHYS2979, PHYS2989,

General Education (Category A).

Computer Science majors add COMP2011 (as their Year 3 technical elective) in Session 2 by moving 2 hours of General Education to Session 1. Higher Mathematics subjects may be taken at the ordinary level.

Physics majors may take the Higher Mathematics subjects at the ordinary level.

Year 3

ELEC3010, ELEC3011, ELEC3012, ELEC3013, ELEC3014, ELEC3020, ELEC3110,

MATH2601, MATH2859, MATH3141,

Two from ELEC3015, ELEC3016 and Technical Elective, General Education (Category B).

Computer Science majors must take COMP2031 (Towards their Science). The Higher Mathematics subject MATH2061 may be taken at the ordinary level.

Physics majors must take PHYS2999 (Towards their Science). The Higher Mathematics subject MATH2601 may be taken at the ordinary level.

Year 4

Refer to course 3970 in the Science Handbook for subject details. Any General Education deferred from Year 2 or 3 should be taken during this year.

Computer Science

Choose at least another 7 Level II or Level III units including at least 4 Computer Science units at Level III with the balance being chosen from Level III Computer Science units and other Level II or Level III units from the Science Program 0600. (COMP2031 is the 8th unit).

Mathematics

Choose at least 5 Mathematics units, 4 of which are Level III.

Choose at least 3 Level II or Level III units from the Science Program 1000.

Physics

Choose another 7 Level II or Level III units of which at least 4 must be Level III Physics units chosen to include PHYS3010, PHYS3031, PHYS3030 and PHYS3060. (PHYS2999 is the 8th unit).

Year !

Year 4 of the Electrical Engineering course.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

ELEC0802

Electrical Power Engineering

Staff Contact: Dr B. Farah

S2 HPW3

Prerequisite: PHYS1002 or equivalent (PHYS2920 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 considerations of electrical apparatus are also treated.

ELEC0805

Electronics for Measurement and Control

Staff Contact: Dr B. Farah

S2 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.

Note/s: 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

Staff Contact: A/Prof H.R. Outhred

S1 L1 T.5

Prerequisite: HSC Exam Score Range Required - 2 unit English (General) 53-100,or 2 unit English 49-100, or 3 unit English 1-50, 2 unit Contemporary 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. organization, verbal and written communication and research skills in engineering.

ELEC1011

Electrical Engineering 1

Staff Contact: Dr E.H. Fooks

S1 & S2 L3 T3

Corequisite: 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.

ELEC1041

Digital Circuits
Staff Contact: Dr T. Hesketh

S2 L2 T1

Prerequisites: ELEC1011

Excluded: ELEC2012, COMP2021

Realisations of combinational circuits: MSI devices, ROM's. PLA's. PAL's. Sequential logic circuits: latches, flip flops, counters, registers. Asynchronous sequential circuits: analysis and design of fundamental-mode circuits, pulse-mode circuits. Algorithmic state machines: systematic design procedures, register transfer notation, bus systems. Design applications: multipliers, dividers, control units.

ELEC2010

Circuit Theory

Staff Contact: Prof I.F. Morrison

S1 L2 T.5

Prerequisites: ELEC1011, MATH1032 Corequisite: 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: phasors, 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

Staff Contact: Dr D.J. Clements

S2 L2 T.5

Prerequisites: ELEC2010, MATH2610 or MATH2510 Corequisites: 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

Staff Contact: Dr T. Hesketh

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

Staff Contact: Dr T.R. Blackburn

S2 L2 T.5

Prerequisites: PHYS2979 Note/s: Excluded 6.825.

General field properties. Electric and magnetic fields. Inductance and capacitance. Dielectric and magnetic materials and their applications. Electrodynamic forces. Transformer and motor action: rotating magnetic fields. Dielectric and induction heating. Applications of Maxwell's equation. Transmission lines from circuit and electromagnetic viewpoints. Electromagnetic radiation and electromagnetic interference.

ELEC2016

Electrical Design and Practice

Staff Contact: Dr K.C. Daly \$1 L1 T1 \$2 L1 T4

Prerequisites: ELEC1011, ELEC1010, PHYS1969 Corequisites: ELEC2010, ELEC2020, ELEC2012

Note/s: 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

Staff Contact: Dr S.R. Wenham

S2 L2 T.5

Prerequisites: ELEC2010, PHYS2989 or PHYS2859

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

ELEC2030

Circuit Theory and Laboratory

Staff Contact: Prof I.F. Morrison

S1 L2 T1.5

Prerequisites: ELEC1011, MATH1032

Corequisite: MATH2620 or MATH2520

Note/s: Excluded ELEC2010. Only available to course

3645.

Dynamic response of linear circuits: 1st and 2nd order circuits with DC sources, introduction to higher order circuits. Sinusoidal steady state operation: phasors, 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. The use of the computer aided circuit analysis package Micro-Cap III. Laboratory Technique.

ELEC2033

Analog Electronics and Laboratory

Staff Contact: Dr S.R. Wenham

S2 L2 T2.5

Prerequisites: ELEC2010, PHYS2989 or PHYS2859

Note/s: Excluded ELEC2020. Only available to course

3645.

Operating principles and terminal characteristics of PN diodes, bipolar and field effect transitors, 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. Laboratory work on circuits, devices and systems. Computer aided experimental work.

Introduction to Electrical Energy Staff Contact: A/Prof C. Grantham

S1 L2 T.5

Prerequisites: ELEC2015 Corequisite: ELEC3110

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

Staff Contact: Dr C.Y. Kwok

S1 L2 T.5

Prerequisite: ELEC2020 Corequisite: ELEC3110

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.

EI EC2012

Signals, Spectra and Filters

Staff Contact: Dr D.H. Irving

S1 L2 T.5

Prerequisites: ELEC2011, MATH3150

Corequisite: MATH2849, MATH2859, ELEC3110

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

Staff Contact: A/Prof I. Korn

S2 L2 T2

Prerequisite: ELEC3012 or ELEC3032

Overview of information acquisition, transmission and processing. Aims to enable students not specializing 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 specialize in communications. Topics include 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

Staff Contact: A/Prof P.D. Neilson

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

Staff Contact: A/Prof C. Grantham

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

Staff Contact: Dr C.Y.Kwok

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

Staff Contact: Dr W.S. Matheson

S1 L2 T.5

Prerequisite: ELEC2012

Note/s: 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

Staff Contact: Dr C.Y. Kwok

S2 L2 T2.5

Prerequisite: ELEC2020

Note/s: Only available to course 3645.

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.

Signals, Spectra and Filters + Laboratory

Staff Contact: Dr D.H. Irving

S1 L2 T1.5

Prerequisites: ELEC2011, MATH3150 Corequisites: MATH2849, MATH2859 Note/s: Only available to course 3645.

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

Staff Contact: Dr R. Radzyner

S1 T6

Prerequisite: ELEC2016

Corequisites: ELEC3020, ELEC3010, ELEC3011,

ELEC3012

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

ELEC3120

Electrical Energy Strand of ELEC3110 Electrical Engineering Laboratory 3

Staff Contact: Dr R. Radzyner

S1 T1

Note/s: Excluded ELEC3110

A program of experiments and laboratory-based design

exercises in electrical energy.

ELEC3121

Electronics Strand of ELEC3110 Electrical Engineering Laboratory 3

Staff Contact: Dr. R. Radzyner

S1 T2

Note/s: Excluded ELEC3110

A program of experiments and laboratory-based design exercises in electronic devices and circuits.

ELEC3122

Signals, Spectra and Filters Strand of ELEC3110 Electrical Engineering Laboratory 3

Staff Contact: Dr R. Radzyner S1 T1

Note/s: Excluded ELEC3110

A program of experiments and laboratory-based design

exercises in signal processing

ELEC3123

Microprocessor and Interfacing Strand of ELEC3110
Electrical Engineering Laboratory 3

Staff Contact: Dr R. Radzyner

S1 T2

Note/s: Excluded ELEC3110.

A program of experiments and laboratory-based design exercises in microprocessors and their applications.

ELEC3401

Reliability Engineering for Design and Development Staff Contact: Dr H. Mehrpour

S2 L2 T2

Prerequisite: MATH2849 attempted

Corequisite: MATH2859 Note/s: Excluded 6.044.

Quantified reliability, maintainability, availability achievement in design and development. Prediction of reliability. Redundancy design. Fault tree analysis. Catastrophic failure models and reliability functions. Combinatorial aspects of system reliability. Three state devices. Modelling spares with instant replacement. Reliability evaluation of systems using Markov models. Failure mechanisms. Environmental factors in design. Reliability growth programs. Reliability requirements imposed by economics. Accelerated testing and models.

ELEC3402

Introductory Physiology for Engineers

Staff Contact: A/Prof B.G. Celler

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 Staff Contact: Prof G.A. Rigby

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 Staff Contact: A/Prof H.R. Outhred

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.

Signal Processing

Staff Contact: Dr C.J.E. Phillips

S1 L2 T3

Prerequisite: ELEC3012

Analysis and processing of continuous-time (analog) and discrete-time (digital) signals and systems with emphasis on digital signal processing. Design and implementation of finite and infinite duration impulse response (FIR and IIR) digital filters. Aspects of nonlinear filtering techniques. Applications of the discrete Fourier transform (DFT), fast Fourier transform (FFT) algorithms and applications. Processing and analysis of random signals and noise; correlation functions, mean square estimation, Wiener filters and linear prediction. Adaptive signal processing; adaptive FIR filters, least mean-square (LMS) algorithm and applications. Spectrum estimation.

ELEC4202

Power Systems

Staff Contact: Dr R.J. Kave, Dr D. Sutanto

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

Staff Contact: Dr T.R. Blackburn

SS L2 T3

Prerequisite: ELEC3010

The design, operation, and maintenance of large industrial electric power systems. Protection and fault calculations. Choice and use of protective equipment, including circuit interrupters, surge diverters and personnel protection. Equipment rating. Relevance of Standards (including 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. Electromagnetic compatibility with electronic equipment.

ELEC4216

Electrical Drive Systems

Staff Contact: A/Prof C. Grantham

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

Staff Contact: Dr K.C. Daly

SS L2 T3

Prerequisites: ELEC2020, ELEC3010, MATH3150

Note/s: 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

Staff Contact: Dr I. Skinner

SS L2 T3

Prerequisite: ELEC2015 or MATH3141

Fundamental concepts and analytical techniques of guided wave propagation. Transmission line theory, impedance matching, waveguide theory, coaxial lines, rectangular and circular waveguides. Poynting theorem. Propagation in semiconductors, plasmas, and anisotropic materials. Nonlinear material responses. Basic antenna theory. Aperture antennas. Phase arrays.

ELEC4313

Optical Communications

Staff Contact: Prof P.L. Chu

SS L2 T3

Prerequisite: ELEC3013

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

ELEC4323

Digital and Analog Communications

Staff Contact: A/Prof I. Korn

SS L2 T3

Prerequisites: ELEC3013, MATH3150, MATH2859

Theory and practice of modern digital and analog communications systems. Sampling, digital multiplexing, pulse shaping. Nyquist'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

Staff Contact: Prof T.B. Vu

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

Staff Contact: Dr W.J. Dewar

SS L3 T2

Prerequisites: ELEC3013, ELEC3020

Data communications. Error detection coding and synchronisation. Physical layer standards and modems. IÉEE-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

Staff Contact: H. Mehrpour

SS L3 T2

Prerequisite: ELEC4351

Data transmission on telephone networks. High speed Local Area Networks (HSLANs) and Metropolitan Area Networks (MANs). Local area network interconnection. Protocol modelling and verification techniques. 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 Staff Contact: Prof N.W. Rees

SS L2 T3

Prerequisites: ELEC3012, ELEC3014

Note/s: ELEC4432 recommended prerequisite.

This subject discusses the analysis and design of control systems using both classical and state-space design methods. The course covers: Process modelling by physical analysis. Experimental methods and system identification. Classical PID control and discrete PID implementation. Classical frequency response and root locus design for continuous systems. Discrete and continuous state space theory, controllability, observability, solution of state equations. State variable feedback pole placement. Observers. Optimal control. Multivariable transfer function models. Decoupling control. Relative gain array.

ELEC4413 Digital Control

Staff Contact: Dr D.J. Clements

Prerequisites: ELEC3014, MATH2849, MATH2859 Note/s: ELEC4412 recommended prerequisite.

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 Staff Contact: Dr K.W. Lim

SS L2 T3

Prerequisites: ELEC3014, ELEC3020

Note/s: ELEC3016 recommended prerequisite.

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 organization of hardware systems for computer control, programmable logic controllers, robust implementation of digital controllers, smart sensors and instrumentation networks.

ELEC4483

Biomedical Engineering

Staff Contact: A/Prof B.G. Celler

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

Staff Contact: Prof G.A. Rigby

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 advanced 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

Staff Contact: Prof M.A. Green

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.

Microelectronics Design and Technology

Staff Contact: Dr C.Y. Kwok

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

Staff Contact: Prof G.R. Hellestrand

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
Staff Contact: Dr S.R. Wenham

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

Staff Contact: Dr D. Sutanto

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.

Students will formally enrol in this subject as part of the program for year 4.

ELEC4910 Thesis Part A Staff Contact: Dr D.H. Irving S1 HPW6

ELEC4911 Thesis Part B

Staff Contact: Dr D.H.Irving

S2 HPW12

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.

Graduate Study

The formal graduate courses offered are: Master of Engineering Science in Electrical Engineering 8501: Graduate Diploma in Electric Power Engineering 5435 and the Graduate Diploma in Electrical Engineering 5458. Opportunities are provided for graduate research leading to the award of the degrees of Master of Engineering 2660. Master of Science 2760 and Doctor of Philosophy 1640.

Course Work Programs

8501 **Master of Engineering Science in Electrical**

MEngSc

Engineering

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 H. Mehrpour 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
- 3. Photovoltaics

Electronics

Program Co-ordinator: Dr C.Y. Kwok Programs:

- 1. Solid State Devices
- 2. Microelectronics
- 3. Photovoltaics

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 as listed normally consist of 18 credits of course work and correspondingly a 12 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

Candidates must normally do 18 credits from the Communications area (a 12 credit project and 6 credits of coursework within one of the following programs).

1. Communication Electronics

One elective subject may be chosen from outside this program.

Compulsory s	ubject	С
ELEC9340	Communication Electronics	3
Elective subje	ects	
COMP9215	VLSI System Architecture and Design	3
COMP9221	Microprocessor Systems	3
ELEC9338	Television and Video Signal Processing	3
ELEC9341	Signal Processing 1 - Fundamental	
	Methods	3
ELEC9343	Principles of Digital Communications	3
ELEC9353	Microwave Circuits: Theory and	
	Techniques	3
ELEC9354	Microwave and Optical Devices	3
ELEC9403	Real Time Computing and Control	3
ELEC9503	Integrated Circuit Design	3
	J	-

2. Digital Communication and Systems

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	3
ELEC9338	Television and Video Signal Processing	3
ELEC9343	Principles of Digital Communications	3
ELEC9347	Digital Modulation	3

3. Microwave and Optical Communications

One of the three elective subjects may be chosen from outside this program.

Compulsory s	BUDJECTS	
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	3
ELEC9353	Microwave Circuits: Theory and	
	Techniques	3
ELEC9355	Optical Communications Systems	3
4. Signal Prod	cessina	
_	our elective subjects may be chosen	from
outside the pro	•	
Compulsory s	ubjects	
ELEC9341	Signal Processing 1 –	
	Fundamental Methods	3
ELEC9342	Signal Processing 2 –	
	Advanced Techniques	3
Elective subje	cts	
ELEC9340	Communication Electronics	3
ELEC9343	Principles of Digital Communications	3
ELEC9350	Theory of Optical Fibres and Optical	
	Signal Processing	3
ELEC9370	Digital Image Processing Systems	
MATH5054	Advanced Mathematics for Electrical	

Electric Power

Normally 18 credits of coursework and a 12 credit project as appropriate. A program in another area offered by the School may be substituted for the project.

Engineers

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 Syst	ems Engineering	C
ELEC4202	Power Engineering 1	3
ELEC4215	Industrial Electrical Systems	3
ELEC9201	Power System Planning and Economics	3
ELEC9202	Power Systems Operation and Control	3
ELEC9203	Power System Analysis	3
ELEC9204	Protection of Power Apparatus and	
	Systems	3
ELEC9223	Power Engineering Seminars	3
2. Electrical P	ower Technology	
ELEC4202	Power Engineering 1	3
ELEC4215	Industrial Electrical Systems	3
ELEC9204	Protection of Power Apparatus and	
	Systems	3
ELEC9214	Power System Equipment	3
ELEC9231	Electrical Drive Systems	3
ELEC9223	Power Engineering Seminars	3
ELEC9226	Electrical Services in Buildings	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.

		_
ACCT9062	Accounting for Engineers	3
COMP9221	Microprocessor Systems	3
ELEC4240	Power Electronics	3
ELEC9341	Signal Processing 1 - Fundamental	
	Methods	3
ELEC9401	Computer Control Systems 1	3
ELEC9504	Solar Energy Conversion	3
ELEC9507	Solar Cells and Systems	3
MANF9400	Industrial Management	3
MANF9660	Energy Modelling, Optimization and	
	Accounting	3
SAFE9213	Introduction to Safety Engineering M	3

C

Electronics

3

Normally 18 credits of coursework and a 12 credit project as appropriate. At least three subjects should be chosen from one of the programs below.

The remaining subjects may be chosen from one of the program lists or from the list of electives appropriate to that program.

Subject to the approval of the Electronics Department Program Co-ordinator, previously listed, a limited number of other subjects outside these lists may also be included in the program.

iir uie program	l•	
1. Solid State ELEC4540 ELEC9354 ELEC9501 ELEC9502 ELEC9504 ELEC9507	Devices Applied Photovoltaics Microwave and Optical Devices Advanced Semiconductor Devices Integrated Circuit Technology Solar Energy Conversion Solar Cells and Systems	C 3 3 3 3 3 3
2. Microelectr COMP9215	onics VLSI Systems Architecture Design	2
ELEC9340	Communication Electronics	3 3
ELEC9501	Advanced Semiconductor Devices	3
ELEC9502	Integrated Circuit Technology	3
ELEC9503	Integrated Circuit Design	3
Additional elec	ctive subjects for programs 1 and 2:	
COMP9221	Microprocessor Systems	3
ELEC4240	Power Electronics	3
ELEC4532	Integrated Digital Systems	3
ELEC9341	Signal Processing 1 - Fundamental Methods	_
ELEC9342	Signal Processing 2 - Advanced	3
ELEC9342	Techniques	3
ELEC9343	Principles of Digital Communications	3
ELEC9353	Microwave Circuits: Theory and	•
	Techniques	3
3. Photovolta	ics	
ELEC4540	Applied Photovoltaics	3
ELEC9501	Advanced Semiconductor Devices	3
ELEC9502	Integrated Circuit Technology	3
ELEC9504	Solar Energy Conversion	3
ELEC9507	Solar Cells and Systems	3
ELEC9508	High Efficiency Silicon Solar Cells	3

Systems and Control

1. Digital Systems and Control

All coursework or 18 credits of course work and a 12 credit project. 12 credit projects are subject to the availability of a suitable supervisor.

Compulsory :	subjects	C
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 subje	ects	
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 subje	ects	
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

5435 Graduate Diploma in Electric Power Engineering

GradDip

The Graduate Diploma in Electric Power Engineering is aimed at providing an award course of postgraduate education in electric power engineering that will enable engineers to develop their knowledge and skills in areas that are important both for the efficient operation and development

of industry and also for the career development of the individual engineer. The course will extend the education provided at undergraduate level to provide in-depth treatments of chosen specialist topic areas.

It is intended that the Graduate Diploma will fit into a national framework for the enhancement of skills in electric power engineering, that is being developed for the electricity supply industry by the Electricity Supply Association of Australia Ltd., working nationally with universities teaching electric power engineering.

The course requirements are

Coursework Short courses 12 credits
-typically 6 courses
at 2 credits each
Project ELEC9912 Project Report 12 credits
Total: 24 credits

The coursework component will, in general, be obtained through satisfactory completion of courses offered in the program of short courses offered by ESAA Ltd. This will, in general, entail the completion of six short courses. (In exceptional circumstances other programs of study may be approved by the Head of School.)

The short courses are provided by a number of universities throughout Australia and will in general reflect the special expertise of the university involved. It is expected that up to 10 courses per annum will be available, some of these on a rolling basis.

For each short course there will be further reading and assignment tasks leading to the submission of work for assessment. This material will usually be assessed by the course presenters or staff of the university offering the course and records will be kept by ESAA.

The topic and scope of the project will be determined by the Department of Electric Power Engineering in consultation with the student and preferably his/her employer, and will be supervised by a member of the staff of the Department of Electric Power Engineering and co-supervised by an industry colleague.

The GradDip is to be completed within five years from the commencement of the first short course. The short courses must have been completed within a period of four years and prior to commencement of the project. Enrolment can be at any time after the completion of eight credits, and, in any event, prior to the commencement of the project.

The graduate Diploma is inherently part-time and the project is to be completed within two Sessions from enrolment. A minimum of one month must be spent full-time within the Department of Electric Power Engineering.

The Graduate Diploma in Electric Power Engineering is available only a full-fee basis. Individual course fees will normally apply to each short course. The fee for the project component will be payable to UNSW.

5458

Graduate Diploma in Electrical Engineering

GradDip

Details of the recommended programs of study may be obtained from the Head of the School of Electrical Engineering. Subjects offered in the Masters programs can

be taken in the Graduate Diploma programs subject to the approval of the course coordinator.

In addition the following subjects are offered specially for Graduate Diploma candidates. Not all electives are necessarily offered in any particular year.

	U
ELEC9224 Special Topic in Power	2
ELEC9225 Special Topic in Power	2
ELEC9411 Introductory Physiology for Engineers	3

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

Department of Electric Power Engineering

ELEC9201

Power System Planning and Economics Staff Contact: A/Prof H.R. Outhred and Dr R.J. Kaye 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.

ELECGOOG

Power Systems Operation and Control

Staff Contact: Dr R.J. Kaye

Introduction to the main techniques currently used in the operation and control of power systems, including operations planning. Current trends in the evolution of the structure of electricity industries in various parts of the world and their implications for power system operations. The subject is in three parts: A: Practices in Power System Operation and Control, B: Trends in Power Industry Structure, C: Operations and Scheduling in a Decentralized Power System.

ELEC9203

Power System Analysis

Staff Contact: Dr D. Sutanto

C3 S2

Prerequisite: Assumed knowledge ELEC4202 or equivalent Note/s: 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.

ELEC9204

Protection of Power Apparatus and Systems

Staff Contact: Prof I.F. Morrison

C

Prerequisite: Assumed knowledge ELEC4202 or equivalent

Overview of the analytical procedures and applications of relaying techniques in power system protection. Aims and purposes of protection. Fault calculations and symmetrical components. Fuses. Overcurrent relays and grading. Earth fault protection. Differential protection. Transformer protection. CT and VT requirements - transient and steady-state responses. Bushar protection. High impedance faults. Pilot-wire feeder protection. Protection of capacitor banks. Motor protection. Generator protection. Transmission line protection. Back-up protection.

ELEC9214

Power System Equipment

Staff Contact: Dr T.R. Blackburn

C3

Prerequisite: 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. Protection of electrical equipment. Effects of electromagnetic fields on personnel. Condition monitoring and testing of power equipment.

ELEC9215

Fields and Materials

Staff Contact: Dr T.R. Blackburn

C:

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

Staff Contact: Prof I.F. Morrison

C3

This syllabus changes to allow presentation of a special topic of current interest particularly by visitors with recognized expertise in the topic.

ELEC9222

Special Topic in Power

Staff Contact: Prof I.F. Morrison

C3

This syllabus changes to allow presentation of a special topic of current interest particularly by visitors with recognized expertise in the topic.

ELEC9223

Power Engineering Seminar

Staff Contact: Prof I.F. Morrison

СЗ

Weekly seminars given by members of the staff, postgraduate students and invited speakers, covering aspects of power and energy engineering. Outside speakers will be drawn from other universities, research institutions and industry. The purpose of the course is to expose students to the range of research and development activities within the power engineering discipline. Subject is taken over two consecutive sessions commencing session 1 or session 2.

ELEC9224

Special Topic in Power

Staff Contact: Prof I.F. Morrison

C2

The content of this subject changes to allow presentation of a special topic of current interest in a short course format.

ELEC9225

Special Topic in Power

Staff Contact: Prof I.F. Morrison

C2

The content of this subject changes to allow presentation of a special topic of current interest in a short course format.

FLFC9226

Electrical Services in Buildings

Staff Contact: Dr D. Sutanto

СЗ

Prerequisite: Assumed knowledge: ELEC3010, ELEC3015

Principles, standards and current technology involved in the provision of electrical services in large buildings. Distribution. Wiring/Cabling. Protection. Voltage considerations. Lighting Design. Sub-system design (security, fire, communications). Emergency supplies. Lightning protection. Energy management. Building Monitoring Systems. Documentation and Contracts.

ELEC9231

Electrical Drive Systems

Staff Contact: A/Prof C. Grantham, Dr F. Rahman

СЗ

Note/s: Excluded ELEC4216

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. Space vector representation. 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. Slip power recovery schemes for induction motor drives. Vector controlled induction motor drives. Brushless DC drives.

Department of Communications

ELEC9330

Special Topic

Staff Contact: Dr H. Mehrpour

C3

This syllabus changes to allow presentation of a special topic of current interest particularly by visitors with recognized expertise in the topic.

ELEC9336

Digital Communication Networks

Staff Contact: Prof T.B. Vu

C

Note/s: 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

Staff Contact: Dr W.J. Dewar

СЗ

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.

ELEC9338

Television and Video Signal Processing

Staff Contact: Dr R.A. Zakarevicius

СЗ

Prerequisites: Assumed knowledge ELEC9351,

ELEC9341 or similar

Note/s: Excluded ELEC4333.

Principles and practice of modern video systems. Human perception of visual images. Techniques and standards for terrestrial and satellite broadcasting, and cable TV systems. High definition television. Digital Television. Video signal processing. Recording techniques.

Communication Electronics
Staff Contact: Dr R.A. Zakarevicius

C3

Prerequisite: Assumed knowledge ELEC3016 or similar

Electronic aspects of modern analogue and digital communication systems. Topics selected from: 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 Staff Contact: Dr R. Radzyner, A/Prof W.H. Holmes C3

Note/s: Excluded ELEC4042.

Analysis and processing of analogue and digital signals with emphasis on digital methods. The topics covered are: Convolution, correlation, energy and power density spectra for signals and linear systems; sampling and analogue to digital conversion; the discrete Fourier transform (DFT) and fast Fourier transform (FFT) algorithms and applications; fundamentals of digital filter design and realization; finite word length effects in digital filters; digital processing of analogue signals, especially implementations on programmable digital signal processing (DSP) chips.

ELEC9342

Signal Processing 2 – Advanced Techniques Staff Contact: Dr R. Radzyner, A/Prof W.H. Holmes

Prerequisite: ELEC4042, ELEC9341 or similar

Advanced techniques and applications of digital signal processing. Topics covered are: advanced frequency domain signal analysis, including spectral estimation; advanced digital filtering methods: signal processing with finite word lengths; sampling rate conversion and multirate signal processing; least square detection and estimation methods,including linear prediction; adaptive filtering in detection and estimation problems; nonlinear digital signal processing; two and three dimensional signal processing; applications in communications, control, radar, sonar and in the processing of speech, audio, image and seismic signals (e.g. equalization, echo cancellation, noise reduction, deconvolution).

ELEC9343

Principles of Digital Communications Staff Contact: A/Prof I. Korn

C3

Prerequisite: ELEC3012 or similar Note/s: 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

Staff Contact: A/Prof I. Korn

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

Staff Contact: Prof P.L. Chu

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

Staff Contact: Dr E.H. Fooks

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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

Staff Contact: Prof T.B. Vu

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.

Microwave Circuits: Theory and Techniques

Staff Contact: Dr E.H. Fooks

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 Staff Contact: Dr R.A. Zakarevicius

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, optical detectors.

ELEC9355

Optical Communications Systems

Staff Contact: Prof P.L. Chu

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 Staff Contact: Dr C.J.E. Phillips

C3

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.

Department of Systems and Control

ELEC9401

Computer Control Systems 1
Staff Contact: A/Prof P.D. Neilson

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

C3

Computer Control Systems 2
Staff Contact: A/Prof P.D. Neilson

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

Staff Contact: Dr T Hesketh

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 Staff Contact: Prof N.W. Rees

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Prerequisites: ELEC9401, ELEC9402

Possible modules include: identification, estimation, multivariable systems, robust control, optimatisation, adaptive control, biomedical applications, instrumentation and sensors, robotics, industrial design case studies, variable structure systems, expert systems and fuzzy control, neural networks.

Advanced Control Topics

Staff Contact: A/Prof P.D. Neilson

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 Staff Contact: A/Prof K.E. Tait

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

Staff Contact: A/Prof K.E. Tait

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 Staff Contact: A/Prof K.E. Tait

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

Staff Contact: A/Prof B.G. Celler

C3 S1 L2 T2

Note/s: Excluded ELEC3402.

This subject is intended primarily for Biomedical Engineering students. It is compulsory for Strand A. part-time students ONLY who are unable to do PHPH2112.

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

Staff Contact: A/Prof P.D. Neilson

Note/s: Excluded FLFC9341

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

Optimization and Optimal Control

Staff Contact: Dr D.J. Clements

C3 SS

Prerequisites: 1 undergraduate Control subject plus

MATH2501

Constrained and unconstrained optimisation. 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, and other methods.

ELEC9416

Non-linear Systems and Simulation

Staff Contact: Prof N.W. Rees

C3 SS

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; Feedback Linearisation, Simulation and non-linear systems, numerical methods, simulation languages and shells.

Department of Electronics

ELEC9501

Advanced Semiconductor Devices

Staff Contact: Prof M.A. Green

C3

Note/s: 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

Staff Contact: Dr R.S. Huang

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 Staff Contact: Dr C.Y. Kwok

Prerequisite: 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

Staff Contact: Dr S.R. Wenham/Dr A.B. Sproul

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.

ELEC9506

Special Topic in Electronics Staff Contact: Dr R.S. Huang C3

This syllabus changes to allow presentation of a special topic of current interest particularly by visitors with recognized expertise in the topic.

ELEC9507

Solar Cells and Systems Staff Contact: Dr. S. Wenham C3

Prerequisite: ELEC4540 or similar

Harnessing of sunlight by using solar cells to convert it directly into electricity. The main emphasis is placed on applications including systems design, construction and operation with this subject building on the material introduced in the subject Applied Photovoltaics. Grid connected systems receive particular attention. Factors important in the design of solar cells are also studied with regard to their effects on spectral response, temperature sensistivity, resistive losses, current generation and open circuit voltages. A range of solar cell technologies are considered both at the laboratory and commercial levels. Advanced concepts and designs for photovoltaic modules and batteries are considered. Experience will be gained with the computer aided design procedures for photovoltaic systems. Management and entrepreneurial approach in relation to starting a small business within the photovoltaic industry are considered.

ELEC9508

High Efficiency Silicon Solar Cells Staff Contact: Prof M.A. Green C3

Prerequisite: ELEC9501 (or equivalent)

This is an advanced level subject for those with a good background in semiconductor device physics and an interest in silicon solar cells or related devices. After a brief review of the crystal structure, energy bands and phonon spectra of silicon, the course examines silicon's optical, recombintation and transport properties in some detail. Next comes a discussion of efficiency limits upon photovoltaic energy conversion, with particular emphasis upon light trapping and the potential for exceeding conventional limits. After discussion of presently achievable surface and bulk material properties, the final section of the course studies in detail the design of silicon cells upon both crystalline and multicrystalline substrates and under concentrated and non-concentrated sunlight.

Project Reports

ELEC9912 Project Report Staff Contact: A/Prof K.E. Tait 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.

ELEC9918 Project Report Staff Contact: A/Prof K.E. Tait

The 18 credit project is no longer available.

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. Kopalinsky

Administrative Officer

Mr A.D. Bauman

The School comprises seven departments: Aerospace Engineering (design, manufacture, and operation of aircraft and spacecraft); 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); Naval Architecture (analysis and design of marine vehicles such as ferries, catamarans, yachts and ships).

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.

No formal part-time courses are offered by the School. However, it is possible for students to undertake studies with a reduced program. Students intending to take a reduced program are advised that very few undergraduate subjects are offered in the evening.

Formal graduate courses offered are: the Master of Engineering Science in Industrial Engineering 8531 and in Mechanical Engineering 8541, and the Graduate Diploma in Industrial Engineering 5455 and Mechanical Engineering 5456. Opportunities are provided for graduate research leading to the award of the degrees of Master of Engineering 2680 and 2692 and Doctor of Philosophy 1662.

The Co-operative Program

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 5 industrial training periods. These take place at the end of year 1, end of year 2, second half of year 3, first half of year 4 and 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. This twelve month period is spent at two different industries. Scholars must be prepared to sacrifice leisure during non-academic periods to gain the considerable practical training available.

Undergraduate Study

Course Outlines

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, Aerospace Engineering and 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 year in the Mechanical Engineering course, 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 may also 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

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. This can be taken within Australia or overseas. Students must complete a total of sixty working days of approved industrial experience between 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 who have had suitable experience in industry may qualify for exemption from certain subjects. The Head of School should be contacted for details.

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

The student's attention is directed to the Faculty's General Rules for Progression contained in this Handbook. As well, the following points should be noted.

- 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.

3610	
Aerospace Engineering	
3663	
Manufacturing Management	
3680	
Mechanical Engineering	

3700 Naval Architecture

Bachelor of Engineering BE

		ПРТ	
Year 1 of all courses		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
Totalling	.	25	24

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

-, F	•		
Year 1		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
PHYS1002	Physics 1	6	6
and			
CHEM1201	Chemistry 1B (required for		
	Materials Science majors)	0	6
or			
COMP1011	Computing 1A (required for		
	Computer Science majors)	0	6
or			
1 relevant leve	el I unit from the School of		
Physics or Ma	thematics undergraduate		
offerings in the	Science Handbook	0	6
Totalling		27	29
_			

		н	PW
Year 2 of all	courses	S1	\$2
CIVL0696	Mechanical Properties of		
	Materials	1.5	0
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 Desig	n 23	3
MECH2300	Engineering Mechanics 2A	3	0
MECH2310	Engineering Mechanics 2B	0	2
MECH2401	Mechanics of Solids 2A	2	0
MECH2402	Mechanics of Solids 2B	0	3.5
MECH2600	Fluid Mechanics 1	2	2
MECH2700	Thermodynamics 1	2	2
General Education subject/s (Cat A)		2	2
Totalling		24.5	23.5

For MATH2009 students may substitute MATH2501, MATH2510, MATH2100 and MATH2120. 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

HDW

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 organizations. 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.

		H	IPW
Year 3		S1	S2
AERO3100	Aerospace Design 1	4	2
AERO3400	Analysis of Aerospace		
AFDOSSA	Structures 1	0	4
AERO3601	Aerodynamics 1	4	0
AERO3602	Flight Dynamics 1	2	0
ELEC0802 MANF3400	Electrical Power Engineering	0	3
MECH3000	Engineering Economics Professional Studies 3	2	0
MECH3200	Engineering Experimentation	0 1.5	2 1.5
MECH3211	Linear Systems	3	0
	Linear Systems	3	U
Year 3		S1	S2
MECH3212	Principles of Control of	_	
MEGUIOGAG	Mechanical Systems	0	3
MECH3310	Vibration Analysis	0	2
MECH3400	Mechanics of Solids 3	4	0
MECH3500 MECH3800	Computing 2M Numerical Methods	2	0
	ation subject/s (Cat B)	0	3
Totalling	auon subject/s (Cat B)	23.5	2 23.5
•		23.5	23.5
Year 4		_	_
AERO4100	Aerospace Design 2	3	3
AERO4201 AERO4202	Aerospace Systems	2	0
AERO4202 AERO4400	Space Engineering	0	2
AERU4400	Analysis of Aerospace Structures 2	3	2
AERO4601	Aerodynamics 2	2	3 2
AERO4602	Flight Dynamics 2	3	ō
AERO4700	Aerospace Propulsion	2	ÿ
MANF4400	Engineering Management	2	2 0
MECH4000	Thesis	6	6
MECH4001	Professional Studies 4	ŏ	2
MECH4002	The Engineer in Society	0	6 2 2
MECH4090	Industrial Training 2	0	0
Totalling	-	23	22

3663 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, development 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 students 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.

		HPW	
Year 3		S1	S2
	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		
1441E	Making Technology 1	4	2
MANF3800	Introduction to Numerical		
1450110000	Methods	0	1.5
MECH3000	Professional Studies 3	0	2
MECH3211	Linear Systems	3	0
MECH3212	Principles of Control of		
MEGUIOEGO	Mechanical Systems	0	3
MECH3500	Computing 2M	2	0
	ation subject/s (Cat B)	2	2
Totalling		22.5	20
Year 4			
MANF4010	Manufacturing Systems Design	2	2
MANF4300	Design of Manufacturing		
	Facilities 2	0	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	4	0
MECH4000	Thesis	6	6
MECH4001	Professional Studies 4	0	2
MECH4002	The Engineer in Society	0	2
MECH4090	Industrial Training	0	0
Totalling		22	18

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.

		Н	PW
Year 3		S1	S2
MECH3000	Professional Studies 3	0	2
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
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
	ation subject/s (Cat B)	2	2
Totalling		23.5	21.5
Year 4			
MANF4400	Engineering Management	2	0
MECH4000	Thesis	6	6
MECH4001	Professional Studies 4	0	2
MECH4002	The Engineer in Society	0	2
MECH4090	Industrial Training	0	0
MECH4500	Computing 3M	2	0
Technical Elec	tives	12	9
Totalling		22	19

Mechanical Engineering Technical Electives

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 corequisites can be satisfied. 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.

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 demand. Students are advised in September of each year which Technical Electives will be offered in the following year.

		Н	PW
Applied Mech	anics	S1	S2
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	Fracture Mechanics	3	or 3
MECH4410	Engineering Applications of		
	Finite Elements	3	or 3
MECH4420	Plates and Shells	3	or 3
Design			
MECH4110	Design Project	3	3
MECH4120	Design Technology	3	0
MECH4130	Computer-Aided Engineering		
	Design	0	3
MECH4131	Advanced CAD Modelling and	_	_
	Applications	3	or 3
MECH4140	Design Activity: Morphology,	_	
1450114450	Strategies and Tools	3	or 3
MECH4150	Design and Maintenance	•	or 3
MECH4160	of Components Design and Management of	3	or 3
MECH4160	Large Systems	3	or 3
	• ,	3	013
	ermal Engineering		
MECH4610	Advanced Fluid Dynamics	3	or 3
MECH4690	Special Fluid Mechanics Elective		or 3
MECH4700	Turbomachines and Engines	3	or 3
MECH4720	Solar Energy	3	or 3
MECH4730	Multiphase Flow	3	or 3
MECH4740	Thermal Power Plants	3	or 3
MECH4751	Refrigeration and Air Conditioning	3	or 3
MECH4790	Special Thermodynamics	•	or 3
	Elective	3	or 3
General	÷		
MECH4020	Group Engineering Project	3	3
MECH4800	Optimal Engineering Strategies	3	0
Recommended External Technical Electives			
MATS9530	Materials Engineering	3	or 3
SAFE9213	Introduction to Safety		
		_	_

Engineering M

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.

		HPW	
Year 3		S1	S2
NAVL3100	Principles of Ship Design 1	1.5	1.5
NAVL3400	Ship Structures 1	2	2
NAVL3600	Ship Hydrostatics	2.5	2.5
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	Ō
MECH3800	Numerical Methods	0	3
ELEC0802	Electrical Power Engineering	0	3
General Education subject/s (Cat B)			2
Totalling		21.5	25
Year 4			
NAVL4000	Ship Management Economics	2	0
NAVL4100	Principles of Ship Design 2	4	2
NAVL4110	Ship Design Project	3	4
B1 63 / 4 4 6 6		•	•

Totalling	, ,	21.5	25
Year 4			
NAVL4000	Ship Management Economics	2	0
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	Ó	2
MECH4002	The Engineer in Society	O	2
MECH4090	Industrial Training	0	0
MECH4500	Computing 3M	2	0
Totalling	, •	23	22

Combined Courses Bachelor of Engineering/ Bachelor of Science

3611 BE BSc in Aerospace Engineering

3664 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 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 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,
- 3. obtained approval from the Board of Studies in Science and Mathematics.

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 compatible' course in the School of Mechanical and Manufacturing 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 relevant undergraduate offerings in the Science Handbook, or in exceptional circumstances, some other equivalent subject with the permission of the Head of the School of Mechanical and Manufacturing Engineering.

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 Session 1 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.

General Education requirements correspond to whatever is required in year 2 of the normal Mechanical Engineering, Manufacturing Management, Aerospace Engineering or Naval Architecture degree course.

Year 2 All students should note that the Mathematics subjects are also offered at a higher level.

		HPW	
		\$1	S2
MECH1500	Computing 1M	0	3
MECH2300	Engineering Mechanics 2A	3	0
MECH2400	Mechanics of Solids 2	3.5	3.5
MATH2100	Vector Calculus	2.5	0
MATH2120	Mathematical Methods for		
	Differential Equations	0	2
MATH2501	Linear Algebra	2.5	2.5
MATH2510	Multivariable Calculus	2.5	0
MATH2520	Complex Analysis	0	2.5
	4.5 Level II units ¹	9+	9+
Totalling		23+	22.5
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 app	propriate Level II or III units of		
which at least 4 must be Level III ¹		10+	10+
One 56-hr or	two 28-hr General		
Education sul	bject/s Cat A	2	2
Totalling		19+	21+

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

Computer Science Majors

Quota restrictions apply to certain Computer Science Level III 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.

Year 2

COMP1021, COMP2011, COMP2021, COMP2031 MATH2501 (or MATH2601), MATH2510 (or MATH2610), MATH2520 (or MATH2620), MATH2100 (or MATH2110), MATH2120 (or MATH2130)

MATS9520 MECH2300, MECH2400, MECH1500²

ELEC0805

MATH2841 (or MATH2839)

MECH2000, MECH2100, MECH2310, MECH2600,

4 Level III units from undergraduate offerings of the School of Computer Science and Engineering for course 3681 in the Science Handbook.

One 56-hr or two 28-hr General Education subject/s Cat A.

Materials Science Majors

Year 2

CHEM20118, CHEM20218

MATH2501 (or MATH2601), MATH2510 (or MATH2610), MATH2520 (or MATH2620)

MATH2100 (or MATH2110), MATH2120 (or MATH2130) MATS43633 (Units 1 and 3), MATS1002, MATS1253,

MATS1072 MECH2300, MECH2400, MECH1500

Year 3

ELEC0805

MATH2841 (or MATH2839)

MATS4363 (Units 2 and 4), MATS93233 (Units 1 and 3),

MATS1263, MATS1083,

MATS1042

MECH2000, MECH2100, MECH2310, MECH2600,

MECH2700

POLY3010

One 56-hr or two 28-hr General Education subject/s Cat A.

Mathematics Majors

Year 2

Same year 2 as for Computer Science or Materials Science or Physics or Statistics majors

ELEC0805

MATH2501 (or MATH2601), MATH2510 (or MATH2610), MATH2520 (or MATH2620),

MATH2100 (or MATH), MATH2120 (or MATH2130) **MATS9520**

MECH2300, MECH2400, MECH1500

3.5 appropriate Level II units from undergraduate offerings for course 3681 in the Science Handbook including some from the School of Mathematics 6.

Year 3

MECH2000, MECH2100, MECH2310, MECH2600, MECH2700, MATH2841 (or MATH2839)

4 Level III units from School of Mathematics undergraduate offerings in the Science Handbook.

One 56-hrour two 28-hr General Education subject/s Cat A.

Physics Majors

Year 2

98

MATH2501 (or MATH2601), MATH2510 (or MATH2610), MATH2520 (or MATH2620).

MATH2100 (or MATH2110) MATH2120 (or MATH2130) MATS9520

MECH2300, MECH2400, MECH1500

PHYS2001, PHYS2011, PHYS2021, PHYS2031

Year 3

MATH2841 (or MATH2839) ·

MECH2000, MECH2100, MECH2310, MECH2600, MECH2700

PHYS3010⁷, PHYS3021, PHYS3030⁷, PHYS3041⁷

1 Level III unit from School of Physics undergraduate offerings in the Science Handbook.

One 56-hr or two 28-hr General Education subject/s Cat A.

Statistics Majors

Year 2

ELEC08056

MATH2501 (or MATH2601), MATH2510 (or MATH2610), MATH2520 (or MATH2620),

MATH2100 (or MATH2110), MATH2120 (or MATH2130),

MATH2801 (or MATH2901),

MATH2821 (or MATH2921), MATH2810 (or MATH2910),

MATH2830 (or MATH2930)

MATS9520

MECH2300, MECH2400, MECH1500

0.5 appropriate Level II unit.5

Year 3

MECH2000, MECH2100, MECH2310, MECH2600, MECH2700

- 4 Level III units from Statistics undergraduate offerings in the Science Handbook
- 1 Level II or III unit from School of Mathematics or School of Physics undergraduate offerings in the Science Handbook.

One 56 hour or two 28 hour General Education subject/s Cat A.

Notes

- The following considerations pertain to the choice of additional units in years 2 and 3 listed in undergraduate offerings in the Science Handbook:
- (a) The Level III 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 corequisites are satisfied.
- 2. With permission of the School of Mechanical and Manufacturing Engineering, students may delay this subject till year 3.
- 3. Provided MECH2401 and MECH2402 are taken concurrently or have been taken, the pre or corequisite requirement of MATS1062 is assumed to be satisfied.
- 4. These Mathematics Majors need to add ELEC0805 Electronics for Measurement and Control to year 3.

- 5. These Mathematics Majors should substitute 1 Level II or III units from the Schools of Physics, Chemistry or Mathematics undergraduate offerings for MATH2841 Statistics in Year 3.
- 6. Students may substitute PHYS2031 Laboratory for ELEC0805 plus a 0.5 Level II unit.
- 7. Under special circumstances, with permission of the Head of the School of Physics, a student may substitute alternative Physics Level III undergraduate offerings of equivalent unit value.
- 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.

Combined Courses Bachelor of Engineering/Bachelor of Arts

3612

BE BA in Aerospace Engineering

3665

BE BA in Manufacturing Management

3682

BE BA in Mechanical Engineering

3702

BE BA in Naval Architecture

The BE BA Program

With these combined degree courses students can add their choice of an Arts program to any of the standard, professionally accredited engineering courses offered by the School of Mechanical and Manufacturing Engineering. The full range of Arts programs is available.

Because the Engineering and Arts programs have common content, such as mathematics and physics, only one more year of study is normally required to gain the additional qualification of Bachelor of Arts.

Eligibility

Anyone who meets the entry requirements for both Engineering and Arts is eligible for the combined course. Students may enter directly in year 1 or may apply to transfer from the normal engineering course later, although with late transfer it might not be possible to complete the course in minimum time.

Organization

The BE BA course is administered by the School of Mechanical and Manufacturing Engineering.

Students should start discussing their program with representatives of the School and the Faculty of Arts and Social Sciences as soon as possible - preferably well before enrolment. Enquiries should be directed to the Executive Assistant to the Dean of the Faculty of Arts and Social Sciences.

Students should work out for themselves the arts program they would like to add to their chosen engineering course. The Arts and Social Sciences Faculty Handbook describes the options, and the School of Mechanical and Manufacturing Engineering can supply sample programs showing what previous students have arranged.

There are no special rules on what to include in each year. Students should schedule the arts and engineering components to suit their preferences while meeting the constraints of timetables and prerequisites. The sample programs can help here too.

The Arts component must be approved by the Faculty of Arts and Social Sciences.

The final program and schedule must be approved by the School.

Rules

 In addition to their chosen BE course, students must complete a major sequence offered within the BA course and meet the additional requirements from the Faculty which provides the chosen major. The required Arts credit points are:

Faculty of Arts and Social Sciences: 48 total including major sequence.

Other Faculties:

Major sequence plus at least 12 credit points from Schools of the Faculty of Arts and Social Sciences.

Mathematics majors are not usually permitted. BE BSc double degrees are more appropriate for this.

- 2. The requirements of the General Education Program must be met. In some cases subjects within the combined course may satisfy the Category A and/or Category B guidelines. Students should consult the Centre for Liberal and General Studies for advice.
- 3. There will be a testamur for each part of the combined degree course.
- 4. Students who complete the BE program first may proceed to graduation with the degree of Bachelor of Engineering in the usual way.
- 5. Students who complete the requirements for their Arts program and the first two years of the BE program may proceed to graduation with the degree of Bachelor of Arts.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

Aerospace Engineering

AERO3100 Aerospace Design 1

Staff Contact: Mr J.R. Page F HPW3

Prerequisites: MATS9520, MECH2100, MECH2401,

MECH2402

Corequisites: 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 1 Staff Contact: A/Prof D.W. Kelly S2 L3 T1 Prerequisites: MATH2009, MECH2401, MECH2402 Corequisite: MECH3400

Aerospace applications of plane frames and space structures. Open and closed section thin walled beams, tapered beams. Semi-monocoque structures, ribs and bulkheads. Stresses due to torsion and shear in multicell tubes. Deflections. Structural instability, buckling of perfect and imperfect columns, bending and buckling of thin flat plates. Introduction to composite materials, sandwich panels.

AERO3601

Aerodynamics 1 Staff Contact: Dr N.E.A. Ahmed

S1 HPW4

Prerequisites: MATH2009, MECH2600, MECH2700

Corequisites: AERO3602 Note/s: 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 Prandtl 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

Staff Contact: Mr J.R. Page

S1 HPW2

Prerequisites: MECH2300, MECH2310, MECH2600

Corequisite: AERO3601 Note/s: 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

Staff Contact: Mr J.R. Page

F L2 T1

Prerequisites: AERO3100, AERO3601, AERO3602 Corequisites: AERO4400, AERO4601, AERO4602.

AERO4700

Note/s: 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

Staff Contact: Mr J.R. Page

S1 HPW2

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

Staff Contact: Mr J.R. Page

S2 HPW2

Prerequisites: AERO3602

Corequisite: 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

Staff Contact: A/Prof D.W. Kelly

F L2 T1

Prerequisites: AERO3400, MECH3400 Note/s: Excluded MECH4410, MECH9410.

Finite element analysis of aerospace structures. Selection of applications from linear and nonlinear elasticity using commercial finite element programs. Fracture mechanics including residual strength of cracked components, crack growth, arrest and damage tolerance. Introduction to aeroelasticity. Thermal stresses. Advanced analysis of composite structures.

AERO4601

Aerodynamics 2

Staff Contact: Dr N.E.A. Ahmed

F L1.5 T.5

Prerequisite: AERO3601

Note/s: 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

Staff Contact: Mr J.R. Page

S1 L2 T1

Prerequisites: AERO3602, MECH3211

Note/s: 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

Staff Contact: Mr J.R. Page

F L1.5 T.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.

Manufacturing Management

MANF0420

Production Management

Staff Contact: Dr K. Hoang

Manufacturing industry dynamics. Porters Model; bases for competition. Meaning of waste; value adding management. Dynamics of materials flow. Hierarchical planning; MRP; OPT; JIT; maintenance management. Manufacturing performance monitoring.

MANF1100

Workshop Technology

Staff Contact: Dr P. Mathew

SS HPW3

Note/s: Students who have done Industrial Arts for the HSC, have an appropriate trade or certificate qualification. or are suitably employed, may qualify for exemption from this subject.

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.

MANF1110

Manufacturing Technology Staff Contact: Dr P. Mathew

S2 HPW3

Corequisites: MECH1100, MECH1300, MECH1400

Description of the processes classified as: forming from liquid or solid, material removal, material joining. Elementary mechanics of forming and cutting processes. Machine tools operation. Relationship between product design and manufacturing process. Elementary functional analysis of product design for manufacturing and performance.

MANF3200

Product Design and Manufacturing Technology Staff Contact: Mr K.C. Chan

S1 HPW4

Corequisites: MANF3410, MECH2100, MECH2401

Note/s: Excluded MANF3209

Design for economic manufacture. Geometric analysis of product designs and the technology and economics of manufacturing and assembly 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

Staff Contact: Dr L.E. Farmer

S2 HPW4

Corequisites: MANF3200, MANF3410, MANF3500,

MATH2839

Note/s: Excluded MANF3309

The design of workplaces where operations such as assembly and measurement are performed by a human operator or robot. Documentation of manufacturing processes, characteristics of human operator and robots. workplace and methods design, measurement of workplace element characteristics.

MANF3400

Engineering Economics Staff Contact: Mr M. Hasan

S1 HPW2

Prerequisite: MECH1500 Note/s: Excluded MANF3619

Concept of Engineering economy; cost information; engineering and investment decision. Interest formulas: nominal and effective interest rate. Methods for evaluating investment; present worth, equivalent annual worth, payback period and rate of return. Comparing alternative investments. Replacement analysis. Depreciation; effect of income taxes on economic analysis; inflation and deflation; benefit-cost analysis.

MANF3410

Quality Systems 1

Staff Contact: Dr P. Mathew

S1 HPW4

Prerequisites: MANF1110, MATH2839 Note/s: Excluded MANF3809, 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

S2 HPW4

Computers in Manufacturing 1

Staff Contact: Prof H. Kaebernick

Prerequisites: ELEC0805, MANF1110, MECH1500

Note/s: Excluded MANF4509.

Selection and use of computer-controlled devices such as robots, machines and vehicles in manufacturing systems: principles of numerical control and PLCs, NC machine tools, NC programming, CNC/AC/DNC computer controls, accuracy of NC machines, fundamentals and applications of robots.

MANF3600

Information and Decision Making Technology 1

Staff Contact: A/Prof R.M. Kerr

S1 HPW2

Prerequisites: MATH2839, MECH1500

Note/s: Excluded MANF3609, MANF4610, MANF9620,

MANE9629

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.

Introduction to Numerical Methods

Staff Contact: Dr I. Maclaine-cross

S2 HPW1.5

Prerequisites: MATH2009, MECH1500

Note/s: Excluded MANF3809. 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 relevant undergraduate offerings in the Science Handbook for this subject.

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

Staff Contact: Dr P. Mathew

F HPW2

Students will work in project teams to perform a complete manufacturing system design, involving activities such as: design for manufacture, process selection, tolerance optimization, workplace design, factory layout, production control system, detailed budget.

MANF4300

Design of Manufacturing Facilities

Staff Contact: Mr K.C. Chan

S2 HPW4

Corequisite: MANF3300

Introduction to plant layout design and materials handling system. Analysis and simulation and various types of

manufacturing facilities.

MANF4400

Engineering Management

Staff Contact: Dr B. Kayis

S1 HPW2

Prerequisite: MANF3400 Note/s: Excluded MANF3619

Summary of macro and micro economic issues from an engineering management perspective, management science models, industrial relations, human resource management, management of quality systems, engineering project management, management of technical change and innovation.

MANF4410

Quality Systems 2

Staff Contact: Dr B. Kayis

S1 HPW2

Prerequisite: MANF3410

Note/s: Excluded MANF4429, MANF9410.

Quality planning in service and manufacturing industries; statistical process control, process capability analysis, lot by lot acceptance sampling by attributes, additional acceptance sampling plan systems, quality management systems, national and international standards.

MANF4420

Management of Manufacturing Systems

Staff Contact: Dr K. Hoang

S1 HPW6 S2 HPW2

Prerequisites: MANF3400, MANF3410, MANF3600
Note/s: Excluded MANF0400, MANF4429, MANF9020.

Manufacturing industry dynamics. Porters Model; bases for competition; meaning of waste; value adding management; dynamics of materials flow; hierarchical planning; MRP, OPT, JIT, maintenance management; manufacturing performance monitoring; use of a production planning and control system in a simulated production company.

MANF4500

Computers in Manufacturing 2

Staff Contact: Prof H. Kaebernick

S1 HPW2

Prerequisite: MANF3500

Integration of the basic elements of manufacturing facilities into systems: selection of automation equipment, principles of group technology and cellular manufacturing, Flexible Manufacturing Cells, planning and layout of Flexible Manufacturing Systems, integration of CAD and CAM, computer integrated manufaturing, computer aided process planning.

MANF4600

Information and Decision Making Technology 2

Staff Contact: A/Prof R.M. Kerr

S1 HPW4

Prerequisite: MANF3600

Note/s: Excluded MANF3609, MANF4610, MANF9620,

MANF9629.

More advanced linear programming; general mathematical optimization techniques including goal programming; examples from manufacturing industry. More advanced topics in simulation, design of simulation experiments; factory simulation packages. Knowledge based and expert systems and their role in integrated manufacturing.

Mechanical Engineering

MECH0130

Engineering Drawing and Descriptive Geometry

Staff Contact: Dr R.A. Platfoot

SS L1 T3

Note/s: This is a servicing subject taught within courses offered by other schools and faculties.

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

Staff Contact: A/Prof A.E. Churches

S1 L3 T2

Note/s: Excluded MECH0130, MECH1110.

This subject is intended specifically for Electrical Engineering students, and is to be taken in conjunction with MECH0360.

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

Staff Contact: Dr R.A.J. Ford

SS L2 T2

Prerequisites: As for MECH1300 Engineering Mechanics 1 Note/s: Excluded MECH0360, MECH1300. This is a servicing subject taught within courses offered by other schools and faculties.

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

Staff Contact: A/Prof J.E. Baker

S1 L2 T1

Prerequisite: HSC Exam Score Range Required - Either 2 unit Science (Physics) 53-100, or 3 unit Science 90-150, or 4 unit Science multistrand 1-50, or 2 unit Industrial Arts (Engineering Science) 53-100, or 3 unit Industrial Arts (Engineering Science) 1-50

Note/s: Excluded MÉCH0330, MECH0440, MECH1300. This subject is intended specifically for Electrical

Engineering students, and is to be taken in conjunction with MECH0160.

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

Staff Contact: Dr R.A.J. Ford

SS L2 T1

Prerequisites: As for MECH1300 Engineering Mechanics 1. Note/s: Excluded MECH0330, MECH0360, MECH1300.

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

Staff Contact: A/Prof E. Leonardi

Prerequisites: MATH2100, MATH2120 or equivalent,

PHYS1969

Note/s: 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.

MECH1000

Professional Studies 1

Staff Contact: Dr R.A.J. Ford

S1 HPW1

Prerequisite: HSC Exam Score Range Required - 2 unit English (General) 53-100, or 2 unit English 49-100, or 3 unit English 1-50, or 2 unit Contemporary English 60-100 Note/s: 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

Staff Contact: A/Prof A.E. Churches

S1 HPW1 S2 HPW2 Corequisite: 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: recognizing 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

Staff Contact: Mr A.J. Barratt

S2 L1 T2

Note/s: Excluded MECH0130, MECH0160.

Freehand sketching of machine components, standard drawing methods, orthogonal projections and sections for analysis and communication, dimensions, tolerances and conventional symbols. Computer graphics modelling of components, assembly and production of detail drawings.

MECH1300

Engineering Mechanics 1

Staff Contact: Dr K. Zarrabi

S1 or S2 L2 T2

Prerequisite: HSC Exam Score Range Required - Either 2 unit Science (Physics) 53-100, or 3 unit Science 90-150, or 4 unit Science multistrand 1-50 or 2 unit Industrial Arts (Engineering Science) 53-100, or 3 unit Industrial Arts (Engineering Science) 1-50

Note/s: Excluded MECH0330, MECH0360. 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-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.

MECH1400

Mechanics of Solids 1

Staff Contact: Dr M. Chowdhury

S1 or S2 L2 T1

Corequisite: MECH1300 or MECH0330 or MECH0360 or

MECH0440

Stress and strain. Internal forces. 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

Staff Contact: Dr R.A. Willgoss

S2 HPW3

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.

Professional Studies 2

Staff Contact: Mr A.J. Barratt

S2 HPW4 total

Prerequisite: MECH1000

To introduce the student to the engineering working environment. To get the student curious about the engineering environment. To give practice in preparation for job applications. Preparation for Industrial Training.

MECH2100

Mechanical Engineering Design 2

Staff Contact: Mr R.B. Frost

F L1 T2

Prerequisites: MANF1110, MECH1110, MECH1400

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

Staff Contact: Dr S.S. Leong

S1 or S2 L2 T1

Prerequisites: MATH1032 or MATH1042, MECH1300 or

MECH0360

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

Staff Contact: Dr J.M. Challen

S1 or S2 HPW2

Corequisite: MECH2300

Differential equations of motion. Transverse vibrations of beams. Whirling of shafts. Single degree-of-freedom systems: free, forced, undamped and damped vibrations. Transmissibility.

MECH2401

Mechanics of Solids 2A

Staff Contact: Dr H.L. Stark

S1 L1 T1

Prerequisite: MATH1032 or MATH1042

Corequisite: MECH1400 Note/s: Excluded MECH2400

Revision of Statics. The variation with orientation of stress at a point in 2D, Mohr's Circle. The variation with orientation of stress at a point in 3D given one principal stress. The variation with orientation of strain at a point, Mohr's Circle, strain gauges. The relationships between stress and strain during linear elastic deformation. The interdependence of elastic moduli. The variation with orientation of stress at a point in the general 3D case. Octahedral stresses. Strain energy stored in a linearly elastic body resulting from volume change and from distortion. Yield Criteria.

MECH2402

Mechanics of Solids 2B

Staff Contact: Dr H.L. Stark

S2 L1.5 T2

Prerequisite: MECH2401

Note/s: Excluded MECH2400

Fatigue, stress concentrations. Fatigue with multiaxial stresses, Miner's rule. Membrane stresses. Simple bending, second moment of area of a cross-section lx. Unsymmetrical bending of beams, second moments of area lx,ly, lxy. Principal second moments of area lu and lv. Bending of composite beams, reinforced concerete beams. Transverse shear stresses in beams. Shear Centre. Combined stresses in beams. Column buckling.

MECH2600

Fluid Mechanics 1

Staff Contact: Prof G.L. Morrison

F L1 T1

Prerequisites: MATH1032 or MATH1042, PHYS1919

Fluid properties. Fluids in static equilibrium. Bouyancy. Pressures in accelerating fluid systems. Steady flow energy equations. Flow measurement. Momentum equation. Dimensional analysis and similarity. Incompressible laminar and turbulent flow in pipes; friction factor. Laminar flow between parallel plates and in ducts. Elementary boundary layer flow; skin friction and drag. Pumps and turbines. Pump and pipe-line system characteristic.

MECH2700

Thermodynamics 1

Staff Contact: A/Prof E. Leonardi

F L1 T1

Prerequisites: MATH1032 or MATH1042, PHYS1919

Basic concepts and definitions: systems, property, state, path, process. Work and heat. Properties of pure substances, tables of properties, equations of state. First Law of thermodynamics. Analysis of closed and open systems. Second law of thermodynamics: definitions, Carnot cycle, Clausius inequality, entropy, irreversibility, isentropic efficiencies. Air-standard cycles. Vapour cycles. Basic heat transfer.

MECH3000

Professional Studies 3

Staff Contact: A/Prof J.A. Reizes

S2 HPW2

Prerequisite: MECH2000

Technical report writing. Oral reporting. Professional ethics, responsibility, liability and intellectual property. Preparation for Industrial Training.

MECH3010

Industrial Training 1

Staff Contact: Mr A.J. Barratt

S1

Note/s: Report to be submitted by end of the second week of Session1 detailing involvement and experience gained prior to year 3.

Practical work in industry at the process or shop floor level to gain experience of people, industrial problems and relations, and process equipment.

Co-operative Training A

Staff Contact: Mr R.B. Randall

Prerequisite: Completion of Year 2 of course.

Co-op scholars are required to do a 22 week period of industrial training in Session 2 of their year 3. The location of the training is at the site of one of the sponsors of scholarships for that year. At the end of the training, they are required to submit a report on the training, which is evaluated by their academic mentor, and normally make a presentation on this topic at the company to company representatives and the academic mentor.

MECH3092

Co-operative Training B

Staff Contact: Mr R.B. Randall

Prerequisite: Completion of Year 2 of course.

Co-op scholars are required to do a 24 week period of industrial training in Session 1 of their fourth year of attendance (before completing their third academic year in Session 2 of the same year). The location of the training is at the site of one of the sponsors of scholarships for that year. At the end of the training, they are required to submit a report on the training, which is evaluated by their academic mentor, and normally make a presentation on this topic at the company to company representatives and the academic mentor.

MECH3100

Mechanical Engineering Design 3

Staff Contact: Dr A.J. Barratt

F L2 T1

Prerequisite: MECH2100

Corequisites: 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

Staff Contact: Dr R.A. Willgoss

F HPW1.5

Prerequisites: ELEC0805, MECH2401, MECH2600,

MECH2700

Note/s: 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

Staff Contact: Dr M.J. Tordon

S1 L2 T1

Prerequisites: MATH2009, MECH1300

Note/s: 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 relevant undergraduate offerings in the Science Handbook.

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

Staff Contact: Dr R.A. Willgoss

S2 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

Staff Contact: A/Prof K.P. Byrne

S1 HPW2

Prerequisites: MATH2009, MECH2300

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

Staff Contact: Prof C. Patterson

S2 HPW2

Prerequisites: MATH2009, MECH2310

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

Staff Contact: A/Prof E.J. Hahn

S1 L3 T1

Prerequisites: MATH2009, MECH2401

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

Staff Contact: Dr J. Katupitiya

S1 HPW2

Prerequisite: MECH1500
Note/s: Excluded 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.

Fluid Mechanics 2

Staff Contact: A/Prof J.A. Reizes

S1 HPW2

Prerequisites: MATH2009, MECH2600, MECH2700

Note/s: Excluded 5.630, 5.653, 5.663.

Dimensional Analysis, dynamic similarity, turbomachines; incompressible, inviscid flow; compressible flow.

MECH3701

Thermodynamics 2

Staff Contact: Dr R.T.Casey

S1 HPW2

Prerequisite: MECH2700

Note/s: 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

Staff Contact: Dr M. Behnia

S2 HPW2

Corequisite: MECH3600 Note/s: Excluded 5.336.

Basic concepts of heat transfer, units, dimensions. One dimensional steady state conduction; multi dimensional conduction. Internal and external laminar and turbulent forced convection. Heat exchanger analysis. Radiative heat exchanges. Experiments and heat transfer measurements.

MECH3800

Numerical Methods

Staff Contact: Dr I.L. Maclaine-cross

S2 L2 T1

Prerequisites: MATH2009, MECH1500

Note/s: 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 relevant undergraduate offerings in the Science Handbook for this subject.

Numerical methods for solution of non-linear equations, linear and non-linear systems, ordinary and partial differential equations.

MECH4000

Thesis

Staff Contact: Dr M. Chowdhury

FT6

Corequisite: MECH4001

Note/s: 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

Staff Contact: Dr I.L. Maclaine-cross

S2 HPW2

Prerequisites: MECH3000

Corequisite: MECH4000, MECH4002

Note/s: 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

Staff Contact: Dr R.T. Casey

S2 HPW2

Corequisite: MECH4001

Note/s: This subject satisfies the requirements of Category

C of the General Education Program.

Reading, instruction and project work concerned with the organizational, 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.

MECH4010

Industrial Training 2

Staff Contact: Mr J.A. Barratt

S1

Note/s: Report to be submitted in Session 1 detailing responsibilities and experience gained in vacation period between Years 3 and 4.

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.

MECH4020

Group Engineering Project

Staff Contact: Dr M. Behnia

F HPW3

Project management and task definition. Selection of a project from a list of available projets in different design areas. Assessment of market potential and subsequent development of design. Consideration of environmental and safety impacts. Procedures for manufacture and/or construction and the industrial design. Preparation of the engineering report and seminar presentation.

MECH4090

Industrial Training

Staff Contact: Mr A.J.Barratt

S1

Prerequisite: MECH2000

Note/s: Excluded MECH3010, MECH4010

Students must complete a minimum of 60 days of appropriate industrial training and prepare a report summarising the work done and training received. The report is to be submitted by the end of week 2 of Session 1 with endorsement of employer confirming completion of training. Industrial experience may include workshop training, manufacturing, design, drafting, development, industrial relations, maintenance and/or management in an engineering environment.

MECH4110 Design Project

Staff Contact: A/Prof A.E. Churches

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

Staff Contact: Mr R.B. Frost

S1 L2 T1

Prerequisite: MECH2100
Note/s: Excluded MECH9120

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

Staff Contact: Dr R. A. Platfoot

S2 L2 T1

Prerequisite: MECH3100

Note/s: Excluded MANF3819, MANF9630, MECH9130

Mathematical modelling and analysis of component and system designs using the computer as a tool to optimise and investigate design solutions. Use of available CAD and computational engineering packages to develop and analyse designs of industrial equipment.

MECH4131

Advanced CAD Modelling and Applications

Staff Contact: Mr A.J. Barratt

SS HPW3

Note/s: Excluded MECH9131

Development of CAD modelling systems, 2D and 3D, wire frame, surface representation and solids. Advanced modelling techniques of complex geometry, surfaces, bodlean operations and solids manipulation. Programming and database interfacing in a CAD environment. Development of engineeering based applications using these facilities.

MECH4140

The Design Activity: Morphology, Strategies and

Tools

Staff Contact: Mr R.B. Frost Prerequisite: MECH3100 Note/s: Excluded MECH9140

Morphology: The nature of the design activity, creativity, synthesis, stereotypes, models, scenarios, the real struggles, determiners of success, factors of influence, protection. Strategies: Creativity enhancing, concept manipulation, modularity, evaluation, strategy generation. Tools: For synthesis: combinatorial methods, modellers. For analysis: FEM, CFD, DSL, HLL's AI, ES, etc. For representation: CAD, DATABASES.

MECH4150

Design and Maintenance of Components

Staff Contact: Dr R.A. Platfoot

SS HPW3

Prerequisite: MECH3100 Note/s: Excluded MECH9150

Functional specification for service life, manufacturing and material requirements. Design for function and strength. Design for manufacture and assembly. Overview of damage mechanisms and their maintenance burden, inspection procedures and damage prediction by mathematical modelling. Quality management including audit checks, inspection and quality in manufacture.

MECH4160

Design and Management of Large Systems

Staff Contact: Dr R.A. Platfoot

SS HPW3

Prerequisite: MECH3100 Note/s: Excluded MECH9160

Plant layout and specification. Modular design of large plants. Design for redundancy and critical path for breakdowns. Operation versus maintenance. Formulation of policies for condition monitoring, plant inspection, risk analysis and life forecasting. Rehabilitation including plant flexibility, redesign and strategies for rehabilitation. Plant modellling and component tracking, work flow tracking and procedure libraries.

MECH4301

Plane Mechanism Kinematics

Staff Contact: A/Prof J.E. Baker

SS L2 T1

Prerequisite: MECH2300
Note/s: 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

Staff Contact: Mr R.B. Randall

SS L2 T1

Prerequisite: MECH3310
Note/s: 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.

Engineering Noise 1

Staff Contact: Dr J.M. Challen

SS L2 T1

Note/s: Excluded MECH9325.

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

Staff Contact: A/Prof K.P. Byrne

SS L2 T1

Prerequisite: MECH4321
Note/s: Excluded MECH9326.

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

Staff Contact: A/Prof E.J. Hahn

SS HPW3

Prerequisites: MECH2600, MATH2009

Note/s: 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

Fracture Mechanics

Staff Contact: Dr K. Zarrabi

SS L2 T1

Prerequisite: MECH3400

Note/s: Excluded MECH9400, 5.424.

Fracture mechanics and its applications to various industries, including aerospace, power generation, etc. Review of mathematical theory of elasticity. Plastic collapse. Overview of damage tolerance analysis. Geometric stress concentration factor. Linear and nolinear fracture mechanics. Residual strength diagram. Crack growth analysis. Damage tolerance analysis. Fracture control. Applications.

MECH4410

Engineering Applications of Finite Elements

Staff Contact: A/Prof D.W. Kelly

SS L2 T1

Prerequisite: MECH3400

Note/s: Excluded AERO4400, MECH9410.

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

Staff Contact: Dr H.L. Stark

SS L2 T1

Prerequisite: MECH3400

Note/s: 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.

MECH4500

Computing 3M

Staff Contact: Dr J. Katupitiya

S1 HPW2

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.

MECH4610

Advanced Fluid Dynamics

Staff Contact: A/Prof E. Leonardi SS HPW3

Prerequisite: MECH3600

Note/s: Excluded MECH4600, MECH4710, MECH9610,

MECH9710

Review of vector analysis and cartesian tensors. Kinematic of fluid motion. Reynolds' Transport theorem. Stress in fluid motion. Cauchy's equation. Constitutive equations. Dynamics of fluid motion. Navier-Stokes equations. Thermodynamics and heat transfer. Turbulent motion. Time smoothing. Typical flows and flow patterns. Internal and external flows with and without heat transfer. Separation. Unsteady flows. Turbulent flow. Large scale and small scale flows.

MECH4690

Special Fluid Mechanics Elective

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.

MECH4700

Turbomachines and Engines

Staff Contact: Prof B.E. Milton

SS-HPW3

Prerequisite: MECH3701

Definition, classes and characteristic of turbomachines, sizing using dimensional analysis. Thermodynamics, 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, heat transfer, turbomachinery in engines. Control of emissions from engines.

MECH4720 Solar Energy

Staff Contact: A/Prof G.L. Morrison

SS L2 T1

Prerequisites: MATH2009, MECH3702

Note/s: Excluded MECH9720.

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. System modelling, energy storage. Computer simulation of performance and economic worth.

MECH4730 Multiphase Flow

Staff Contact: Dr M. Behnia SS L2 T1

Prerequisite: MECH3600 Note/s: Excluded MECH9730

Nature of multiphase flow. Flow patterns. Gas-liquid multi-component flows. Two phase flow models. Pressure drop correlations for pipe design. Mechanisms of boiling and condensation. Design of boilers, evaporators and condensors. Design of refrigeration heat exchangers. Design of oil and gas pipelines. Measurement techniques and experiments.

MECH4740

Thermal Power Plants Staff Contact: Dr M. Behnia

SS HPW3

Prerequisites: MECH2600, MECH2700

Note/s: 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. Power station field trip.

MECH4751

Refrigeration and Air Conditioning Staff Contact: A/Prof E. Leonardi

SS HPW3

Corequisite: 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.

MECH4790

Special Thermodynamics Elective

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.

MECH4800 Optimal Engineering Strategies Staff Contact: A/Prof J.E. Baker SS L2 T1

Prerequisites: MATH2009, MECH2300

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.

Naval Architecture

NAVL3100

Principles of Ship Design 1 Staff Contact: Dr P.K. Pal

F HPW1.5

Coreguisites: NAVL3600, NAVL3610

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

Staff Contact: Dr M. Chowdhury

F HPW2

Prerequisites: MATH2009, MATS9520, MECH2402

Corequisite: MECH3400

Introduction to rationally-based structural design and optimization. Loading and responses in ship and off-shore structures. Bending of the hull girder-linear deterministic approach. Statistical predictions of wave loads and hull girder response. Fatigue strength and minimum required section modulus. Concepts in matrix stiffness analysis and finite element analysis. Frame analysis and applications in ship structures. Laterally loaded grillages and stiffened panels - elastic analysis. Applications of extended beam theory - hull girder analysis. Use of super-elements in hull module analysis.

NAVL3600

Ship Hydrostatics

Staff Contact: Mr P.J.Helmore

F L2 T.5

Prerequisites: MATH1032, MECH1300, MECH1500,

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

Staff Contact: A/Prof L.J. Doctors

F12T5

Prerequisites: MATH2009, MECH2300, MECH2310,

MECH2600

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 Staff Contact: Dr P.K. Pal S1 HPW2

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 Staff Contact: Dr P.K. Pal S1 HPW4 S2 HPW2 Prerequisite: NAVL3100 Corequisite: NAVL4400

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 Staff Contact: Dr P.K. Pal

S1 T3 S2 T4

Prerequisites: NAVL3100, NAVL3600, NAVL3610 Corequisites: NAVL4000, NAVL4100, NAVL4700

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

Staff Contact: Dr M. Chowdhury

F HPW2

Prerequisite: NAVL3400 Corequisite: MECH3400

Plate bending — elastic and ultimate strength analysis. Orthotropic plate bending and applications to double bottom structures. Buckling and ultimate strengths of columns and rectangular plates. Buckling and ultimate strength of stiffened panels. Plastic theory and simple applications. Nonlinear aspects - iterative finite element analysis. Iterative and incremental frame analysis and applications. Elements of longitudingal and transverse ultimate strength analysis of hull module - computer aided design. Design of pressure hulls.

NAVL4700

Ship Propulsion and Systems

Staff Contact: Mr P.J. Helmore

F HPW4

Prerequisites: NAVL3600, NAVL3610

Components of ship resistance. Froude's law and laboratory tests. Practical resistance prediction. Acceleration and deceleration of vessels. Propeller terminology, theories, practical design and drawing. Rudder design. Design documentation, tendering and contract administration. Design aspects of special types of craft. Timber, glass-reinforced plastic, aluminium and steel as construction materials. Further aspects of intact stability. Steam, diesel, gas turbine, turbo- and diesel-electric and nuclear propulsion. Systems for power transmission, fuel, electricity, pumps, compressors, purifiers, pumping and piping, and automation.

Graduate Study

Formal graduate courses offered are: the Master of Engineering Science in Industrial Engineering 8531 and in Mechanical Engineering 8541, and the Graduate Diploma in Industrial Engineering 5455 and Mechanical Engineering 5456. Opportunities are provided for graduate research leading to the award of the degrees of Master of Engineering 2680 and 2692 and Doctor of Philosophy 1662.

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.

Specialist Programs

1. Aerospace 12 credits of co		С
AERO9105	Aerospace Vehicle Design and	
	manufacture	3
AERO9415	Finite Element Analysis and Application	3
AERO9606	Aerodynamics	3
AERO9705	Aerospace Propulsion	3
and 12 credit p	roject	12
The remaining	6 credits may be selected from:	
AERO9543	CAD/CAM for Aerospace Structures	3
AERO9607	Flight Dynamics	3
	ts (based on availability) as may be se Head of School.	

2. Aerospace Structures

This program will be run jointly with the University of Sydney. Before enrolling in the program a student has to get appropriate approval from the Aerospace Engineering Department of the University of New South Wales and the Aeronautical Engineering Department of the University of Sydney.

9 credits of cor AERO9105	re subjects must be selected from: Aerospace Vehicle Design and Manufacture	С 3
AERO9415 AERO9543 and 12 credit p	Finite Element Analysis and Application CAD/CAM for Aerospace Structures	3 3 12
3. Computer I	ntegrated Manufacturing ore subjects:	
MANF9470	Production Management 1	3
MANF9560	Computer Integrated Manufacturing	3
MANF9543	CAD/CAM	3
MANF9544	Concurrent Product and Process Design	1 3
MANF9040	Seminar	0
and 12 credit p	project	
MANF9010	Research Project	12
The remaining following elections	6 credits may be selected from the ives:	
MANF9410	Total Quality Management	3
MANF9601	Economic Decisions in Industrial	
	Management	3
MANF9400	Industrial Management	3
MECH9410	Finite Element Applications	3
MANF9340	Flexible Manufacturing Systems	3
MANF9500	Computer-Aided Programming for	
	Numerical Control	3

4. Industrial Management

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.

12 credits of core subjects:

	oo. o oabjooto.	
MANF9400	Industrial Management	3
MANF9470	Production Management 1	3
MANF9410	Total Quality Control	3
MANF9040	Seminar	0
SAFE9224	Principles of Ergonomics	3
and 12 credit	project	
MANF9010	Research Project	12
	•	

The remaining 6 credits may be selected from the following electives:

ACCT9062	Accounting for Engineers	3
MANF9601	Economic Decisions in Industrial	
	Management	3
MANF9340	Flexible Manufacturing Systems	3
MANF9543	CAD/CAM	3
MANF9544	Concurrent Product and Process Design	3
MANF9560	Computer Integrated Manufacturing	3
SAFE9213	Introduction to Safety Engineering M	3

5. Refrigerat	ion and Air Conditioning						
	ertaking the postgraduate program in						
	Refrigeration and Air Conditioning must complete the						
following subj	ects which are offered in even years (e.g.						
1994, 1996):	•	C					
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					
The remaining	g 6 credits for MEngSc students may	be					
	en years (e.g 1994, 1996) from:						
MECH9325	Fundamentals of Noise	3					
MECH9326	Advanced Noise	3					
MECH9610	Advanced Fluid Dynamics	3					
MECH9720	Solar Energy	3					
MECH9750	Industrial Applications of Heat Transfer	3					
or in odd year	rs (e.g 1995, 1997) from:	•					
MECH9325	Fundamentals of Noise	3					
MECH9326	Advanced Noise	3					
MECH9730	Multiphase Flow	3					
MECH9741	Energy Conservation and System	·					
10120110741	Design	3					
MECH9757	Ambient Energy Air Conditioning	2					
and 12 credit		_					
MECH9010	Project	12					
6. Mechatron	lics						
*	ore subjects must be selected from:						
MECH9201	Digital Fundamentals for Mechanical						
	Engineers	3					
MECH9202	Microprocessor Fundamentals	3					
MECH9203	Industrial Applications for						
	Microprocessors	3					
MECH9211	Modelling and Control of Mechatronic						
1450110004	Systems	3					
MECH9221	Industrial Robotics	3					
MECH9222	Artificially Intelligent Machines	3					
MANF9500	Computer Aided Programming for Numerical Control	^					
and 12 credit		3					
MECH9010	Project Project	12					
	•						
ine remaining	9 9 credits may be selected from the abo	ve					
School.	ther subjects as approved by the Head	OT					
7. Mechanica							
9 credits from the following subjects:							

7. Mechanica	ı Design	
9 credits from	the following subjects:	
MECH9120	Design Technology	3
MECH9130	Computer-Aided Engineering Design	3
MECH9131	Advanced CAD Modelling and	
	Applications	3
MECH9140	The Design Acitivity: Morphology,	
	Strategies and Tools	3
MECH9150	Design and Maintenance of	
	Components	3
MECH9160	Design and Management of	
	Large Systems	3
and a 12 cred	lit project	
MECH9010	Project	12

The remaining 9 credits	may	be	selected	from	the	above
subjects or:						

		С			
MANF9400	Industrial Management	3			
MANF9544	Concurrent Product and Process Design				
MANF9601	Economic Decisions in Industrial				
	Management	3			
MECH9211	Modelling and Control of Mechatronic				
	Systems	3			
MECH9221	Industrial Robotics	3			
MECH9310	Advanced Vibration Analysis	3			
MECH9325	Fundamentals of Noise	3			
MECH9400	Mechanics of Fracture and Fatigue	3			
MECH9410	Finite Element Applications	3			
MECH9740	Power Plant Engineering	3 3 3 3 3 3			
SAFE9224	Principles of Ergonomics	3			
or other subject	ts approved by the Head of School.				
8. Noise and \	/ibration				
9 credits of cor	e subjects:				
MECH9311	Fundamentals of Vibration	3			
MECH9312	Fundamentals of Noise and Vibration	•			
	Measurement	3			
MECH9325	Fundamentals of Noise	3			
and 12 credit p	roject	•			
MECH9010		2			
The remaining	9 credits may be selected from:				
MECH9310	Advanced Vibration Analysis	3			
MECH9323	Environmental Noise	3			
MECH9324	Building Acoustics	3			
MECH9326	Advanced Noise	3			
		•			
or such other subjects (based on availability) as may be approved by the Head of School.					

5455 Graduate Diploma in Industrial Engineering

GradDip

5456 Graduate Diploma in Mechanical Engineering

GradDip

Details of recommended programs of study may be obtained from the Head of School. Subjects from the Masters degree programs are offered in the Graduate Diploma programs subject to the approval of the course coordinator.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

Aerospace Engineering

AERO9105

Aerospace Vehicle Design and Manufacture Staff Contact: Mr J.R.Page, Dr N.A. Ahmed C3 SS HPW3

Design objectives and constraints: function, cost durability. Design process: configuration design, structural design, systems. Integration Design. Production Methods. Quality control: design manufacture, operation. Design development: prototyping, component and system testing (ground and flight), manufacture. The above topics will be dealt with in the context of workshops associated with an intensive design project.

AERO9415

Finite Element Analysis and Applications for Aerospace Structures
Staff Contact: A/Prof D.W.Kelly

Staff Contact: A/Prof D.W.Kell)
C3 SS HPW3

Theoretical foundations. Linear static and dynamic analysis. Non-linear material behaviour and geometrically non-linear behaviour. Validation of models. *Project:* Each student will undertake a project involving the finite element modelling of a structure and the analysis of its static and dynamic characteristics. A major finite element package will be used for the conduct of this project.

AERO9543

CAD/CAM for Aerospace Structures Staff Contact: Mr J.R. Page, Dr K. Hoang C3 SS HPW3

Current aviation standards in Australia for CAD/CAM use in aerospace industries. Concepts of CAD/CAM and introductions to CATIA, NC and Fourth Shift. Concurrent engineering. Group technology. Process planning. Integrated manufacturing planning and control. *Manufacturing control:* computer and numerical, robotics, measurement, analysis and actuation.

AERO9606 Aerodynamics

Staff Contact: Dr N.A.Ahmed

C3 SS HPW3

Potential flow and wing theory. Low speed, inviscid and incompressible flow; high-speed viscous and compressible flow. Visualisation in the laboratory and the use of computer modelling techniques.

AERO9607

Flight Dynamics

Staff Contact: Mr J. R. Page

C3 SS HPW3

Introduction to atmospheric and space environment. Aerospace vehicle performance. Mission Profiles. Longitudinal and static stability. Neutral and manoeuvre points and margins. Flight test measurements and handling qualities. Dynamic stability and control of atmospheric vehicles and their testing in flight and evaluation.

AERO9705

Aerospace Propulsion

Staff Contact: Dr R. Casey

C3 SS HPW3

Propulsion systems: history, types, basic thrust, efficiency equations. Propellers, rotors and fans: engine cycle thermodynamics, performance, test. Engine intakes: subsonic, supersonic, ramjets, rockets. Noise and pollution.

Industrial Technology and Management

MANF9010

Research Project

Staff Contact: Prof H. Kaebernick

C12

MANF9019

Project

C9

MANF9029

Project Report

C18

MANF9039

Thesis

C36

MANF9040

Seminar Industrial Management

Staff Contact: Prof H. Kaebernick

CO

MANF9340

Flexible Manufacturing Systems

Staff Contact: Prof H. Kaebernick

C3 SS HPW3

Corequisite: MANF9543

Technology and management of Flexible Manufacturing Cells and Systems: group technology and cellular manufacturing, computerised NC-controls, Flexible Manufacturing Cells. Flexible Manufacturing Systems, including planning and layout, material handling, tool management, control system, justification. Flexible Assembly Systems.

MANF9400

Industrial Management

Staff Contact: Dr B. Kayis

C3 SS HPW3

Evolution of management thought, the planning process; nature of managerial decision making, organizational structures; managing organizational change, motivation, performance, satisfaction, interpersonal and organizational communication, use of management information systems.

MANF9410

Total Quality Management

Staff Contact: Dr B. Kayis

C3 SS HPW3

Note/s: Excluded MANF4429

Quality control systems, quality assurance, planning for quality, total quality management (TQM) philosophy, implementation of TQM in service and manufacturing industries. national and international standards.

MANF9470

Production Management 1

Staff Contact: A/Prof R.M. Kerr

C3 SS HPW3

Dynamics of industry competitiveness: Porter's Model; waste elimination and value adding management; material flow dynamics; production planning and control techniques including MRP, OPT and JIT; maintenance management; purchasing; physical distribution; manufacturing strategy and performance monitoring.

MANF9491

Special Topic in Industrial Engineering

Staff Contact: Prof H. Kaebernick

C3

MANF9492

Special Topic in Industrial Engineering

Staff Contact: Prof H. Kaebernick

C3

MANF9500

Computer Aided Programming for Numerical Control

Staff Contact: Dr P. Mathew

C3 SS HPW3

Prerequisite: MECH1500 or equivalent

Note/s: Excluded MANF4509.

NC systems and manual programming. Computer assisted programming dealing with specific and generalized part programming. Mathematics for computer assisted part programming. Study of APT and CAD programming for manufacture. Selection of operating conditions.

MANF9543

Computer Aided Design/Computer Aided

Manufacture

Staff Contact: Dr K. Hoang

C3 SS HPW3

Note/s: Student numbers are limited due to computer availability. Preference will be given to CIM Program students. Students must contact the Department of Industrial Technology and Management one week after enrolment to confirm enrolment.

Topics to be covered include: manufacturing systems; elements of CAM; computer process monitoring and control; production systems at the plant and operation

levels; principles underlying the intergration between a CAD/CAM package such as CATIA and a Manufacturing Management System such as Fourth Shift; applications to design and engineering processes.

MANF9544

Concurrent Product and Process Design

Staff Contact: Dr Y.L.Yao

C3 SS HPW3

Producibility, maintainability, design for manufacturing, design for assembly, inspectability, computer-aided concurrent engineering, knowledge-based approaches, environmental and ecological impacts.

MANF9560

Computer Integrated Manufacturing

Staff Contact: Dr K. Hoang

C3 SS HPW3

Prerequisite: MANF9543

Systems analysis and design of computer integrated manufacturing, including flexible manufacturing systems and automated factories. Communication protocols.

MANF9601

Economic Decisions in Industrial Management

Staff Contact: Mr M. Hasan

C3 SS HPW3

Note/s: Excluded MANF3619.

Concept of economic analyses. Cost concepts; interest and interest formulae. Methods for economy studies; present work, annual worth, payback period and rate of return; comparing alternative investments; depreciation methods, effect of income taxes, inflation; replacement analysis; capital budgeting; break-even and sensitivity analyses; economic decision making under risk and uncertainty; evaluation of projects in public sector.

Mechanical Engineering

MECH9010

Project

C12

MECH9120

Design Technology Staff Contact: Mr R.B.Frost

CS SS HPW3

Prerequisite: MECH2100 or equivalent

Note/s: Excluded MECH4120

Aspects of mechanical engineering technology which form the basis for machinery design including: performance matching of systems and components; hydraulic components and circuits for power and control; fluid couplings and torque converters; power circulation in multi-path machinery; driveline logic and synthesis opportunities; steering systems for tracked and wheeled vehicles; manual and automatic transmissions.

MECH9130

Computer-Aided Engineering Design

Staff Contact: Dr R.A.Platfoot

C3 SS HPW3

Prerequisite: MECH3100 or equivalent

Note/s: Excluded MECH4130

Mathematical modelling and analysis of component and system designs using the computer as a tool to optimise and investigate design solutions. Use of available CAD and computational engineering packages to develop and analyse designs of inudstrial equipment.

MECH9131

Advanced CAD Modelling and Applications

Staff Contact: Mr A.J.Barratt C3 SS HPW3

Note/s: Excluded MECH4131

Development of CAD modelling systems, 2D and 3D, wire frame, surface representation and solids. Advanced modelling techniques of complex geometry, surfaces, bodiean operations and solids manipulation. Programming and database interfacing in a CAD environment. Development of engineering based applications using these facilities.

MECH9140

The Design Activity: Morphology, Strategies and Tools

Staff Contact: Mr R. B. Frost

C3 SS HPW3

Prerequisite: MECH3100 or equivalent

Note/s: Excluded MECH4140

Morphology: The nature of the design activity; creativity, synthesis, stereotypes, models, scenarios, the real struggles, determiners of success, factors of influence, protection. Strategies: Creativity enhancing, concept manipulation. modularity, evaluation, strategy generation. Tools: For synthesis: combinatorial methods, modellers. For analysis: FEM, CFD, DSL, HLL's AI, ES etc. For representationb: CAD, DATABASES.

MECH9150

Design and Maintenance of Components

Staff Contact: Dr R.A. Platfoot

C3 SS HPW3

Prerequisite: MECH3100 or equivalent

Note/s: Excluded MECH4150

Functional specification for service life, manufacturing and material requirements. Design for function and strength. Design for manufacture and assembly. Overview of damage mechanisms and their maintenance burden, inspection procedures and damage prediction by methematical modelling. Quality management including audit checks, inspection and quality in manufacture.

MECH9160

Design and Management of Large Systems

Staff Contact: Dr R.A. Platfoot

C3 SS HPW3

Prerequisite: MECH3100 or equivalent

Note/s: Excluded MECH4160

Plant layout and specification. Modular design of large plants. Design for redundancy and critical path for breakdowns. Operation versus maintenance. Formulation of policies for condition monitoring, plant inspection, risk analysis and life forecasting. Rehabilitation including plant flexibility, redesign and strategies for rehabilitation. Plant modelling and component tracking, work flow tracking and procedure libraries.

MECH9201

Digital Logic Fundamentals for Mechanical Engineers

Staff Contact: Dr M.J. Tordon

C3 SS HPW3

Note/s: 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

Staff Contact: Dr M.J. Tordon

C3 SS HPW3

Prerequisite: MECH9201 or equivalent

Note/s: Excluded 6.0318, 6.613, COMP9221, ELEC4432, 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

Staff Contact: Dr R.A. Willgoss

C3 SS HPW3

Prerequisite: MECH9202 or equivalent

Note/s: 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

Staff Contact: Dr R.A. Willgoss

C3 SS HPW3

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

Staff Contact: Dr R.A. Willgoss

C3 SS HPW3

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.

Modelling and Control of Mechatronic Systems

Staff Contact: Dr J. Katupitiya

C3 SS HPW3

Prerequisite: MECH3212 or equivalent

Development of modelling technique and design of controllers using digital computers, with special emphasis on motion control. Typical examples of mechatronics systems.

MECH9212

Control and Modelling of Mechanical Systems 2

Staff Contact: Dr R.A. Willgoss

C3 SS HPW3

Prerequisite: MECH3211 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

Staff Contact: Dr R.A. Willgoss

C3 SS HPW3

Applications survey. System structure, hardware, software, handling. 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

Staff Contact: Dr R.A. Willgoss

C3 SS HPW3

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

Staff Contact: A/Prof J.E. Baker

C3 SS HPW3

Prerequisite: Assumed knowledge MECH2300 or

equivalent

Note/s: 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

Staff Contact: A/Prof J.E. Baker

C3 SS HPW3

Prerequisite: Assumed knowledge MECH2300 or equivalent

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

Staff Contact: Mr R.B. Randell

C3 SS HPW3

Prerequisite: Assumed knowledge MECH3310 or equivalent

Note/s: 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.

MECH9311

Fundamentals of Vibration

Staff Contact: Mr R.B. Randell

C3 SS HPW3

Prerequisite: Assumed knowledge MECH2300,

MATH2009 or equivalent Note/s: Excluded MECH3310

Single-degree of freedom vibrating systems: free/forced, undamped/damped, response/transmissibility. Whirling of shafts. Harmonic analysis. Vibration measuring instruments. Linear vibrations of multi-degree-of-freedom systems: normal modes. Introduction to the analysis of continuous systems.

MECH9312

Fundamentals of Noise and Vibration Measurement

Staff Contact: A/Prof K.P. Byrne

C3 SS HPW3

Parameters used to describe and measure noise and vibration. Characteristics of microphones and vibration transducers and their associated signal conditioning devices. The performance of analogue, digital, linear and exponential averaging detectors. Frequency analysis using analogue and digital filters. FFT analysers. Sound intensity measurement. Tape recording.

MECH9320

Random Vibrations

Staff Contact: School Office

C2 SS HPW2

Prerequisite: 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.

MECH9323

Environmental Noise

Staff Contact: A/Prof K.P. Byrne

C3 SS HPW3

Prerequisite: MECH4321 or equivalent

Prediction of source strengths of transport and construction noise. Noise propagation models including atmospheric and topological effects. Propagation in urban and rural areas. Attenuation by barriers. Strategies for controlling environmental noise. Prediction models. Environmental noise exposure concepts.

MECH9324

Building Acoustics

Staff Contact: A/Prof K.P. Byrne

C3 SS HPW3

Prerequisite: MECH4321 or equivalent

Room acoustics viewed from modal and energy aspects. Absorption and transmission performance of building elements such as carpets, windows and walls. Relationship between laboratory and field performance measurements. Noise problems associated with building services.

MECH9325

Fundamentals of Noise

Staff Contact: A/Prof K.P. Byrne

C3 SS HPW3

Note/s: Excluded MECH4321, MECH9321

Development of the acoustic plane wave equation. Introduction of the concepts of acoustic impedance, characteristic impedance, acoustic energy density, acoustic intensity and acoustic power. Measurement of sound pressure. Decibel scales. Standing waves. The effect of noise on people. Wave propagation in porous media. Transmission phenomena including transmission of plane waves between different media, through walls and along pipes. The analysis of expansion chamber mufflers and pipe side-branches. Basic energy approach to room acoustics.

MECH9326

Advanced Noise

Staff Contact: A/Prof K.P. Byrne

C3 SS HPW3

Prerequisite: MECH4321 or MECH9321 or MECH9325

Note/s: Excluded MECH4322, MECH9322

Development of the three dimensional acoustic wave equation. Applications of the three dimensional form of the acoustic wave equation in rectangular coordinates, including transmission of plane waves at oblique incidence between media, waves in rectangular ducts, standing waves in enclosures. Applications of the three dimensional wave equation in cylindrical and spherical coordinates. Basic structural-acoustic interaction.

MECH9361

Hydrodynamic Lubrication Theory and Design

Staff Contact: A/Prof E.J. Hahn

C3 SS HPW3

Note/s: Excluded MECH4361.

Types of hyrdodynamic bearings and bearing operation; properties of lubricants; theory of steady state hydrodynamic lubrication; hydrostatic and squeeze film lubrication applied to slider and journal bearings; bearing design with side leakage; thermal balance. Journal bearing dynamics; instability analysis. Elastohydrodynamic lubrication. Bearing materials; friction and wear. Grease lubrication.

MECH9362

Lubrication Theory and Design 2

Staff Contact: A/Prof E.J. Hahn

C2 SS HPW2

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

Staff Contact: Dr K. Zarrabi

C3 SS HPW3

Note/s: 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

Staff Contact: A/Prof D.W. Kelly C3 SS HPW3

Note/s: Excluded MECH4410.

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

Staff Contact: A/Prof A.E. Churches

C3 SS HPW3

Prerequisite: 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

Staff Contact: A/Prof A.E. Churches

C3 SS HPW3

Prerequisite: 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

Staff Contact: School Office

C3 SS HPW3

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.

MECH9610

Advanced Fluid Dynamics

Staff Contact: A/Prof E. Leonardi

C3 SS HPW3

Prerequisite: MECH3600 or equivalent

Note/s: Excluded MECH4600, MECH 4610, MECH4710,

MECH9710

Review of vector analysis and cartesian tensors. Kinematic of fluid motion. Reynolds' Transport theorem. Stress in fluid

motion. Cauchy's equation. Constitutive equations. Dynamics of fluid motion. Navier-Stokes equations. Thermodynamics and heat transfer. Turbulent motion. Time smoothing. Typical flows and flow patterns. Internal and external flows with and without heat transfer. Separation. Unsteady flows. Turbulent flows. Large scale and small scale flows.

MECH9620

Computational Fluid Dynamics Staff Contact: A/Prof J.A. Reizes C3 HPW3

Incompressible flow: primitive equations; stream function, vorticity 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

Staff Contact: School Office

C2 SS HPW2

Note/s: 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

Staff Contact: School Office

C2 SS HPW2

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

Staff Contact: A/Prof J.A. Reizes

C3 SS HPW3

Prerequisite: Assumed knowledge MECH3800 or equivalent

Note/s: Excluded MECH4710

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.

MECH9720

Solar Thermal Energy Design Staff Contact: Prof G.L. Morrison

C3 SS HPW3

Note/s: 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

Staff Contact: Dr M. Behnia

C3 SS HPW3

Prerequisite: Assumed knowledge MECH3701 or equivalent

Note/s: 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. 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

Staff Contact: Dr M. Behnia

C3 SS HPW3

Prerequisite: 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. Power station field trip.

MECH9741

Energy Conservation and System Design Staff Contact: A/Prof J.A. Reizes C3 SS HPW3

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

Staff Contact: Dr M. Behnia

C3 SS HPW3

Prerequisite: Assumed knowledge MECH3600 and

MECH3701 or equivalent

Components of hydro, coal and nuclear fuel power station designs. Economics of power production. Operation and maintenance costs. Efficiency and heat balance calculations of thermal power stations. Comparison of electrical energy production costs of different power stations.

Industrial Applications of Heat Transfer

Staff Contact: Dr M. Behnia

C3 SS HPW3

Prerequisite: MECH3702 or equivalent

Steady-state and transient heat conduction in one, two and three dimensions. 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. Industrial heat exchangers. Cooling of electronic components. 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 industrial problems.

MECH9751

Refrigeration and Air Conditioning 1

Staff Contact: A/Prof E. Leonardi

C3 SS HPW3

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

Staff Contact: A/Prof E. Leonardi

C3 SS HPW3

Prerequisite: Assumed knowledge MECH9751 or

equivalent

Note/s: Candidates wishing to specialize in Refigeration and Air Conditioning should select this subject.

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

Staff Contact: Dr I.L. Maclaine-cross

C3 SS HPW3

Prerequisite: Assumed knowledge MECH9730,

MECH9751, MECH9752 or equivalent

MECH9754

Refrigeration and Air Conditioning Design 2

Staff Contact: Dr I.L. Maclaine-cross

C3 SS HPW3

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 Staff Contact: A/Prof E. Leonardi

C3 SS HPW3

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

Staff Contact: A/Prof E. Leonardi

C3 SS HPW3

Prerequisites: MECH9751, MECH9752 Corequisites: 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

Staff Contact: Dr I.L. Maclaine-cross

C2 SS HPW2

Prerequisite: 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

Staff Contact: Prof B.E. Milton

C3 SS HPW3

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

Staff Contact: Prof B.E. Milton

C3 SS HPW3

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 Staff Contact: A/Prof J.E. Baker

Staff Contact: A/Prof J.E. Bake C3 SS HPW3

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 SS HPW2

MECH9910 Special Topic in Mechanical Engineering C2 SS HPW2

MECH9920 Special Topic in Mechanical Engineering C3 SS HPW3

MECH9930 Special Topic in Mechanical Engineering C3 SS HPW3

These syllabi change to allow presentation of a special topic of current interest particularly by visitors with recognized expertise in the topic.

School of Surveying

Head of School Professor J.C. Trinder

Administrative Assistant

Mr L. Daras

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 specialized 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).

The two undergraduate degrees in the School are the Bachelor of Surveying course 3740 and the combined degree in Bachelor of Surveying, Bachelor of Science in Computer Science 3745.

Formal graduate courses lead to the award of the degree of Master of Surveying Science 8651 and of the graduate diploma in Surveying **5491**, and opportunities are provided for graduate research leading to the award of the degrees of Master of Surveying **2720** and Doctor of Philosophy **1680**.

The School of Surveying is also involved in the Centre for Remote Sensing and Geographic Information Systems in association with the School of Geography in the Faculty of Applied Science. The Centre supports graduate programs leading to the award of the degree of Master of Engineering Science 8641 or Master of Applied Science 8026 or the Graduate Diploma in Remote Sensing and Geographic Information Systems 5026 or 5496 in addition to supervision for the degree of Doctor of Philosophy.

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 recognizes 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 specialized surveying applications. Throughout the course, theoretical studies are complemented by practical exercises in the field and in the laboratory.

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 recognized by the New South Wales Surveyors' Board as meeting all examination requirements for registration as a Registered Surveyor in New South Wales, and is recognized 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.

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 Revision

The BSury 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. Further revision to the course was carried out in 1993. 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.

Undergraduate Study

						HF	w
Course O	utlines			Year 4		S1	S2
				SURV7051	Survey Camp 3	7	0
				SURV7311	Offshore Surveying	3	0
				SURV7511	Photogrammetry and Mapping 2	3	0
				SURV7532	Spatial Information Systems 2	3	0
3740				SURV7712	Land Management and		
Surveying					Development Project 1 (General		
Juiveying					Education Subject Cat. C)	2	0
				SURV7722	Project Management 1	3	0
Bachelor of S	Surveying			SURV7811	Land Subdivision and		
BSurv					Development	3	0
		ы	•w	SURV8001	Project	1	8
		П	- **	SURV8011	Project Surveying	0	3
Year 1		S1	S2	SURV8221	Advanced Geodesy	0	3
MATH1032	Mathematics 1	6	6	SURV8711	Professional Practice	1	1
or				SURV8712	Land Management and		
MATH1042	Higher Mathematics 1				Development Project 2 (General	_	_
PHYS1929	Physics 1	4	4		Education Subject Cat. C)	0	2
SURV1111	Introduction to Computing	4	0	SURV8722	Project Management 2	0	3
SURV1712	Introduction to Surveying	3	3	Totalling		26	20
	(General Education Cat.C)						
SURV1042	Survey Data Presentation	4	0				
SURV2111	Principles of Computer						
	Processing	0	4				
SURV2122	Computer Graphics 1	0	3	Combine	ed Course 3745		
SURV2221	Introduction to Geodetic Science		3	Rachalor	of Surveying/Bachelor	οf	
Totalling		21	23			٠.	
Year 2				Science i	n		
MATH2009	Engineering Mathematics 2	4	4	Compute	er Science		
MATH2829	Statistics SU	3	0	Compan			
PHYS2969	Physics of Measurements	3	0				
SURV3012	Surveying Instruments	5	0	BSurv BSc i	n Computer Science		
SURV3111	Survey Computations	3	0	77. a aku cak wa	e of this new course is flexible to acc	nmm.	ndate
SURV3231	Geodetic Computations	3	0	ine structure	ut a recommended program which	will c	etiefy
SURV4051	Survey Camp 1	0	3		throughout the course is:	WIII 3	ausiy
SURV4011	Surveying Techniques	0	6	prerequisites	unoughout the course is.		
SURV4111	Data Analysis and Computing 1	0	. 3	Year 1			
SURV4221	Geodetic Positioning 1	0	3	MATH1032,			
	cation Subject Cat.A	2	2	PHYS1929.			
Totalling		23	21	SURV1712	(General Education Cat.C), St	JRV.	1111,
Year 3					SURV2122, SURV2221,		
CIVL0646	Engineering for Surveyors 1	3	0	SURV3012,	SURV4011		
CIVL0656	Engineering for Surveyors 2	0	3	3/			
PLAN9111	Town Planning	2	0	Year 2	00101001		
SURV5011	Engineering Surveying	4	0	COMPIUII,	COMP1021, , MATH2501, MATH2510, M/	۵ты	2520
SURV5111	Data Analysis and Computing 2	3	0		, MATH2501, MATH2510, M/	~	2320,
SURV5122	Computer Graphics 2	3	0	PHYS2969,	, SURV3231, SURV4051, SU	IRV	4111.
SURV5221	Geodetic Positioning 2	3	0	SURV4221,	, 30NV3231, 00NV4001, 00	,,,,	,
SURV5621	Cadastral Surveying 1	3	0	General Ed.	Cat A		
SURV6051	Survey Camp 2	0	4	Gerierai Lu.	Oat. A		
SURV6511	Photogrammetry and Mapping 1		3	Year 3			
SURV6522	Remote Sensing and Resource		•	COMP201	1, COMP2021, COMP2031, SI	URV	5011,
	Surveys	0	3		MATH2120,		
SURV6532	Spatial Information Systems 1	0	3	PLAN9111.			
SURV6621	Cadastral Surveying 2	0	3	SURV5111	I, SURV5221, SURV6051, SI	JRV	6511,
SURV6811	Land Economics and Valuation	0	3 2	SURV6811,			
	al Education Subject Cat.B	2 23	24	General Ed.			
Totalling		20	24				

Year 4

CIVL6140, CIVL6150,

COMP3111, COMP3121, COMP3311, COMP3421

SURV5621, SURV6621.

Plus 2 units (4 or 5 hours per week each) at level II or higher either from Table 1 of the Sciences Handbook, or from Table 2 for Program 0600.

Year 5

SURV7051, SURV7311, SURV7511, SURV7711,

SURV7712 (General Education Cat.C),

SURV7722, SURV7811, SURV8001, SURV8011, SURV8221, SURV8711.

SURV8712

(General Education Cat.C), SURV8722

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

Note: Electronic Calculators - Students enrolled in the surveying courses are required to equip themselves with an electronic calculator. Advice on the purchase of this equipment is given to students at the commencement of their course.

SURV0411

Surveying for Builders

Staff Contact: School Office

C2 S1 L1 T2

Note/s: This is a servicing subject taught within courses offered by other schools and faculties.

A compulsory subject.

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

Staff Contact: School Office

S2 L2 T2.5

Note/s: This is a servicing subject taught within courses offered by other schools and faculties.

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

Staff Contact: School Office

Note/s: This is a servicing subject taught within courses offered by other schools and faculties.

A one-week field camp for students studying SURV0441 Surveying for Engineers.

SURV0580

Mining Surveying

Staff Contact: School Office

S1 L2 T1

Prerequisite: SURV0441

Note/s: This is a servicing subject taught within courses offered by other schools and faculties.

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

Staff Contact: School Office

S1 L3 T1

Note/s: This is a servicing subject taught within courses offered by other schools and faculties.

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

Staff Contact: School Office

S1 L1 T.5

Note/s: This is a servicing subject taught within courses offered by other schools and faculties.

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.

SURV1042

Survey Data Presentation

Staff Contact: School Office

S1 L2 T2

Introduction. Governing principles of report writing. Principles applied to memos and letter writing. Letters for job applications. Removing barriers to understanding: writing style; correct t grammar; tests for concise writing, formal corrrectness, style. Reports: research and analysis: writing and presentation: use of graphic elements in reports, critical analysis of draft, computer spelling and grammar checking. Tables and Graphics (Excel, MacDraw). Final

production of report. Table of contexts, index. Seminar - oral presentation, field Data Recording, Methods of survey data notetaking: principles and aims, title page and sketch plans for field notes. Maps, plans, charts. Plan materials. Plotting: scales and bearings; radiations; intersections. Representation of elevation: spot heights, contouring. Cadastral Plans. Long and cross-sections for engineering plans.

SURV1111

Introduction to Computing

Staff Contact: School Office

S1 L2 T2

Revision of plane trigonometry and co-ordinate systems. Join, polar, area calculations using hand calculators. Spherical trigonometry. Principles of calculation; representation of numbers, round-off errors, significant figures, orders of magnitude. Introduction to computers: computer hardware, computer software, operating systems, programs. Program design and documentation. Introduction to FORTRAN; constant types, data elements, selection control, loop control, input and output, program modules.

SURV1712

Introduction to Surveying

Staff Contact: School Office

F L2 T1

Principles of surveying; geodetic positioning, photogrammetry and remote sensing; cadastral surveying and land information management; engineering, mining, geophysical and hydrographic surveying; mapping. Error propagation. Principles and practical aspects of levelling. Planimetry. Survey data. Transformations and homogeneous co-ordinates. Planar geometric projections. Surveying profession, key values, professional ethics, current and future challenges.

SURV2111

Principles of Computer Processing

Staff Contact: School Office

S2 L2 T2

Corequisite: SURV1111

Operating systems; VAX/VMS, or command language. Software; spreadsheets, compilers. Program structure; subroutines, functions, control structures. Program libraries; creation, system libraries. Data structures; arrays, stacks, lists, queues, trees. Data files; types and organizations. Sorting, searching, merging. Data bases; concepts, types, information access.

SURV2122

Computer Graphics 1

Staff Contact: School Office

S212T1

Descriptive geometry and perspectives. Computer aided drawing. Use of commercial software for survey computations and drawing.

SURV2221

Introduction to Geodetic Science

Staff Contact: School Office

S2 L2.5 T.5

Historical development of geodesy. Scope and goals of contemporary geodesy. The Earth's gravity field. The Earth's motions in space; the role of time in geodesy, co-ordinate systems and transformations. Near-earth satellite motion. Principles of terrestrial and space geodetic positioning. Integrated geodesy.

SURV3012

Surveying Instruments

Staff Contact: School Office

S1 L3 T2

Prerequisite: SURV1711

Survey tapes and bands; measurement, calibration, reductions. Precise levelling instruments; principles, construction, applications, testing and adjustment, ancillary equipment. Optical and electronic theodolites; principles, construction, testing and adjustment.

SURV3111

Survey Computations

Staff Contact: School Office

S1 L2 T1

Prerequisite: SURV1111

Intersection, resection, trilateration, with and without redundant data, semigraphic solutions. Missing data problems, road intersections. Subdivision calculations. Transformations, Traverse computations, Introduction to PCs and MS DOS.

SURV3231

Geodetic Computations

Staff Contact: School Office

Corequisites: MATH2009, SURV1111

Principles of map projections. Surveying and mapping projections; transverse Mercator projection. Geometry of the ellipsoid; ellipsoidal computations. Corrections to field observations; arc-to-chord, scale factor and grid convergence.

SURV4011

Surveying Techniques

Staff Contact: School Office

S2 L4.5 T1.5

Prerequisite: SURV1042

Corequisites: SURV3012, SURV3111

Principles, reduction of observations and errors in survey techniques of horizontal and zenith angle measurement, trigonometric heighting, traversing, vertical staff tacheometry. Electronic distance measurement; principles, corrections, reductions, calibration, electro-optical distance meters.

SURV4051

Survey Camp 1

Staff Contact: School Office

S2 T3

Prerequisite: SURV1712

Corequisites: SURV3012, SURV4011

Note/s: Students are required to attend a one-week survey camp, which is equivalen to 3 class contact hours per week.

Theodolite and steel band traverse between control points. Contour survey by stadia. Line levelling. Setting out with theodolite and steel band. Calibration of electronic distance meter.

SURV4111

Data Analysis and Computing 1

Staff Contact: School Office

S2 L2 T1

Prerequisites: MATH1032, SURV2111

Corequisite: SURV3111

Least squares theory; modelling of observations; general, parametric and condition methods. Solution of equations and inverses. Treatment of singular equations and datum problems. Law of propagation of variances. Statistical testing; confidence intervals, error ellipses. Applications in surveying, geodesy, photogrammetry and other sciences. Software design and coding for least squares analysis. Use of personal computers.

SURV4221

Geodetic Positioning 1

Staff Contact: School Office

S2 L2 T1

Prerequisite: SURV2221

Corequisites: SURV1111, SURV3231

Review of reference systems in classical positioning. Introduction to positional astronomy; determination of azimuth from sun and close circumpolar stars. Design, establishment and measurement of geodetic control networks. Latitude, longitude, azimuth, geoid determinations. Geodetic levelling; datum and methods. Geodetic data bases.

SURV5011

Engineering Surveying

Staff Contact: School Office

S1 L3.5 T.5

Corequisites: SURV3111, SURV4011

Design and computation of horizontal and vertical curves, volume determination, route surveys. Setting out surveys: techniques, setting out of roads, buildings and large structures. Introduction to mine surveying: height and azimuth transfer.

SURV5111

Data Analysis and Computing 2

Staff Contact: School Office

S1 L2 T1

Prerequisite: MATH2829

Corequisite: SURV3111, MATH2009

Applications of least squares analysis in surveying, geodesy and photogrammetry. Statistical testing. Detection of outliers. Use of software packages. Software design and optimisation.

SURV5122

Computer Graphics 2

Staff Contact: School Office

S2 L2 T1

Overview of graphics systems and their relation to computer assisted mapping and information systems. Acquisition, processing, presentation of data. Graphics data structures, algorithms and transformations. Graphics programming using a high level language and graphics language. Use of interactive graphics display terminals.

SURV5221

Geodetic Positioning 2

Staff Contact: School Office

S1 L2 T1

Prerequisite: SURV4221 Corequisite: SURV4111

Introduction to satellite positioning; review of reference systems in satellite geodesy; absolute and relative positioning; ranging methods and review of satellite technology. Introduction to the GPS system; measurement modes. Surveying with GPS; planning a survey, instrumentation, field and office procedures. Modelling the observations; principles of data processing. Combination of terrestrial and GPS data. Height determination using GPS. Case studies.

SURV5621

Cadastral Surveying 1

Staff Contact: School Office

S1 L2 T1

The legal system in Australia and NSW; the nature of land law including land tenure, estates in land, interests in land. Land title systems. Land administration in Australia and NSW. Boundary surveying principles. Cadastral mapping in NSW.

SURV6051

Survey Camp 2

Staff Contact: School Office

S2 T4

Prerequisite: SURV4051 Corequisite: SURV5011

Note/s: Students are required to attend a one week Survey Camp which is equivalent to 3 class contact hours per week together with 1 hour per week evaluation.

One week survey project of substantial extent, followed by one hour per week computations, plan and report preparation at the School of Surveying.

SURV6511

Photogrammetry and Mapping i

Staff Contact: School Office

S2 L2 T2

Properties of photogrammetric and remotely sensed images; photography, electro-optical, linear array, microwave systems. Photograph geometry; camera calibration, inner orientation, collinearity equations, deviations from collinearity. Stereoscopic vision; Principles of instrumentation for analogue and analytical photogrammetry. Exterior orientation; relative and absolute orientation, ground control point selection.

SURV6522

Remote Sensing and Resources Surveys

Staff Contact: School Office

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.

SURV6532 Spatial Information Systems 1 Staff Contact: School Office

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.

SURV6621

Cadastral Surveying 2 Staff Contact: School Office

S2 L2 T1

Corequisite: SURV5621

Survey investigation for both artificial and natural boundaries; survey and title searching. Field note preparation for cadastral surveying. Survey marking and preparation of plans of survey. Study of appropriate statutes and regulations. Cadastral 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.

Land Economics and Valuation

Staff Contact: School Office

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

Staff Contact: School Office

S1 T7

Prerequisites: all Year 3 subjects

Two weeks survey camp for projects (equivalent to 6 class contact hours per week) 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

Staff Contact: School Office

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

Staff Contact: School Office

S1 L2 T1

Prerequisite: SURV6511

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.

SURV7532

Spatial Information Systems 2

Staff Contact: School Office

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.

SURV7712

Land Management and Development Project

Staff Contact: School Office

S1 L1 T1

Corequisite: SURV7811

Design and studio project for a residential neighbourhood development. Constraint and site analysis: preparation of maps of land use, vegetation, surface and soils, drainage and terrain, slopes, climate and aspect; composite overlay maps. Structure plan design: residential precincts, schools, commercial areas, industrial areas, active and passive recreation, pedestrian ways and raod hierarchy.

SURV7722

Project Management 1

Staff Contact: School Office

S1 L2 T1

Types of business. Organizational and management principles. Goals, strategies and actions. Phases of a project: feasibility study, pilot project, contract work, final report, and control. Principles of project management: organization, management, planning responsibilities, information control. Communication: meeting, negotiation, conflict, dialectic for managers. Financial management reporting, accounting systems, cash flow, cash flow analysis. Budgeting (financial, personnel, equipment), personnel planning. Management of the project resources.

SURV7811

Land Subdivision and Development

Staff Contact: School Office

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

Staff Contact: School Office

S2 L2 T1

Coreauisites: 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

Staff Contact: School Office

S2 L2 T1

Prerequisite: SURV5221

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.

SURV8711

Professional Practice

Staff Contact: School Office

F T1

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.

SURV8712

Land Management and Development Project 2

Staff Contact: School Office

S2 L1 T1

Prerequisite: SURV7712 Corequisite: SURV7811

Continuation of design and studio project for a residential neighbourhood development. Plan of detailed lot layout: consideration of access, grades, drainage reserves, parks and pedestrian ways. Engineering design and plans: catchment details, road longitudinal and cross-sections, drainage layout, flow schedule, hydraulic grade line calculations, longitudinal sections of kerb profiles.

SURV8722

Project Management 2

Staff Contact: School Office

S2 L2 T1

Corequisite: SURV7722

Aims and forms of project organization. Preparation of contracts and specifications: contract law, subcontracting, contract work, bidding. Project scheduling, control and documentation. 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.

Graduate Study

Formal graduate courses lead to the award of the degree of Master of Surveying Science 8651 and of the graduate diploma in Surveying 5491, and opportunities are provided for graduate research leading to the award of the degrees of Master of Surveying 2720 and Doctor of Philosophy 1680.

The School of Surveying is also involved in the Centre for Remote Sensing and Geographic Information Systems in association with the School of Geography in the Faculty of Applied Science. The Centre supports graduate programs leading to the award of the degree of Master of Engineering Science 8641 or Master of Applied Science 8026 or the Graduate Diploma in Remote Sensing and Geographic Information Systems 5026 or 5496 in addition to supervision for the degree of Doctor of Philosophy 1680.

8651 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 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.

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Core subjects		C
GEOG9240	Principles of Geographic Information Systems	3
GEOG9241	Advanced Geographic Information Systems or	3
GEOG9280	Application and Management of GIS or	3
GEOG9330	Spatial Data/Processing and Integration	3
SURV9604	Land Information Systems	3
Elective subje	ects	
COMP9311	Data Base Systems	3
ELEC9336	Digital Communication Networks 1	3
GEOG9150	Remote Sensing Applications	3
GEOG9290	Image Analysis in Remote Sensing	3
LIBS0815	Economics of Information Systems	3
LIBS0817	Information Storage and Retrieval	
	Systems	3
SURV9107	Special Topic in Surveying B	3
SURV9532	Data Acquisition and Terrain Modelling	3
SURV9600	Principles of Remote Sensing	3
SURV9608	Cadastral Systems	3
Project		12

Other elective subjects may be added with the approval of the Head of School.

The Masters degree program in 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.

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	C
GEOG9150	Remote Sensing Applications	3
GEOG9290	Image Analysis in Remote Sensing	3
SURV9600	Principles of Remote Sensing	3
SURV9605	Field Data Collection and Integration	3
SURV9606	Microwave Remote Sensing	3
Project in Ren	note Sensing (one elective project to be	
	he list helow)+	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.

		С
COMP1011	Computing 1A	4
COMP1021	Computing 1B	4
ELEC9370	Digital Image Processing Systems	3
ELEC9408	Computer Display Systems and	
	Interactive Instrumentation	3
GEOG9210	Computer Mapping and Data Display	3
GEOG9240	Geographic Information Systems	3
GEOL0360	Remote Sensing Applications in	
	Geoscience	3
SURV9213	Physical Meteorology	3
SURV9602	Remote Sensing Procedures	3
SURV9604	Land Information Systems	3

5496

Graduate Diploma in Remote Sensing

GradDip

5491

Graduate Diploma in Surveying

GradDip

Details of the recommended programs of study may be obtained from the Head of the School of Surveying. Subjects from the Masters programs can be taken in the Graduate Diploma programs subject to the approval of the course coordinator.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

SURV9106

Special Topic in Surveying A

This syllabus changes to allow presentation of a special topic of current interest particularly by visitors with recognized expertise in the topic.

SURV9107

Special Topic in Surveying B

СЗ

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

Staff Contact: School Office

C3 SS L2 T1

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

Selements of Geodetic Equipment Staff Contact: School Office C3 SS L2 T1 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

Staff Contact: School Office

C3 SS L2 T1

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

Staff Contact: School Office

C3 SS L2 T1

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

Staff Contact: School Office

C3 SS L2 T1

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 Staff Contact: School Office C3 S1 L2 T1

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 Staff Contact: School Office

C3 S2 L2 T1

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 Staff Contact: School Office C3 SS L2 T1

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 Staff Contact: School Office C3 SS L2 T1

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 Data Acquisition and Terrain Modelling Staff Contact: School Office C3 SS L2 T1

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. Terrain modelling and display. Automation of mapping processes. Archival of digital map data.

SURV9600

Principles of Remote Sensing Staff Contact: School Office C3 S1 L2 T1

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 Staff Contact: School Office

C3 S2 L2 T1

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 M

SS. TM. SPOT and SAR.

SURV9604

Land Information Systems Staff Contact: School Office

C3 SS L2 T1

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

Field Data Collection and Integration

Staff Contact: School Office

C3 S1 HPW3

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.

SURV9606

Microwave Remote Sensing

Staff Contact: School Office

C3 S1 HPW3

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.

SURV9608
Cadastral Systems
Staff Contact: School Office
C3 SS L2 T1

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.

SURV9906 Major Assignment SURV9909 Project C9

SURV9912 Project C12

SURV9918 Project Report C18

Graduate School of Engineering

Head of School

Professor C. Patterson

The Graduate School in the Faculty of Engineering is a special unit set up to take study program initiatives on a non-subject oriented basis. The courses that run under its auspices are those that cannot properly be positioned within a particular School.

The two courses currently offered by the School through the MBT Program are the Master of Business and Technology and the Graduate Diploma in Industrial Management. Although the MBT Program is a joint initiative of the Faculties of Applied Science and Engineering, candidates enrol through the Faculty of Engineering.

These courses aim to produce fully professional engineers with advanced management training. Principal amongst the aims and objectives of the MBT Program is a commitment to developing and enhancing links with industry and in so doing improve the quality and relevance of tertiary education and research services to the private and public sectors.

The skills and knowledge developed are directly related to candidates' roles within their organizations. It is, in effect, learning through working-organized learning with the opportunity to draw on examples from leading experts. The program should become an integral component of training strategies used by organizations for preparing their professional technologists and other staff for middle management. It will ultimately be used to prepare outstanding personnel for the challenges of functional and general management. In addition to the traditional management training route of the MBA employers have highlighted the need for managers capable of integrating the technical, commercial and managerial appropriate to their businesses.

The MBT program is strongly aligned to the open learning principles used in the Graduate Management Qualification (GMQ) developed by the Australian Graduate School of Management (AGSM) in order to maintain the University's unique standard of excellence in the professional development of managers.

Subjects from the Industrial Management Qualification (IMQ), the first in the series of articulated courses of the MBT Program, complement those of the GMQ so that is is possible to use subjects from both to qualify for the Master's award. Candidates successfully completing four MBT subjects will have the option of either being awarded an IMQ or proceeding to the second level, the Graduate Diploma in Industrial Management course. Those successfully completing the requirements for the Graduate Diploma will be eligible to transfer to the Master of Business and Technology award course subject to approval by the Head, Graduate School of Engineering. In each case candidates electing to continue to the higher award will normally be required to pass at credit level assessment tasks already undertaken. It is anticipated that a candidate may require a minimum of three years to complete all three levels of the MBT Program.

However, the time taken will depend upon a candidate's starting qualifications and attainment in the program. Special arrangements can be made to vary the normal route of progression subject to the approval of the Head of the Graduate School of Engineering. The programs are full-fee paying courses.

Course Outlines

8616 Master of Business and Technology

MBT

The course can normally be completed in a minimum of six sessions and must be completed within ten sessions. To qualify for the Master of Business and Technology (MBT). a candidate must successfully complete 8 subjects (24 credits) and any one of the following options to give a total equivalent to 36 credits. At present, four subjects have been prepared, a second group will be available in 1993.

Core subjects	3	С
GSOE9101	Project Management	3
GSOE9102	Management of Manufacturing Systems	3
GSOE9103	Environmental Management	3
GSOE9104	Management of Innovation and	
	Technological Change	3
Ontione		

an intensive, industry-based research project or 12 an industry-based research project with one other subject to give a total of 36 credits or an industry-based research project with two other subjects to give a total of 36 credits

One subject is to considered equivalent to 3 credits with 1 credit equivalent to a minimum of 1 hour per week in a semester/session.

This is because the open learning principles employed for the subjects require 1.5 hours per week per subject and two 3 hour workshops per session per subject face-to-face contact with an instructor. Further, each subject comprises 12 units with each unit requiring a minimum of 4 hours of self-guided learning activities. Consequently each subject requires an input of time in excess of 6 hours per week per session.

Courses of study leading to the award of a Master of Business and Technology provide technical graduates with

opportunities to extend their career paths into management. Because the subjects that have been developed for the course require minimum contact hours, employment-based experience and self-paced learning based on open learning principles, it is anticipated that in most cases, candidates will choose only from those subjects. There are also opportunities to select subjects from other professional areas in which candidates may be interested particularly those that incorporate similar open learning strategies, such as the subjects required for the Graduate Management Qualification of the Australian Graduate School of Management (AGSM) provided more than half the credits are selected from the subjects listed above. Enrolment in such subjects will require the approval of the Graduate School of Engineering and other course authorities as appropriate.

The conditions for admission to the Master of Business Technology are the same as those that apply to the Master of Engineering Science.

5457 Graduate Diploma in Industrial Management

GradDipIndMgt

An applicant should submit an intended program to the Head, Graduate School of Engineering for approval. Candidates must complete a program of eight subjects totalling 24 credits and including core subjects from the Graduate School of Engineering. Those successfully completing all eight subjects may elect to graduate with the Graduate Diploma in Industrial Management or proceed to the third and final level, the Master of Business and Technology.

The Graduate Diploma in Industrial Management is offered only as a self-guided course. It can normally be completed in a minimum of four academic sessions. The maximum period of candidature is six academic sessions. In special circumstances extensions may be granted.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For further details and academic advice regarding the following subjects consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

GSOE9101 Project Management

Staff Contact: Prof D.G. Carmichael

СЗ

GSOE9102 Management of Manufacturing Systems Staff Contact: A/Prof R.M. Kerr C3

GSOE9103 Environmental Management Staff Contact: Prof A.G. Fane

GSOE9104 Management of Innovation and Technological Change Staff Contact: Dr J. Carlopio СЗ

GSOE9105 Risk Management Staff Contact: Prof J. Cross СЗ

GSOE9106 Information Systems Management Staff Contact: Mr G. Dick C3

GS0E9107 **Maintenance Management** Staff Contact: School Office

GSOE9109 **Energy Management** Staff Contact: A/Prof G. Sergeant

Centres in the Faculty of Engineering

The University has established Centres to encourage research and teaching in areas not readily covered by the established programs in Schools and Faculties. Most Centres have concentrated on multidisciplinary fields and have focussed on new initiatives in the expansion of teaching, research and professional services in specialized areas. The majority of Centres are formed within a School or Faculty or groups thereof although some operate as autonomous units.

The Faculty of Engineering has 9 Centres either located within relevant Schools or in association with other Faculties.

Centre for Advanced Numerical Computation in Engineering and Science

Centre for Biomedical Engineering

Centre for Manufacturing and Automation

Centre for Photovoltaic Devices and Systems

Centre for Postgraduate Studies in Civil Engineering

Centre for Remote Sensing and Geographic Information Systems

Centre for Wastewater Treatment

Munro Centre for Civil and Environmental Engineering

UNSW Groundwater Centre

Two centres have subjects with their own subject identifier. These are the Centre for Biomedical Engineering (BIOM) and the Centre for Advanced Numerical Computation in Engineering and Science (ANCE). The Centre for Biomedical Engineering course details are listed later in this section. Information on study programs available through other Centres is located under the appropriate School section in this Handbook.

The Faculty is also actively involved in seven major Co-operative Research Centres. They are:

CRC for Waste Management and Pollution Control
CRC for Aerospace Structures
Australian Maritime Engineering CRC
CRC for Eye Research and Technology
CRC for Intelligent Manufacturing, Systems and Technologies
Australian Phototonics CRC
CRC for Cardiac Technology

Centre for Advanced Numerical Computation in Engineering and Science

Director:

Professor C.A.J.Fletcher

The Centre for Advanced Numerical Computation in Engineering and Science is a joint initiative of the Faculties of Engineering and Science to provide a focus for the very active UNSW community of computational engineers and scientists exploiting state-of-the-art workstation clusters, vector and parallel supercomputers. The Centre

contributes to graduate training through Masters and PhD programs, carries out both fundamental and applied research through developing and using computer codes, provides short courses for industry-based engineers and scientists and organizes conferences and workshops on the latest computational techniques. The Centre has three areas of special emphasis: a) Industrial Computational Fluids and Heat Transfer, b) Environmental Modelling, c) Finite Element Structural Analysis.

Graduate Subject Descriptions

ANCE8001

Computational Mathematics C3 S1 HPW3

Discretisation, linear algebra, ODE and PDE solvers, appropriate for contemporary computational engineering and scientific applications.

ANCE8002

Supercomputing Techniques

C3 S1 HPW3

For understanding and efficiently using vector and parallel supercomputers for contemporary computational engineering and scientific applications.

ANCE8102

Mesh Generation C3 SS HPW3

Algebraic and PDE grid generation techniques for structured and unstructured grids. Exposure to techniques used in commercial packages, such as PATRAN. Relationship to pre-processing. Relationship to solution accuracy and error control.

ANCE9105

Computational Techniques for Fluid Dynamics C3 SS HPW3

General and specific computational techniques for fluid flow behaviour occurring in industrial, geophysical and chemical processes etc.

Centre for Biomedical Engineering

Director:

Professor K. Schindhelm

Centre Administration:

Ms R. Cuningham

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 offers formal graduate programs leading to the award of the degree of Master of Biomedical Engineering 8660, Master of Engineering Science in Biomedical Engineering 8665 and a Graduate Diploma in Engineering 5445 Opportunities are provided for graduate research leading to the award of the degrees of Master of Science 2795, Master of Engineering 2675 and Doctor of Philosophy 1710.

Course Outlines

8660

Master of Biomedical Engineering

MBiomedE

The MBiomedE degree course is designed to cater for students with either a medical or engineering/physical science background. Initially, students with a medical background study basic engineering subjects such as mathematics, mechanics, electronics and computing, whilst students with a non-medical background take courses in physiology, anatomy, pathology and biochemistry. Later, both groups choose electives from biomechanics, biophysics, biomaterials, medical instrumentation and mass transfer in medicine, as well as undertaking a research project.

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.

Period of candidature: The normal period is four academic sessions (full-time) or six academic session (part-time) from the date of enrolment. The maximum period of cadidature is eight academic sessions (full-time) and ten academic sessions (part-time). In special cases extensions may be granted. A candidate is not permitted to continue in the course if the credit value of the subjects failed totals more than twelve.

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.

5

3

12

(7)

(8)(9)

Session 1 (March-June)			
ANAT2111	Introductions Anotomy (Strand A) LID	C	
BIOM9028	Introductory Anatomy (Strand A) HR Radiation Physics	3	
BIOM9028 BIOM9040	Analogue Electronics for Biomedical	3	
BIOM9040	Engineers	4	
BIOM9060	Biomedical Systems Analysis	3	
BIOM9101	Mathematical Modelling for Biomedical	3	
PIOMAIOI	Engineers (Strand B) C	4	
BIOM9501	Computing for Biomedical Engineers		
	(Strand B) HR	4	
BIOM9510	Introductory Biomechanics	3	
BIOM9551	Biomechanics of Physical Rehabilitation	3	
BIOM9561	Mechanical Properties of Biomaterials	3	
BIOM9601	Biomedical Applications of		
	Microcomputers 1	3	
BIOM9621	Biological Signal Analysis	3	
BIOM9701	Dynamics of the Cardiovascular System	3	
ELEC9411	Introductory Physiology for Engineers	3	
PHPH2112	Physiology (1 full year) (Strand A) C	12	
Session 2 (Ju	ıly-November)		
BIOM9010	Biomedical Engineering Practice C	2	
BIOM9012	Biomedical Statistics	4	
BIOM9018		18	
BIOM9027	Medical Imaging		
		4	
BIOM9030	Project Report	30	
BIOM9030 BIOM9050	Project Report Microprocessors and Circuit Design for	30	
BIOM9050	Project Report Microprocessors and Circuit Design for Biomedical Engineers	30 4	
BIOM9050 BIOM9311	Project Report Microprocessors and Circuit Design for Biomedical Engineers Mass Transfer in Medicine	30 4 4	
BIOM9050 BIOM9311 BIOM9321	Project Report Microprocessors and Circuit Design for Biomedical Engineers Mass Transfer in Medicine Physiological Fluid Mechanics	30 4 4 4	
BIOM9050 BIOM9311 BIOM9321 BIOM9332	Project Report Microprocessors and Circuit Design for Biomedical Engineers Mass Transfer in Medicine Physiological Fluid Mechanics Biocompatibility	30 4 4 4 3	
BIOM9050 BIOM9311 BIOM9321 BIOM9332 BIOM9541	Project Report Microprocessors and Circuit Design for Biomedical Engineers Mass Transfer in Medicine Physiological Fluid Mechanics Biocompatibility Mechanics of the Human Body	30 4 4 4	
BIOM9050 BIOM9311 BIOM9321 BIOM9332	Project Report Microprocessors and Circuit Design for Biomedical Engineers Mass Transfer in Medicine Physiological Fluid Mechanics Biocompatibility Mechanics of the Human Body Biomedical Applications of	30 4 4 4 3 3	
BIOM9050 BIOM9311 BIOM9321 BIOM9332 BIOM9541 BIOM9602	Project Report Microprocessors and Circuit Design for Biomedical Engineers Mass Transfer in Medicine Physiological Fluid Mechanics Biocompatibility Mechanics of the Human Body Biomedical Applications of Microcomputers 2	30 4 4 4 3 3	
BIOM9050 BIOM9311 BIOM9321 BIOM9332 BIOM9541 BIOM9602 BIOM9603	Project Report Microprocessors and Circuit Design for Biomedical Engineers Mass Transfer in Medicine Physiological Fluid Mechanics Biocompatibility Mechanics of the Human Body Biomedical Applications of Microcomputers 2 Image and Flow Cytometry	30 4 4 4 3 3	
BIOM9050 BIOM9311 BIOM9321 BIOM9332 BIOM9541 BIOM9602 BIOM9603 BIOM9612	Project Report Microprocessors and Circuit Design for Biomedical Engineers Mass Transfer in Medicine Physiological Fluid Mechanics Biocompatibility Mechanics of the Human Body Biomedical Applications of Microcomputers 2 Image and Flow Cytometry Medical Instrumentation	30 4 4 4 3 3 3	
BIOM9050 BIOM9311 BIOM9321 BIOM9541 BIOM9602 BIOM9603 BIOM9612 PHPH2112	Project Report Microprocessors and Circuit Design for Biomedical Engineers Mass Transfer in Medicine Physiological Fluid Mechanics Biocompatibility Mechanics of the Human Body Biomedical Applications of Microcomputers 2 Image and Flow Cytometry Medical Instrumentation Physiology 1 (continued)	30 4 4 4 3 3 3	
BIOM9050 BIOM9311 BIOM9321 BIOM9541 BIOM9602 BIOM9603 BIOM9612 PHPH2112 SAFE9533	Project Report Microprocessors and Circuit Design for Biomedical Engineers Mass Transfer in Medicine Physiological Fluid Mechanics Biocompatibility Mechanics of the Human Body Biomedical Applications of Microcomputers 2 Image and Flow Cytometry Medical Instrumentation	30 4 4 4 3 3 3 5	
BIOM9050 BIOM9311 BIOM9321 BIOM9541 BIOM9602 BIOM9603 BIOM9612 PHPH2112	Project Report Microprocessors and Circuit Design for Biomedical Engineers Mass Transfer in Medicine Physiological Fluid Mechanics Biocompatibility Mechanics of the Human Body Biomedical Applications of Microcomputers 2 Image and Flow Cytometry Medical Instrumentation Physiology 1 (continued) Electrical Safety	30 4 4 4 3 3 3 5	

8665 Master of Engineering Science

MEngSc

Candidates are required to complete a course totalling at least 30 credits composed of graduate level subjects, including a 12 credit project. Entry is for Engineering graduates only. Individual study programs, generally selected from the subjects listed below, are to be approved by the Director or his nominee. Although appropriate graduate level subjects may be taken from other schools within the University a minimum of half the coursework credits (ie 9 credits) are to be selected from subjects offered by the Centre for Biomedical Engineering (BIOM9xxx). The degree will normally comprise one year (two sessions) of full-time study or two years (4 sessions) of part-time study.

Session 1	Subjects	(March-June)
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Session 1 Sub	ojects (March-June)		
	ı	Notes	C
BIOM9028	Radiation Physics		3
BIOM9060	Biomedical Systems Analysis		3
BIOM9510	Introductory Biomechanics	(1)	3
BIOM9551	Biomechanics of Physical	• •	
	Rehabilitation	(2)	3
BIOM9561	Mechanical Properties of		
	Biomaterials	(2)	3
BIOM9601	Biomedical Applications of		
	Microprocessors 1	(3)	3
BIOM9621	Biological Signal Analysis		3
BIOM9701	Dynamics of the Cardiovascular		
	System		3
ELEC9411	Introductory Physiology for		
	Engineers	(4)	
BIOT7100	Biological Principles		3
Session 2 Sul	ojects (July-November)		3 3 3 3
BIOM9010	Biomedical Engineering Practice	(4)	2
BIOM9012	Biomedical Statistics	٠,	4
BIOM9027	Medical Imaging	(5)	4
BIOM9311	Mass Transfer in Medicine		4
BIOM9321	Physiological Fluid Mechanics		
BIOM9332	Biocompatibility		
BIOM9541	Mechanics of the Human Body	(2)	4
BIOM9602	Biomedical Applications of		
	Microprocessors II	(6)	3
BIOM9603	Static and Flow Cytometry	_	3

Notes:

BIOM9612

SAFE9533

BIOM9912

(1) For students with no mechanics background.

Electrical Safety

Project Report

- (2) These three electives vary according to session offered. BIOM9510, or equivalent, is prerequisite for BIOM9541, and BIOM9541 is prerequisite for BIOM9551.
- (3) Prerequisite BIOM9050 or equivalent. Class size restricted.

Medical Instrumentation

- (4) Highly Recommended for 8665 MEngSc students
- (5) Assumed knowledge/prerequisite BIOM9028
- (6) Subject follows on from BIOM9601
- (7) Credit value may change
- (8) Research project may be done concurrently with course work during the other sessions.
- (9) Compulsory

5445

Graduate Diploma in Biomedical Engineering

GradDip

Details of the recommended programs of study may be obtained from the Director of the Centre for Biomedical Engineering. Subjects from the Masters programs can be taken in the Graduate Diploma program subject to the approval of the the course coordinators.

Graduate Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

BIOM9010

Biomedical Engineering Practice

Staff Contact: Prof K. Schindhelm

C2 S2 L2

Note/s: Compulsory for all students

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

Staff Contact: Dr R. Odell

C4 S2 L3 T1

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

Staff Contact: Prof K. Schindhelm

C18

Note/s: Compulsory for all MBiomedE students.

Projects are undertaken at the Centre or other relevant institutions towards the end of the course. Topics are chosen in collaboration with a supervisor from the Centre.

BIOM9027

Medical Imaging

Staff Contact: A/Prof C.D. Bertram

C4 S2 L2 T2

Prerequisites: Assumed knowledge/prerequisites

BIOM9028, BIOM9010

Fundamentals of producing a medical image, image collection techniques, image reconstruction algorithms. Detailed examination of four main areas of medical imaging: Nuclear Medicine, Ultrasound, Diagnostic Radiology, Magnetic Resonance Imaging. Clinical application of each area.

BIOM9028

Radiation Physics

Staff Contact: A/Prof B.K. Milthorpe

C3 S1 L2 T1

Prerequisites: Mathematics at University year 1 level required.

Basic physics of interaction of photons and particles 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.

BIOM9040

Analogue Electronics for Biomedical Engineers

Staff Contact: Dr B.K. Milthorpe

C4 S1 L2 T2

Note/s: For students with no electronics background.

Basic theory of passive components, simple network analysis, small signal amplifiers, feedback and oscillators. operational amplifiers and their uses, analogue integrated circuits. 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**

Staff Contact: A/Prof B.K. Milthorpe

C4 S2 L2 T2

Prerequisite: BIOM9501, BIOM9040 or equivalents.

Note/s: Students should NOT have a digital electronics background.

Examination of the fundamental digital and analogue 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

Staff Contact: Dr R. Odell

C3 S1 L2 T1

Corequisite: BIOM9101 at least

Note/s: Mathematics background required.

Analysis of compartmental systems in biology and medicine. Applications include pharmacology, physiology and nuclear medicine. Topics include the mathematics of linear compartmental systems, non-linear systems, tracer methods, parameter estimation by fitting models to date, the optimum design of experiments, and methods of control.

BIOM9101

Mathematical Modelling for Biomedical Engineers

Staff Contact: Dr R. Odell

C4 S1 L3 T1

Note/s: Compulsory for Strand B students. This subject is also for students with 1 year university maths or less. Calculus Bridging Course is recommended for those with less.

Model formulation and validation. Ordinary differential equations. Laplace transforms. Partial differential equations. Fourier series. Numerical methods.

BIOM9311

Mass Transfer in Medicine

Staff Contact: Dr R. Odell

C4 S2 L2 T2

Mass transfer in the living organism and in extracorporeal medical devices. Principles of diffusion and convection. Models of gas transfer in the lung. Transfer of solutes at the capillary level. Haemodialysis, haemofiltration, plasma filtration and blood oxygenators. Transfer across the peritoneal membrane-dialysis or drug delivery. Drug delivery across the skin.

BIOM9321 Physiological Fluid Mechanics Staff Contact: A/Prof C.D. Bertram C4 S2 L2 T2

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

Staff Contact: Prof. K. Schindhelm

C3 S2 L2 T1

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

Staff Contact: Prof K. Schindhelm

C4 S1 L2 T2

Note/s: Highly recommended for Strand B students. This subject is for students with little or no previous computing experience.

Algorithm design and documentation, printer plotting, editing, using the VAX/Vms systems. Programming in FORTRAN and PASCAL languages. Overview of computing in biomedical engineering and hospitals. Automated patient monitoring and laboratory testing. Data storage and information retrieval.

BIOM9510

Introductory Biomechanics

Staff Contact: A/Prof C.D. Bertram

C3 S1 L2 T1

Note/s: Mechanics Bridging Course recommended for students with NO mechanics background.

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

Staff Contact: Prof N.L. Svensson

C3 SS L2 T1

Prerequisites: BIOM9510 and ANAT2111

Statics and dynamics of the musculoskeletal system: mathematical modelling and computer simulation, analysis of pathological situations.

BIOM9551

Biomechanics of Physical Rehabilitation

Staff Contact: Prof N.L. Svensson

C3 S1 L2 T1

Prerequisite: BIOM9541

Note/s: This subject is not offered on a regular basis.

The application of biomechanics principles to the areas ofperformance testing and assessment, physical therapy, design of rehabilitation equipment, design of internal and external prostheses and orthoses.

BIOM9561

Mechanical Properties of Biomaterials

Staff Contact: Prof N.L. Svensson

C3 SS L2 T1

Prerequisite: BIOM9510

Note/s: This subject is not offered on a regular basis.

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

Staff Contact: Dr A. Avolio

C3 S1 L3

Prerequisites: BIOM9040 and BIOM9050 or equivalents. Note/s: Excluded ELEC9406. A reasonably advanced background in microprocessors is required. Entry to course is by interview.

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

Staff Contact: Dr A. Avolio

C3 S2 L3

Prerequisite: BIOM9601

Note/s: A reasonably advanced background in microprocessors is required. Entry to course is by interview.

Data communication; serial and parallel ports; BIOS and DOS interrupts; interfacing to external 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

Staff Contact: A/Prof B.K. Milthorpe

C3 S2 L3

Note/s: Basic electronics/computing background required.

Technology, techniques and uses of flow and static 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.

BIOM9612

Medical Instrumentation

Staff Contact: A/Prof C.D. Bertram/ Dr A. Avolio

C3 S2 L2 T1

Prerequisite: BIOM9040 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 Staff Contact: A/Prof C.D.Bertram C3 S1 L3

Note/s: Basic electronics and mathematics background

required.

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

Staff Contact: A/Prof C.D. Bertram

C3 S1 L2 T1

Note/s: Some mathematics background desirable.

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.

BIOM9912

Project Report

C12

Centre for Manufacturing and Automation

Director:

Dr S.S. Leona

The Centre is located within the School of Mechanical and Manufacturing Engineering. Its main purpose is to offer short courses for professionals from industry to upgrade their technological and managerial skills

Centre for Photovoltaic Devices and Systems

Director:

Professor M. Green

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.

Centre for Remote Sensing and Geographic Information Systems

Director:

Dr A.K. Skidmore

Deputy Director:

Professor J.C. Trinder

The Centre for Remote Sensing and Geographic Information Systems is a joint multidisciplinary 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, in association with schools in the Faculties of Engineering and Applied Science supports graduate programs leading to the award of the degree of Master of Engineering Science 8641 or Master of Applied Science 8026 or the Graduate Diploma in Remote Sensing 5026 or 5496 in addition to supervision for the degree of Doctor of Philosophy. Students from a wide variety of backgrounds can undertake the programs which may include engineering, geography, geology, surveying, planning, biology and agricultural or environmental studies.

Entry into either the Faculty of Engineering or the Faculty of Applied Science depends on the background of the applicant and the orientation of the proposed program. The Schools involved in the Centre are the School of Geography in the Faculty of Applied Science and the School of Surveying in the Faculty of Engineering.

Centre for Wastewater Treatment

Director:

Professor T.D. Waite

The Centre for Wastewater Treatment was established with a grant provided by the Australian Water Advisory Council. Wastewater treatment is concerned with the application of research to the solution of problems of wastewater and its treatment. The Centre's program comprises grant projects. sponsored research projects, consultancies, education and training elements. As well as supporting research students. the Centre provides professional refresher and other continuing education courses.

Munro Centre for Civil and Environmental Engineering

Director:

Professor R. Fell

The Munro Centre for Civil and Environmental Engineering has been established in the School of Civil Engineering. Its purpose is to support the School, and to facilitate interactiion between the School, the engineering profession, industry and government. The Centre promotes ongoing education in civil and environmental engineering by organizing conferences, courses and seminars.

UNSW Groundwater Centre

Director:

Dr R.I. Acworth

The UNSW Groundwater Centre was established early in 1987 as a Federal National Centre (Centre for Groundwater Management and Hydrogeology). In 1992 the Centre was reorganized as a joint initiative of the Department of Applied Geology in the Faculty of Applied Science, and the School of Civil Engineering in the Faculty of Engineering, with the general objective of improving and continuing teaching technology and research in groundwater studies.

Information on the centre's courses is listed under the School of Civl Engineering section in this handbook or the School of Mines, Department of Applied Geology section in teh Faculty of Applied Science handbook. The following programs are available.

8021

Hydrogeology and Groundwater Management
Graduate Course

Master of Applied Science MAppSc

The Master of Applied Science degree is undertaken through the Department of Applied Geology in the Faculty of Applied Science.

8612 (Internal)

8614 (External)

Waste Management Graduate Course

Master of Engineering Science MEngSc

The Master of Engineering Science degree is undertaken through the School of Civil Engineering in the Faculty of Engineering.

5459 (Internal)

5498 (External)

Waste Management Graduate Diploma Course

Graduate Diploma GradDip

The Graduate Diploma is undertaken through the School of Civil Engineering in the Faculty of Engineering.

Servicing Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

The following subjects are offered by other Faculties at UNSW, and contribute as either part of courses contained in this handbook, or as electives.

Accounting

Accounting is a school in the Faculty of Commerce and Economics.

ACCT9001

Introduction to Accounting A Staff Contact: School Office S1 L1.5

Introduces 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

Staff Contact: School Office

S2 L1.5

Prerequisite: ACCT9001

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

ACCT9062

Accounting for Engineers

Staff Contact: School Office

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.

Anatomy

Anatomy is a school in the Faculty of Medicine.

ANAT2111

Introductory Anatomy

Staff Contact: Dr P. Pandey

F HPW6

Prerequisites: BIOS1011, BIOS1021

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

Biological Science

Biological Science is a school in the Faculty of Biological and Behavioural Sciences.

BIOS1021 Biology B

Staff Contact: Dr M.L. Augee

S2 L2 T4

Prerequisite: BIOS1011 (however, students without this prerequisite may seek the permission of the Co-ordinator of First Year Biology to enrol. Students enrolling in Environmental Engineering will be exempted)

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

Staff Contact: A/Prof B. Fox

S1 L2 T4

Prerequisite: BIOS1021 and MATH1032 or MATH1042 ornd MATH1021

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.

Biotechnology

Biotechnology is a department in the School of Applied Bioscience, Faculty of Applied Science.

BiOT7100 Biological Principles Staff Contact: Dr S Delaney

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

Chemical Engineering and Industrial Chemistry is a school in the Faculty of Applied Science.

CEIC0010

Mass Transfer and Material Balances Staff Contact: A/Prof M. Brungs

F L1 T1

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
Staff Contact: A/Prof N.R. Foster

SS L1.5 T.5

Particle characterization: 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

Staff Contact: Dr P. Crisp 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

CEIC5630

Industrial Water and Wastewater Engineering

Staff Contact: Prof A.G. Fane

C3 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.

CHEN3070 Process Control

Staff Contact: Dr D.C. Dixon

\$2 L2

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.

INDC4120

Chemistry of the Industrial Environment

Staff Contact: Dr P. Crisp

\$1 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.

Chemistry

Chemistry is a school in the Faculty of Science.

Level I

CHEM1002 Chemistry 1

Staff Contact: Dr P. Chia

F L3 T3

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

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

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.

CHEM1201 Chemistry 1B

Staff Contact: Dr P. Chia

S2 L3 T3

Prerequisites: CHEM1101

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

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

CHEM1806

Chemistry 1EE

Staff Contact: Dr P. Chia

S1 L2 T1

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

Staff Contact: Dr P. Chia

S1 L3 T3

Note/s: Excluded CHEM1101, CHEM1201, CHEM1002. Restricted to Course 3681.

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

Staff Contact: Dr P. Chia

S2 L3 T3

Note/s: Excluded CHEM1101, CHEM1201, CHEM1002. Restricted to Course 3730.

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.

Level II

CHEM2011

Physical Chemistry

Staff Contact: Prof R.F. Howe

S1 or S2 L3 T3

Prerequisites: CHEM1002, MATH1032 or MATH1042 or

MATH1011 and MATH1021

First, second and third laws of thermodynamics. Applications of thermodynamics. Chemical and phase equilibria. Solutions of electrolytes and nonelectrolytes. Principles and applications of electrochemistry. Reaction kinetics: order and molecularity; effect of temperature on reaction rate. Molecular energy levels. Structure of solids and solid surfaces.

CHEM2031

Inorganic Chemistry and Structure

Staff Contact: Dr N. Roberts

S1 or S2 L3 T3

Prerequisites: CHEM1002

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, properties and reactions of selected compounds of transition and main group elements.

CHEM2041

Chemical and Spectroscopic Analysis

Staff Contact: Dr G. Moran

S1 or S2 L3 T3

Prerequisites: CHEM1002, MATH1032 or MATH1042 or

MATH1011 and MATH1021

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

Level III

CHEM3311

Environmental Chemistry

Staff Contact: Dr W. Johnson

S2 L3 T3

Prerequisites: CHEM2011, CHEM2041

Note/s: Availability subject to demand

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

Economics

Economics is a school in the Faculty of Commerce and Economics.

ECON1103

Microeconomic Principles

Staff Contact: Dr E. Ahmad

S1 L2 T1.5

Prerequisite: HSC minimum mark required - Contemporary English 60, or 2 unit English (General) 60, or 2 unit English 53. or 3 unit English 1

Note/s: Excluded ECON1101 and ECON1102.

Introduction to economics as a social science, scarcity, resource allocation and opportunity cost. Consumer and producer behaviour as the basis for supply and demand analysis. Introduction to marginal analysis. Applications of supply and demand analysis. Efficiency concepts and market forces.

Fuel Technology

Fuel Technology is a department in the School of Chemical Engineering and Industrial Chemistry, Faculty of Applied Science.

FUEL0020

Fuels and Energy

Staff Contact: A/Prof G. Sergeant

S2 L3 T1

A servicing subject for students in Electrical Engineering which covers the topics, 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.

FUEL5880

Unit Operations in Wastewater, Sludge and Solid Waste Management

Staff Contact: A/Prof G. Sergeant

C3

Please see subject description for FUEL5881.

FUEL5881

Unit Operations in Wastewater, Sludge and Solid Waste Management

Staff Contact: A/Prof G. Sergeant

C3

Note/s: FUEL5881 is for external students

Physical wastewater treatment processes including sedimentation, flotation, flocculation, pecipitation. Sludge management including conditioning, filtering, lagoons, drying. Introductory fuel engineering. Combustion principles. Incineration. Pyrolysis. Gasification. Resource recovery and recycling. Incinerator and afterburner design.

FUEL5910

Atmospheric Pollution and Control (Theory)

Staff Contact: A/Prof G. Sergeant

C3 S1 or S2 L3

Causes, properties, dispersion, measurement and monitoring control and legislation of air pollution in ambient and industrial environments.

Geography

Geography is a school in the Faculty of Applied Science.

GEOG1031

Environmental Processes

Staff Contact: A/Profs M. Fox & M. Melville, & Mr A. Evans S2 L2 T2

Note/s: Excluded 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, and to movement of materials.

GEOG2021

Introduction to Remote Sensing

Staff Contact: Mr A. Evans

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

Staff Contact: Dr W. Erskine, Dr I. Prosser S2 L2 T2

Prerequisites: GEOG3051

Drainage basin processes including: weathering, the production of runoff and sediment, sediment tracing, sediment budgets and denudation histories. The processes of river channel change including sediment transport, hydraulics, hydrogeology, hydraulic geometry and channel patterns and floodplain formation. There will be an emphasis on the application of geomorphic principles to land management.

GEOG3011

Pedology

Staff Contact: A/Prof M. Melville

Prerequisites: GEOG1031 or GEOG1051 and one of CHEM1101 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

Staff Contact: A/Profs J. Dodson & M. Fox

S1 L2 T2

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

Staff Contact: Mr A. Evans

S1 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

Staff Contact: A/Prof B. Garner and Dr W. Erskine

Prerequisites: GEOG1031 or GEOG1051 or by permission from Head of School

Rationale and basic objectives; history and legislative framework; standardized types of environmental impact assessment EIA, including matrix approach, adopted methods of EIA in Australia. 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 ElAs.

GEOG3051

Soils and Landforms

Staff Contact: Drs W. Erskine & I. Prosser

S1 L2 T2

Prerequisite: GEOG1031 or GEOG1051

An introduction to soil classification schemes with particular emphasis on the soils and landforms of floodplains and the Riverina Plain, NSW. Long term development of landscapes with emphasis on the evolution of mountain ranges. Arid zone and coastal landforms emphasising currrent processes and Quaternary history.

GEOG3062

Environmental Change

Staff Contact: A/Prof J. Dodson

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

Staff Contact: A/Prof M. Fox and Dr I. Prosser

Prerequisite: GEOG1051 or GEOG1031

The characteristics of Australia's physical and biotic environment: geology, climate, geomorphology, soils, vegetation and fauna. The problems of exploiting Australia's water and land resources including the degradation of land by erosion, salinization and soil fertility decline; and habitat loss and fragmentation

GEOG9150

Remote Sensing Applications

Staff Contact: Drs A. Skidmore, Q. Zhou and Mr A. Evans C3 S1 L1 T2

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

Staff Contact: Prof B. Garner C3 S1 L2 T2

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.

GF0G9240

Principles of Geographic Information Systems

Staff Contact: Dr Q Zhou

C3 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.

GEOG9290

Image Analysis in Remote Sensing

Staff Contact: Dr A. Skidmore and Mr A. Evans C3 S1 L1 T1

Techniques for extracting information from satellite imagery including image enhancement techniques, classification and feature recognition, statistical methods and related procedures. Emphasis is on applications relating to vegetation cover and natural resource management. Practical work will be undertaken using the ERDAS image processing software.

GEOG9300

Vegetation Management

Staff Contact: A/Profs J. Dodson & M. Fox, & Dr A. Skidmore C3 S1 L2 T1

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

Staff Contact: Dr W. Erskine

C3 S1 L2 T1

Note/s: Fieldwork forms a compulsory part of this subject and students will incur personal costs.

The principles of river management including total or integrated catchment management, environment impact assessment, in-stream uses and hydrogeomorphic behaviour. Issues covered include regulated rivers, 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

Staff Contact: A/Prof M. Melville & Dr W. Erskine

C3 S2 L2 T1

Note/s: Fieldwork forms a compulsory part of this subject and students will incur personal costs.

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.

Applied Geology

Applied Geology is a department in the School of Mines, Faculty of Applied Science.

GEOL 5100

Geology for Civil and Environmental Engineers

Staff Contact: Dr P.G. Lennox

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.

GEOL5311 Geology for Mining Engineers 2 Staff Contact: Dr M.B. Katz

Note/s: Fieldwork of up to 1 day is a compulsory part of this subject. Students will incur personal costs.

Stratigraphy and the use of fossils. Structural Geology including stereographic projection and fracture analysis as applied to mining operations. Origin and properties of coal, oil, oil shale and natural gas. Principles of hydrogeology including the significance of groundwater in mining operations. Mineralogy of important metallic and non-metallic resources, processes of ore formation. Exploration methods.

GEOL9010

Groundwater Environments

Staff Contact: Dr J. Jankowski/Dr R.I. Acworth C3 S1

Physical properties of groundwater. Darcy flow; hydraulic conductivity - field and laboratory methods; storage and transmissivity; flow nets - local and regional flow systems. Drilling methods; well design and completion; well development; pumping tests and interpretation. Study of the detailed occurrence; methods of development and environmental problems associated with groundwater, in aguifer systems of importance to Australia. Environments will include fractured rock systems (upland salinity); the Murray-Darling Basin; The Great Artesian Basin; Oceanic Islands and coastal aquifers and karstic aquifer systems.

GEOL9011

Hydrogeology

Staff Contact: Dr J. Jankowski/Dr R.I. Acworth C3 S1 L1.5 T1.5

Physical properties of groundwater. Darcy flow; hydraulic conductivity - field and laboratory tests. Storage and transmissivity: flow nets: local and regional flow systems. Drilling methods well design and completion; well development; pumping tests and interpretation. Groundwater chemistry. Introduction to contamination. Geophysical methods for groundwater investigation. Groundwater modelling - finite difference methods. Introduction to remote sensing for groundwater.

GEOL9012

Contaminant Hydrogeology

Staff Contact: Dr J. Jankowski/Dr R.I. Acworth

Sources of groundwater contamination; groundwater quality investigation; groundwater sampling procedures at contaminated sites; water quality criteria and review of Australian legislation. Hydrochemical modelling for inorganic and organic contaminant plumes; analytical and numerical approaches to modelling contaminant transport, dispersion, diffusion, adsorption and desorption processes. Groundwater restoration; site remediation. Occupational health and safety issues. Case studies in contaminant hydrogeology; practical field techniques; drilling, probing, piezometer installation, pumping equipment and sampling procedures, slug and tracer tests.

GEOL9030 Geological Engineering Staff Contact: Mr G. McNally C3 S1 L1.5 T1.5

Geomechanical properties of intact rock. Geomechanical properties of discontinuities and rock masses. Weathering processes and geotechnical consequences. Engineering classification of rock masses. Excavation - rippability. mechanical excavation of tunnels, surface and tunnel blasting. Rock support for shallow underground structures. Dam engineering, dam size geology, embankment zoning, foundation treatment and grouting, materials selection and specificaiton, dispersive soils and filter design. Foundations on rock, buildings, temporary support of open excavations.

GEOL9060

Environmental Geology Staff Contact: Mr G. McNally C3 S1 L1.5 T1.5

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, uyse 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. Evironmental impact of dams, road, explorative and extractive stages of mining, impact statement techniques, case studies. Communication of geological information to technical and non-technical people. Geological lesislation for water resources and waste disposal.

GEOL9110

Hydro and Environmental Geology

Staff Contact: Prof G. Hocking/Dr J. Jankowski/ Dr I. Acworth S2 L2 T1

Prerequisite: GEOL5100

Note/s: Field work of up to two days is a compulsory part of this subject. Students will incur personal costs.

Hydraulics of groundwater in fractured rock, Hydrodynamic dispersion of contaminants in porous 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 radioactive waste disposal, deep well injections. Geological hazards and urban planning. Impact of dams, mineral exploration, mining and impact statement techniques. Land use conflicts. Coastal Geology: Properties of sedimentary populations. Sampling practices. Geological significance of sediment parameters. The shoreline's processes, littoral and longshore drifts and net sand movement.

Groundwater Contaminant Transport

Staff Contact: Dr J. Jankowski

S1 L2 T1

Prerequisites: GEOL9110

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 groundwater and hydrochemical facies in aquifers. 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 aquifers. Modelling low permeability materials. Analogue, analytical and numerical model forms. Stochastic modelling and characterisation of variability. Modelling multiphase. immiscible fluids, and regional groundwater flow. Applications of modelling to bore-field management. saltwater intrusion, mine dewatering, waste disposal and contaminant transport.

Industrial Relations and Organizational Behaviour

Industrial Relations and Organizational Behaviour is a School in the Faculty of Commerce and Economics.

IROB2721 Managing People Staff Contact: Dr A. Donovan S1 L2 T2

Managing in a rapidly changing environment. Leadership, decision-making and innovation. Power, legitimacy, and the socialization process. The structure and design of organizations, organization and domination, the evolution of ethical awareness. Intergroup conflict and conflict resolution. Skills of managing: communication, negotiation, coaching and objectives setting. Organizational culture and transformation.

IROB5701 Industrial Relations A Staff Contact: A/Prof B. Dabscheck C3 S1 L3

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.

Information, Library and Archive Studies

Information, Library and Archive Studies is a school in the Faculty of Professional Studies.

LIBS0815

Economics of Information Systems Staff Contact: A/Prof C.J. Maguire S1 HPW2

Information as a resource. Effects of information technology on work and the distribution of wealth. Copyright, patents, licences and other systems aimed at ensuring appropriability of economic benefits from information. Market research and the pricing and distribution of information products and services.

LIBS0817

Information Storage and Retrieval Systems Staff Contact: Mrs C.S. Wilson

S2 HPW3

Automatic indexing; Automatic thesaurus construction and maintenance; Online searching and information retrieval; Database construction and database software evaluation; Advanced information retrieval techniques; systems analyis, design and costing; advanced technologies for information storage and retrieval.

Law

LAWS1010

Litigation

Staff Contact: Dr Jill Hunter

C6 F HPW4

An introduction to issues and problems in three areas:

Civil pre-trial procedure: focus on selected topics - parties to an action; pleadings and the discovery and exchange of information. Supreme Court Rules are examined to determine the extent to which they facilitate just, accurate and speedy resolution of disputes. Problems of delay and cost are addressed with particular reference to case-flow management techniques and alternative dispute resolution.

Criminal procedure: the law and related issues associated with arrest, the use of warrants, police searches, interrogation and the formulation of pleadings. Comparisons drawn between the civil and criminal pre-trial processes.

Evidence: a basic understanding of the legal and philosophical principles related to the presentation of evidence in court. In particular, examination of the rules designed to protect the accused at trial; the rule against hearsay evidence; the use of expert evidence; the treatment of unreliable evidence and some analysis of the philosophy of proof and probability theory.

The effect of pre-trial procedures on the final outcome at trial highlighted.

LAWS1120 **Legal System Torts** Staff Contact: Mr Robert Shellev C6 F HPW4

The legal significance of the arrival of the British in Australia; the principal institutions of the legal system, particularly the courts, the legislature, and the executive arms of government; the judiciary; the legal profession; their history, roles, interrelationships, operation and techniques; general constitutional principles and institutions; the notion and consequences of federalism; Bill of Rights proposals; precedent and statutory interpretation, practice and theory; sources of Australian law, including the past and present status of Aboriginal customary law; origins of the common law: classifications within the common law; jurisdiction of Australian courts: the development of compensation law. with particular reference to workers' compensation and occupational health and safety; modern statutory compensation schemes; the rules and concepts of the law of torts, their origins, growth, operation and limitations; tort law protection from assault, injury and death; negligence; interests in another's life and services; false and misleading statements affecting economic interests; loss distribution; employers' liability; occupiers' liability; causation; remoteness of damage; product liability; interference with interests in land; interference with personal liberty. Some of these topics are dealt with in outline only.

LAWS1410 Contracts Staff Contact: Mr Denis Harley C6 F HPW4

This course examines the nature of contractual obligations and how parties make and break contracts.

Topics include: how contracts are formed and the necessary elements of a validly constituted contract; express and implied terms of a contract and how such terms are imported into the contract; how courts interpret the terms of a contract: the consequences where a contract is induced by misrepresentation, mistake unconscionability; exemption clauses; estoppel and contract: contracts which are illegal under statute or contrary to public policy; remedies for breach of contract and the damages payable for such breach.

Students are encouraged to examine the role of contract law from an historical and contemporary standpoint.

LAWS1610 Criminal Law Staff Contact: A/Prof David Brown C6 F HPW4

The principles of criminal law and criminal liability. Aims to: promote and refine research and social policy analysis skills; develop a rigorous analytic and socially oriented approach to the study of criminal law; investigate the constitution of concepts like crime, criminal and criminal law; question traditional approaches which assume a unified set of general principles; suggest an approach to criminal law as a number of diverse fields of regulation; acknowledge the importance of forms of regulation outside the criminal law; examine empirical material on the actual operation of the N.S.W. criminal process such as court statistics and a court observation exercise; examine the substantive rules developed in selected criminal offence areas; stress the importance and relevance of criminal law in an understanding of law, even (and especially) for those who do not intend to practise in the area. Topics include: the phenomenon of crime, the criminal process, criminal responsibility, homicide offences, public order offences, drug offences, offences against the person, offences of dishonest acquisition, general defences, complicity, conspiracy, sentencing and penal practices.

LAWS2150 Federal Constitutional Law Staff Contact: Prof George Winterton C3 S1 or S2 HPW4

Federal constitutional law, stressing the legislative and judicial powers of the Commonwealth and the judicial interpretation by the High Court of the extent of those powers, in particular: trade and commerce, external affairs, corporations, appropriation, grants and taxation powers, family law and industrial law powers, inconsistency of Commonwealth and State laws, freedom of interstate trade and commerce, excise and implied limitations on Commonwealth and State powers. Techniques and approaches adopted by the High Court in interpreting the Australian Constitution, and occasionally, federal executive

Further study of constitutional law may be undertaken in LAWS2100 The High Court of Australia.

LAWS2160 Administrative Law Staff Contact: Ms Melinda Jones C3 S1 or S2 HPW4

This course considers the law concerning the accountability and control of government officials. Topics covered include: the principles of responsible government and separation of powers; the regulation of delegated legislation; the problem of corruption; the duty to give reasons for administration decisions; freedom of information, the Ombudsman, the Administrative Appeals Tribunal; and judicial review of administrative action [the principles of legality and procedural fairness].

LAW\$3010 Property and Equity Staff Contact: Dr Chris Rossiter C6 F HPW4

The basic principles of the law of property, transcending the traditional boundaries of real and personal property. For reasons of time and convenience, most topics are those usually considered in the context of 'real property'.

Enquiry into the meaning of the concepts of property and the purposes that are or ought to be fulfilled by the law of property. Some of the traditional concepts and classifications adopted by the common law in the content of the study of fixtures. Topics: possession as a proprietary interest in land and goods; some basic concepts such as seisin and title; the fragmentation of proprietary interests, including the doctrines of tenure and estates; an introduction to future interests; the development of legal and equitable interests, including a comparative treatment of their nature, extent and sphere of enforceability and an introduction to trusts; legal and equitable remedies; the statutory regulation of proprietary interests in land, including an examination of the Torrens and deeds registration systems; co-ownership; an introduction to security interests; the acquisition of proprietary interests; the alienability of interests including trusts for sale; commercial transactions involving leasehold estates in land and bailment of goods.

LAWS3410 Environmental Law Staff Contact: A/Prof Gerard Rowe C3 SS HPW4

This subject examines environmental law in both a theoretical and a practical sense. From the theoretical point of view, environmental law is considered through interdisciplinary perspectives in a policy setting. The non-legal perspectives in terms of which environmental law is considered include ecology, economics and philosophy. The practical orientation of the course is toward developing an understanding of the legal framework for environmental decision making in Australia, particularly in N.S.W. Topics to be covered include the relevance of ecology to environmental law, environmental ethics, environmental economics, international environmental law, Commonwealth powers with respect to the environment, a range of Commonwealth and NSW legislation relating to the environment, and different legal techniques for enhancing protection of the environment (eg. regulation through the criminal law, through traditional common law techniques such as nuisance and private covenants, through economic incentive schemes, and through systems of consents and licenses). Alternative Dispute Resolution techniques will also be examined.

Attention is also paid to: (1) the part played by political and administrative discretion in the field of environmental decision-making, with some emphasis on the tensions which exist between various levels and arms of government; (2) the role of public participation in the decision making process; and (3) environmental law in other countries, particularly the U.S.

Students are encouraged to take an interest in topical environmental issues.

LAWS6210 Law, Lawyers and Society Staff Contact: Dr. Stan Ross C3 S1 or S2 HPW4

1. The lawyer-client relationship, including who exercises control and the lawyers' duties to accept work, to keep client confidences, to act competently and to avoid conflicts of interest; the social implications of lawyers' professional behaviour. 2. The adversary system of litigation and the lawyers' role therein, both generally and specifically as defence counsel and as prosecutor in criminal cases. 3. The structure of the profession and methods of regulation including discussion of the concept of professionalism, control of admission, discipline generally and conducting court specifically; selection and control of the judiciary. 4. Issues relating to the delivery of legal services, including specialization in lawyers' practice, the structure and availability of legal aid, the regulation of lawyers' fees, the extent of the lawyers' monopoly and the role of non-lawyers in delivering legal services.

LAWS7420 Legal Research and Writing 2 Staff Contact: Ms Irene Nemes C1 S2 HPW2

A revision of legal research skills acquired in LAWS741 Legal Research and Writing 1, particularly the use of Australian digests, law reform materials and indexes to legal periodicals. Practice in ascertaining delegated legislation, in using English, Commonwealth and US digests and in tracing recent amendments to case-law, statutes and regulations. Further instruction on the use of computers for retrieval of legal materials.

LAWS7430

Research Component

Staff Contact: A/Prof Adrian Brooks
Note/s: Taken after or concurrently with LAWS7420.

This subject must be taken either concurrently with or after LAWS7420 Legal Research and Writing 2, though students are advised where possible to complete Legal Research and Writing 2 first so that they have a command of the relevant research techniques. Students must select one from amongst the subjects for which they are enrolled in which a piece of assessable work (a research essay or moot) will be allocated for Research Component, and must submit a Research Component Form to the Administrative Assistant (Undergraduate) by the end of Week 4 in the Session in which they elect to undertake Research Component. This form must identify the subject in which the work for Research Component will be undertaken, and must be signed by the teacher in the subject. Students must attach to the completed research essay or moot submission a written research report, outlining the research methods adopted in preparation for the essay or moot. The piece of assessable work chosen for allocation to Research Component must be worth 30% of the total mark (in the case of a three-credit point subject, or 15% of the total mark in the case of a six-credit point subject). The assessment of Research Component will be made on the basis of the research report, in addition to the separate assessment of the essay or moot for the purpose of the subject selected. All subjects offered in the Law School are prima face available to Research Component students for this purpose. Where for compelling reason no provision for a suitable essay or moot is or can be made in a program of assessment of a particular subject, the teacher of that subject may ask the student to select another subject. There is no formal teaching in LAWS7430 Research Component and no credit points are awarded for it. It is compulsory for all students except those taking one or more of the Research Thesis electives (LAWS6510, LAWS6520, LAWS6530).

LAWS8320 Legal Theory Staff Contact: A/Prof Martin Krygier C3 S1 or S2 HPW4

Introduction to theoretical - particularly philosophicalquestions which underline the practical workings of the law. The course concentrates on questions to do with the reasoning, particularly the reasoning of judges, and of moral reasoning; and the interrelationships between law and morals and law and politics.

LAWS8820 Law and Social Theory Staff Contact: A/Prof Martin Krygier C3 S1 or S2 HPW4

Examination of sociological assumptions about law, about society, and about the relationships between law, legal institutions and social ordering. Topics include: The role and functions of law within modern society, the extent to which law embodies implicit social theories and the nature

of these theories, and the implications of empirical social research on our understanding of the place of law in society.

LAWS8320 and LAWS8820 form part of the compulsory core of the LLB and BJuris degree courses with respect to students who entered the Faculty in 1981 or later. Students are required to take one of these two subjects to fulfil compulsory requirements and are permitted to take the other as an elective.

Mathematics

Mathematics is a School in the Faculty of Science.

MATH1032 Mathematics 1

Staff Contact: School of Mathematics First Year Office

U2 F HPW6

Prerequisites: HSC exam score range required: 2 unit Mathematics (67-100)(from 1994 this will be 90-100) or 2 and 3 unit Mathematics (100-150) or 3 and 4 unit Mathematics (100-200) or MATH1011 (2 unit Mathematics in this instance 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 vear to vear.)

Note/s: Excluded MATH1011, MATH1021, MATH1042, ECON2200, ECON2201, ECON2202.

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

MATH1042

Higher Mathematics 1

Staff Contact: School of Mathematics First Year Office U2 F HPW6

Prerequisites: HSC exam score range required: 3 unit Mathematics (145-150) or 4 unit Mathematics (186-200) (these numbers may vary from year to year.)

Note/s: Excluded MATH1011, MATH1021, MATH1032,

ECON2200, ECON2201, ECON2202.

As for MATH1032 Mathematics 1, but in greater depth.

MATH1081

Discrete Mathematics

Staff Contact: School of Mathematics First Year Office U1 S1 or S2 HPW6

Prerequisites: As for MATH1032.

Corequisites: MATH1032 or MATH1042

Note/s: Excluded MATH1090.

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 Staff Contact: School of Mathematics First Year Office S1 HPW3

Corequisite: MATH1032 or MATH1042

Note/s: Excluded MATH1081. Restricted to combined degree course 3725.

The role of proof in mathematics, logical reasoning and implication, different types of proofs. Sets, algebra of sets, operations on sets, mathematical logic, truth tables, syntax, induction. Recursion, recursive logic, recurrence relations.

MATH2009

Engineering Mathematics 2 Staff Contact: School Office

F HPW4

Prerequisite: MATH1032

Note/s: Restricted to Combined degree courses 3681,

3730

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

Vector Calculus

Staff Contact: School Office U.5 S1 or S2 HPW2.5

Prerequisite: MATH1032 or MATH1042

Note/s: 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 Vector Analysis Staff Contact: School Office

U.5 S1 HPW2.5

Prerequisites: MATH1032 or MATH1042

Note/s: Excluded MATH2100.

As for MATH2100 but in greater depth.

MATH2120

Mathematical Methods for Differential Equations

Staff Contact: School Office U.5 S1 or S2 HPW2.5

Prerequisite: MATH1032 or MATH1042.

Note/s: Excluded MATH2130.

Introduction to qualitative and quantitative methods for ordinary and partial differential equations. The following topics are treated by example. Ordinary differential equations: linear with constant doefficients, first-order systems, singularities, boundary-value problems, eigenfunctions, Fourier series. Bessel's equation and Legendre's equation. Partial differential equations: characteristics, classification, wave equation, heat equation, Laplace's equations, separation of variables methods, applications of Bessel functions and Legendre polynomials.

MATH2130

Higher Mathematical Methods for Differential Equations

Staff Contact: School Office

U.5 S2 HPW2.5

Prerequisite: MATH1032 or MATH1042 with a mark of at

least 70

Note/s: Excluded MATH2120.

As for MATH2120 but in greater depth.

MATH2400

Finite Mathematics

Staff Contact: School Office

U.5 S1 HPW2

Prerequisite: MATH1032 or MATH1042

Note/s: MATH1081 Discrete Mathematics is advised.

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

Linear Algebra

Staff Contact: School Office U1 S1 or S2 HPW5 or F HPW2.5

Prerequisite: MATH1032 or MATH1042

Note/s: Excluded MATH2601.

Vector spaces, linear transformations, change of basis, inner products, orthogonalization, reflections and QR factorizations, Eigenvalues and eigenvectors, diagonalization. Jordan forms and fuctions of matrices. Applications to linear systems of differential equations, quadratics, rotations. Laplace transforms.

MATH2510

Real Analysis

Staff Contact: School Office

U.5 S1 or S2 HPW2.5

Prerequisite: MATH1032 or MATH1042

Note/s: Excluded MATH2610.

Multiple integrals, partial differentiation. Analysis of real valued functions of one and several variables.

MATH2520

Complex Analysis

Staff Contact: School Office

U.5 S1 or S2 HPW2.5

Prerequisite: MATH1032 or MATH1042

Note/s: Excluded MATH2620.

Analytic functions, Taylor and Laurent series, integrals. Cauchy's theorem, residues, evaluation of certain real integrals.

MATH2601

Higher Linear Algebra

Staff Contact: School Office

U1 S1 HPW5

Prerequisite: MATH1032 or MATH1042 with a mark of at least 70

least /U

Note/s: Excluded MATH2501. .

As for MATH2510, but in greater depth, and with additional material on unitary, self-adjoint and normal transformations.

MATH2610

Higher Real Analysis

Staff Contact: School Office

U.5 S1 HPW2.5

Prerequisite: MATH1032 or MATH1042 with a mark of at

least 70

Note/s: Excluded MATH2510.

As for MATH2510 Pure Mathematics 2 Real Analysis but in greater depth.

MATH2620

Higher Complex Analysis

Staff Contact: School Office

U.5 S1 or S2 HPW2.5

Prerequisite: MATH1032 or MATH1042 with a mark of at least 70

Note/s: Excluded MATH2520.

As for MATH2520 Pure Mathematics 2 Complex Analysis, but in greater depth.

MATH2801

Probability and Random Variables

Staff Contact: School Office

U1 S1 HPW4

Prerequisite: MATH1021(Cr) or MATH1032 or MATH1042 Note/s: Excluded MATH2819, MATH2841, MATH2901, BIOS2041.

Probability, random variables, standard discrete and continuous distributions, multivariate distributions, transformations, random sampling, sampling distributions, limit theorems.

MATH2810

Statistical Computing and Simulation

Staff Contact: School Office

U.5 S1 HPW2

Prerequisites: MATH1021(Cr) or MATH1032 or

MATH1042

Co-requisite: MATH2801

Note/s: Excluded MATH2910.

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

Basic Inference

Staff Contact: School Office

U1 S2 HPW4

Prerequisite: MATH2801

Note/s: Excluded MATH2921, MATH2841, MATH2819, BIOS2041.

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

Staff Contact: School Office

S1 HPW3

Prerequisite: MATH1032 or MATH1042

Note/s: Not available to Science students.

Introduction to probability theory, random variables and distribution functions, sampling distributions, including

those of t. chi2 and F. Estimation procedures, including confidence interval estimation with an emphasis on least squares and surveying problems, and computer based exercises.

MATH2830

Nonparametric Statistical Inference

Staff Contact: School Office

U.5 S2 HPW2

Prerequisite: MATH2801. Corequisite: MATH2821 Note/s: Excluded MATH2930.

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

Staff Contact: School Office

U1 F HPW2

Prerequisite: MATH1032

Note/s: Excluded MATH2841, MATH2801, MATH2821, MATH2901, MATH2921. Restricted to combined degree course 3681.

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, c2 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

Staff Contact: School Office

U1 F HPW2

Prerequisites: MATH1021(CR), MATH1032 or MATH1042 Note/s: Excluded MATH2801, MATH2821, MATH2901, MATH2921, MATH2819, BIOS2041.

An introduction to the theory of probability, with finite, discrete and continuous sample spaces. The standard univariate distributions: binomial, Poisson and normal, an introduction to multivariate distributions. Standard sampling distributions, including those of c2, 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 effect models.

MATH2849

Statistics SE1

Staff Contact: School Office

S2 HPW2

Prerequisite: MATH1032 or MATH1042 Note/s: Not available to Science students.

Introduction to probability theory, random variables and distribution functions; the binomial, Poisson and normal distributions in particular. Standard sampling distributions including those of c2, t and F.

MATH2859

Statistics SE2

Staff Contact: School Office

S1 HPW2

Prerequisite: MATH1032 or MATH1042 Note/s: Not available to Science students.

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

Staff Contact: School Office

S1 HPW2

Prerequisite: MATH1032 or MATH1042 Note/s: Not available to Science students.

Introduction to probability. Random variables. Elementary distribution. Statistical inference. Point estimation. Confidence intervals.

MATH2901

Higher Probability and Random Variables

Staff Contact: School Office

U1 S1 HPW4

Prerequisite: MATH1032 or MATH1042

Note/s: Excluded MATH2801, MATH2841, MATH2819,

BIOS2041.

As for MATH2801 but in greater depth.

MATH2910

Higher Statistical Computing and Simulation

Staff Contact: School Office

U.5 S1 HPW2

Prerequisite: MATH1032 or MATH1042.

Co-requisites: MATH2901 Note/s: Excluded MATH2810.

As for MATH2810 but in greater depth.

MATH2921

Higher Basic Inference

Staff Contact: School Office

U1 S2 HPW4

Prerequisite: MATH2901

Note/s: Excluded MATH2821, MATH2841, MATH2819,

BIOS2041.

As for MATH2821 but in greater depth.

MATH2930

Higher Nonparametric Statistical Inference

Staff Contact: School Office

U.5 S2 HPW2

Prerequisite: MATH2901.

Corequisite: MATH2921

Note/s: Excluded MATH2830.

As for MATH2830 but in greater depth.

MATH3101

Numerical Analysis

Staff Contact: School Office

U1 S1 HPW4

Note/s: Excluded MATH3141.

Analysis of some common numerical methods. Iterative methods for solving nonlinear equations; interpolation using polynomials, splines and trigonometric functions; least-squares approximation and orthogonal functions; numerical differentiation and integration: 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

Staff Contact: School Office

S2 HPW3.5

Prerequisites: MATH2100, MATH2501, MATH2510

Note/s: Excluded MATH2120, MATH2130, MATH3101.

Not available to Science Students.

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

Transform Methods

Staff Contact: School Office

U.5 S2 HPW2

Prerequisites: MATH2520

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.

MATH5045

Advanced Mathematics for Electrical Engineers

Boundary value problems in partial differential equations. Selected topics from complex variable analysis, integral transforms, and orthogonal functions and polynomials.

Materials Science and Engineering

Materials Science and Engineering is a school in the Faculty of Applied Science.

MATS1002

Microstructural Analysis

Staff Contact: Dr P. Krauklis

S2 L1 T2

Note/s: Restricted to combined degree course 3681

Specimen preparation techniques. Principles of optical micriscopy. Quantitative microscopy and sterology. Electron microscopy. Microchemical analysis.

MATS1042

Crystallography and X-Ray Diffraction

Staff Contact: Dr P. Munroe

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 analysis, stress measurement, X-ray fluorescence spectroscopy.

MATS1062

Mechanical Properties of Materials

Staff Contact: Dr P. Krauklis

S1 L2 T2

Prerequisite: MECH0130

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

Staff Contact: Dr B. Gleeson

S2 L2 T1

Prerequisite: PHY\$1002

Note/s: Restricted to combined degree course 3681

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

Staff Contact: Dr P. Krauklis

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

Staff Contact: Dr P. Krauklis

S1 L1 T2

Note/s: Restricted to combined degree course 3681

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.

S2 L1 T1

S1 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 equibilria Staff Contact: Dr A.G. Crosky

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

Staff Contact: Dr A.K. Hellier 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

Staff Contact: Dr A.G. Crosky S1 T3

Determination of equilibrium phase diagrams. Solidification processes in moulds Metallography of non-ferrous alloys.

Unit 4 Phase transformations Staff Contact: Dr B. Gleeson

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**

Staff Contact: School Office

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 Staff Contact: Dr A.G. Crosky 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 Staff Contact: Dr B. Gleeson

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 Staff Contact: Dr A.G. Crosky S1 L2 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 Staff Contact: Dr A.G. Crosky S1 or S2 L2 T1

Prerequisite: MATS9520

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 Electrical Engineers

Staff Contact: Dr S. Blairs S2 L3 T1

Prerequisite: PHYS2989

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.

Mines

Mining Engineering is a department in the School of Mines, Faculty of Applied Science.

MINE1131

Mining of Metalliferous Deposits

Staff Contact: Mr D Panich

S1 L3

Prerequisites: MINE0210, MINE1420, GEOL5211

Geology, mineralogy and physical characteristics of a mineral deposit. Mineralisation inventory: maps and sections. Determination of reserves. Choice between surface and underground mining: selection criteria. Mining methods in surface and underground operations. Mining sequence. Production planning and scheduling. Equipment selection: systems approach; types of equipment; selection type, capacity and number. Mining and ancillary operations. Productivity and operating costs. Health and safety. Communications and control. Rehabilitation.

MINE1132

Mining of Coal Deposits

Staff Contact: Dr A.K. Bhattacharyya

S1 L3

Prerequisites: MINE0210, MINE1420, GEOL5211

Geological factors, physical and mechanical characteristics of the seam, roof and floor. Maps and sections. Determination of reserves. Choice between surface and underground mining methods: selection criteria. Mining methods for surface and underground operations. Impact of surface constraints. Production planning and scheduling. Mining geometrics. Stability and support. Equipment selection: systems approach; types of equipment; selection of type, capacity and number. Mining and ancillary operations. Productivity and operating costs. Health and safety. Communications and control. Rehabilitation.

MINE1140

Geotechnical Engineering

Staff Contact: Dr A.K. Bhattacharyya

FL1T1

Prerequisites: MINE1231, MINE1232

Stresses around mine openings: magnitude and distribution, determination by analytical methods, analogue and mathematical modelling, in situ measurements. Energy changes caused by excavations. Initiation and propagation of failure in rock structures. Stability of excavations: natural and artificial supports, permanent and temporary supports. Design of support systems. Stability of rock slopes. Ground control measurements. Rockbursts. Outbursts in coal. Mining subsidence, nature effects, prediction and control.

MINE1231

Geomechanics A

Staff Contact: Dr V.S. Vutukuri

S2 L2 T2

Prerequisite: MATH1032, MINE0120

Rock mass, rock material and discontinuities. Geomechanical properties of discontinuities - orientation, spacing, persistence, roughness, apertures and filling. Rock mass classification. Rock strength and deformability, concepts and definitions, common laboratory strength tests, measurement of deformability by static tests, dynamic measurements, influence of time on rock deformation.

Strength criteria for isotropic and anisotropic rock material, shear behaviour of discontinuities, behaviour of rock masses containing discontinuities. Pre-mining state of stress and its measurement.

MINE1320

Fluid Mechanics and Thermodynamics

Staff Contact: Dr A.C. Partridge

F L1 T1

Prerequisites: MINE0110, MECH1300, PHYS1002,

MATH1032

Corequisite: MATH2001

Fluid properties, fluid statics, fluid flow - laminar and turbulent. Continuity equation, energy equation, momentum equation. Flow measurement. Pumps and pump characteristics. Energy losses in pipelines and open channels. Boundary layer theory. Dimensional analysis. Thermodynamic systems - states, processes and properties. Energy of a system, first and second laws of thermodynamics. Reversibility, ideal gas laws, cycles for heat engines, heat pumps, compressors and refrigerators, psychrometrics.

MINE1330

Bulk Materials Handling and Transport

Staff Contact: A/Prof G.C. Sen

S2 L1.5 T.5

Transport systems for minerals, waste and supplies. Descriptions and power requirements for: conveyors (belt and chain), rope haulage systems, free steered vehicles and locomotive haulage systems. Descriptions and pressure loss calculations for hydraulic and pneumatic transport systems. Mine winding systems for shafts: mechanics for hoisting; winding cycle diagrams; power requirements. Safety aspects and maintenance programs for haulage and winding systems.

MINE1420

Elements of Mining

Staff Contact: Mr D. Panich

S1 L1

Prerequisite: MINE0210

Note/s: Visits to mines and related undertakings are a

requirement of this subject.

Exploration. Development of mines, infrastructure requirements; environmental assessment. Ore body parameters for surface and underground mines; stratified and non-stratified deposits; mine layout for surface and underground operations; underground access; introduction of techniques of rock breakage and support for coal and metal mines; processing of minerals; disposal of overburden and rejects rehabilitation.

MINE1524

Mining Conservation

Staff Contact: Dr V.S. Vutukuri

C3 S1 or S2 L2 T2

The reclamation of excavated land; integration with operational stages of mining. Mining cycles of alluvial, strip, and open cuts. Land clearing. Stabilising the mined area. Socio-economic aspects of mining. Rehabilitation costs. Government regulations. Examination and evaluation of current operations.

MINE1530

Power Supply in Mines

Staff Contact: Dr C.R. Daly

S1 L1 T1

Prerequisites: MINE0310, MINE1320, PHYS2920,

ELEC0802

Electric power distribution, mine cables, switchgear. Flameproofing and intrinsic safety, fault protection. Oil hydraulic power. Fluid characteristics. Components and circuits. Pumps, motors, valves. Speed and torque control. Compressed air: generation, distribution, applications and equipment, compressors. Control theory, automatic control in mining.

MINE1630

Excavation Engineering (Blasting)

Staff Contact: AProf G.C. Sen

S1 L2

Percussive, rotary and hydraulic rock drilling equipment: applications and operating principles, maintenance. Drilling methods: in-the-hole hammer, diamond core, overburden, Odex. Theories of rock fragmentation by blasting. Types of explosives and their properties. Various initiation systems. Blasting accessories and their applications. Blast design in various underground and surface mining operations. Blasting hazards and precautionary measures. Protection of structures against blast induced ground vibrations and airblast. Alternatives to conventional explosives.

MINE1740 Mining Legislation

Staff Contact: Dr C.R. Daly

S2 L2

An appreciation of the laws relating to coal and metal mining practice and to safety and health in mines.

MINE1830

Mine Ventilation and Environment

Staff Contact: Dr V.S. Vutukuri

S2 L2 T2

Prerequisites: MINE0210, MINE1320, MINE1420

Mine ventilation - practice in mines, forces causing airflow, resistance of workings and distribution of mine air, network analysis, fans and their operation, auxiliary ventilation, economic size of airways. Ventilation surveys. Mine environment mine gases - hazards, occurrence, detection, monitoring and control. Airborne dust - physiological effects, sampling, measurement and analysis, sources and control. Ventilation planning - airflow requirements based on gaseous, airborne dust and heat.

Laboratory experiments.

MINE1940

Tunnel Engineering and Shaft Sinking

Staff Contact: A/Prof G.S. Sen

S1 L2

Scope for tunnels. Site investigation. Primary excavation in soft and hard ground. Drilling and blasting. Tunnelling shields, full face boring, partial face machines. Debris disposal. Temporary and permanent support. Ground stability. Sub-aqueous tunnels. Cut and cover tunnels, immersed tubes. Compressed air working. Environmental considerations. Tunnel services, ventilation, drainage and lighting for road and all-rail tunnels. Shaft sinking in different

ground conditions. Ground treatment before excavation. Shaft lining.

MINE2141

Mineral Economics

Staff Contact: Mr D. Panich

S1 L2

Prerequisites: MINE1131, MINE1132

Commodities. Supply and demand. business cycles. Exchange rates. Metal markets and hedging. Project financing including: Joint Ventures. Types of capital. Reporting by companies. Feasibility studies and mine evaluation. Determination of cut-off grades. Smelter returns, Marketing and sales contracts.

MINE2142

Mine Planning and Design

Staff Contact: Mr D. Panich

F L1 T2

Prerequisites: MINE1131, MINE1132

Corequisite: MINE2141

Interpretation of exploration data. Sampling. Estimation of resource and reserves: traditional and geostatistical methods. Mine planning parameters. Mine design. Equipment selection. Productivity. Capital and operating costs. Mine design project.

MINE3040

Mine Safety Engineering

Staff Contact: Dr V.S. Vutukuri

S2 L1.5 T1.5

Prerequisites: MINE 0210, MINE1420

Outburst in coal mines: occurrence, prediction and control. Mine explosions and their control: methane, coal dust. sulphide dust. Mine fires and their control: open fires, spontaneous combustion of coal and sulphide ores in underground mines, sealing off fires underground, fire fighting, recovery of sealed-off areas. Water in mines: inundations, inrushes, precautions. Radiation in mines: hazards, dosage, radon gas emission and sources, control of radiation. Safety in mines: accidents; types, causes, rates, prevention. Breathing apparatus; types, uses, physiological requirements. Emergency organisation and rescue work. Miners' diseases; prevention and treatment. Noise and its control in mines; properties of vibrations, measurement of sound, effects, sources, control. Illumination in mines; properties of light, light sources, illumination in underground and open cut mines, standards for mine lighting, photometry, design of lighting systems. Laboratory experiments.

MINE5355

Mine Fill Technology

Staff Contact: A/Prof E.G. Thomas

C3 S1 or S2 HPW3

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.

MINE7342 Minerals Engineering Processes Staff Contact: Dr A.C. Partridge F L1 T1

Objectives of mineral processing and coal preparation. Mine-mill interface. Properties of minerals and ores. Sampling and evaluation. Comminution: fracture, liberation, size criteria, energy-size relationships. Crushing and grinding. Screening and classifying. Concentration processes: density and other physical methods. Dissolution processes. Interfacial phenomena. Flotation. Liquid-solid separation: flocculation, thickening, filtration. Washability curves. Partition curves. Material balances. Performance prediction. Laboratory exercises.

MINE7440 Mineral Process Technology Staff Contact: Dr A.C. Partridge S1 L1.5 T.5

Feed characterisation: Float-sink separation, release analysis, tree procedure. Vector representation for samples: Mayer curves and release curves. Physics and chemistry of surfaces. Measurement of surface properties. On-stream and laboratory analyses and measurements. Laboratory and pilot testing. Flow-sheet design. Equipment selection and plant layout. Materials handling, storage and blending. Rejects and tailings disposal. Sampling: sampling theory, sources of error in sampling, design of sampling plants. Process optimisation and control. Incremental ash theory. Process modelling and simulation. Laboratory exercises.

Physiology and Pharmacology

Physiology and Pharmacology is a school in the Faculty of Medicine.

PHPH2112 Physiology 1

Staff Contact: Dr J. Morley

F HPW6

Prerequisites: BIOS1021; CHEM1002 or CHEM1011 and CHEM1201 or a credit level pass in CHEM1302 or CHEM1401 and CHEM1501; MATH1032 or MATH1042 or MATH1011 and MATH1021

Corequisite: BIOC2312 or BIOC2372

Note/s: From 1994, student numbers in Physiology 1 will be limited, and entry to the subject will be allocated on academic merit.

Introduces fundamental physiological principles, dealing first with basic cellular function in terms of chemical and physical principles, and, with the operation of the various specialized systems in the body, for example, the cardiovascular system; the respiratory system; the gastrointestinal system; the endocrine system; the nervous system. Includes a substantial series of practical class experiments on these different areas of physiology. This subject is taken by students enrolled in any of the Physiology program.

Physics

Physics is a school in the Faculty of Science.

Level 1

PHYS1002 Physics 1

Staff Contact: 1st Year Director

F L3 T3

Prerequisites: HSC Exam Score Range Required - 2 unit Mathematics 67-100, or 3 unit Mathematics 1-50, or 4 unit Mathematics 1-100 or (for PHYS1002 only) MATH1011, and 2 unit Science (Physics) 57-100, or 2 unit Science (Chemistry) 60-100, or 3 unit Science 90-150, or 4 unit Science 1-50, or PHYS1022 (In this instance 2 unit Mathematics refers to the 3 Unit Mathematics subject and does not refer to the subjects Mathematics in Society or Mathematics in Practice.)

Corequisite: MATH1021 or MATH1032

Motion of particles under the influence of mechanical, electrical, magnetic and gravitational forces. Force, inertial mass, energy, momentum, charge, potential, fields. Conservation principles applied to problems involving charge, energy and momentum. Application of Kirchoff's laws to AC and DC circuits. Uniform circular motion, Kepler's laws and rotational mechanics. Properties of matter: solids, liquids, gases. Application of wave theories to optical and acoustical phenomena such as interference, diffraction and polarization.

PHYS1919

Physics 1 (Mechanical Engineering)

Staff Contact: 1st Year Director

F L2 T2

Prerequisites: As for PHYS1002 Physics 1

Note/s: Excluded PHYS1002. For students in the School of Mechanical and Industrial Engineering.

Mechanics of intermolecular systems. Atomic structure of solids; forces and defects. Plasticity of solids. Fracture of solids. Thermal properties of solids, liquids and gases. Geometrical optics, optical instruments, interference and diffraction, polarization. Magnetic forces and fields, electromagnetic induction, electrostatics, direct-current circuits. Elementary circuit theory. Introduction to electronics and electronic devices. Boolean algebra; instrumentation.

PHYS1929

Physics 1 (Surveying)

Staff Contact: 1st Year Director

F L2 T2

Prerequisites: As for PHYS1002 Physics 1

Motion of particles under influence of mechanical, electrical, magnetic and gravitational forces. Force, mass, energy, momentum, charge, potential fields. Conservation principles applied to problems involving charge, energy and momentum. Applications of Kirchoff's laws to DC and AC circuits. Uniform circular motion, Kepler's laws and rotational mechanics. Geometrical optics, optical instruments. Application of wave theory to interference, diffraction and polarization.

PHYS1969

Physics 1 (Electrical Engineering)

Staff Contact: 1st Year Director

F L3 T3

Prerequisites: As for PHYS1002 Physics 1

Note/s: For students in the School of Electrical

Engineering.

Electrostatics, steady state currents, magnetostatics in vacuum, ferromagnetism, electromagnetic induction, transient currents. Vectors ,kinematics, particle dynamics, work and energy, the conservation of energy, conservation of linear momentum, rotational kinematics and dynamics, simple harmonic motion, gravitation. Temperature, heat and the first law of thermodynamics, kinetic theory of gases. Waves in elastic media, sound waves, geometrical optics, interference, diffraction, gratings and spectra, polarization.

PHYS1989

Physics 1 (Civil Engineering)

Staff Contact: 1st Year Director S1 L2 T2 and S2 L2 T1

Prerequisites: As for PHYS1002

Note/s: For students in the School of Civil Engineering. In all first year Civil Engineering undergraduate degree courses students are advised to attempt PHYS1989 Physics1CE but if timetabling difficulties arise or other exceptional circumstances prevail permission will be given to attempt PHYS1002 Physics 1. However, students who intend to apply for transfer to the Combined BE BSc degree program involving Level 2/3 Physics subjects must enrol in PHYS1002.

Mechanical concepts, properties of matter, atomic structure, elasticity, plasticity, fracture of solids; surface tension and viscosity of fluids, electrical and magnetic forces, DC and AC circuits, digital electronics. Simple harmonic motion. Acoustic and mechanical waves, attenuation, velocity of propagation. Elastic moduli. Non-destructive testing, instrumentation.

Level II

PHYS2001

Mechanics, and Computational Physics

Staff Contact: Executive Assistant

S1 L3 T1

Prerequisites: MATH1032, PHYS1002

Corequisite MATH2100
Note/s: Excluded PHYS2999.

Harmonic motion, systems of particles, central force problems, Lagrange's equations, coupled oscillations, travelling waves, pulses, energy and momentum transfer, computer operating systems, introduction to FORTRAN, libraries and software packages, use of computers to solve

problems in physics.

PHYS2011 Electromagnetism and Thermal Physics

Staff Contact: Executive Assistant

S2 L3 T1

Prerequisites: MATH1032, PHYS1002

Corequisite: MATH2100

Note/s: Excluded PHYS2999.

Electric field strength and potential, Gauss' law, Poisson's and Laplace's equations, capacitance, dielectrics and polarization, magnetism, electro-magnetic induction,

Maxwell's equations, electromagnetic waves. Laws of thermodynamics, kinetic theory, microscopic processes, entropy, solid state defects, Helmholtz and Gibbs functions, Maxwell's relations, phase diagrams, chemical and electrochemical potential.

PHYS2021

Quantum Physics and Relativity

Staff Contact: Executive Assistant

F L1.5 T.5

Prerequisites: MATH1032, PHYS1002

Note/s: Excluded PHYS2989.

Wave-particle duality. Operators, postulates of quantum mechanics. Applications – steps, barriers and tunnelling. H. atom. Orbital, spin angular momentum, magnetic moment. Spin orbit interaction. Molecules. LCAO, rotation and vibration. Introduction to statistical mechanics. The nucleus: properties, forces, models, fission and fusion. Special theory of relativity, simultaneity, time dilation, length contraction, momentum and energy.

PHYS2031

Laboratory

Staff Contact: Executive Assistant

U1 F HPW3

Prerequisites: PHYS1002, MATH1032

Note/s: Excluded PHYS2920.

Experimental investigations in a range of areas: x-ray diffraction, work function, semiconductor bandgap, Hall effect, carrier lifetimes, nuclear magnetic resonance, magnetic properties and electrostatics. Electronics bench experiments and tutorials on diodes, transistors, operational amplifiers, power supplies and digital electronics.

PHYS2959

Introductory Semiconductor Physics (Computer Engineering)

Staff Contact: Executive Assistant

S1 L1 T.5

Prerequisites: MATH1032, PHYS1969 or PHYS1002

Note/s: Excluded PHYS2021, PHYS2989.

Structural properties of solids; free electrons in metals; introductory quantum physics; band theory; semi-conductors in equilibrium.

PHYS2969

Physics of Measurement (Surveying)

Staff Contact: Executive Assistant

S1 L1 T2

Prerequisite: PHYS1929

Resolution, accuracy and sensitivity of instruments. Errors of observation; transducers; thermometry; electrical noise; mechanical design of apparatus; optical instruments; optical fibres: photometry; analogue-to-digital conversion and digital instruments. Measurements of very large and very small quantities.

PHYS2979

Electromagnetic Theory

Staff Contact: Executive Assistant

S1 L2 T1.5

Prerequisites: ELEC1011, PHYS1969

Corequisite: MATH2100

Electrostatics in vacuum and in dielectric materials. Electric current. Magnetostatics in vacuum and magnetic media,

magnetic materials and magnetic circuits. Time-varying fields. Capacitance and inductance calculations. General field concepts. Superconductivity, Maxwell's equation.

PHYS2989

Solid State Physics (Electrical Engineering)

Staff Contact: Executive Assistant

S1 L2.5 T2

Prerequisites: MATH1032, PHYS1969 or PHYS1002

Corequisite: MATH2100

The concepts of waves and particles, introductory quantum mechanics, atomic structure, optical spectra and atomic structure, structural properties of solids, band theory and its applications, uniform electronic semiconductors in equilibrium, excess carriers in semiconductors.

Mechanics and Thermal Physics (Electrical Engineering)

Staff Contact: Executive Assistant

F L1.5 T.5

Prerequisites: MATH1032, PHYS1969

Corequisite: MATH2100

Note/s: Excluded PHYS2001, PHYS2011.

Particle mechanics, harmonic motion, central force problems, systems of particles, Lagrange's equations with applications, coupled oscillations, wave equation. Thermodynamic laws, entropy, kinetic theory, M-B distribution, microscopic processes, Maxwell's relations. chemical potential, phase diagrams, multicomponent systems, electrochemical potential, statistics of defects in solids.

Level III

PHYS3010

Quantum Mechanics

Staff Contact: Executive Assistant

S1 L1.5 T.5

Prerequisite: PHYS2021 Corequisite: MATH2120

Foundation principles, harmonic oscillator systems, spherically symmetric systems, angular momentum, hydrogen atom, perturbation theory, variational methods,

identical particles, quantum theory of atoms.

PHYS3021

Statistical Mechanics and Solid State Physics

Staff Contact: Executive Assistant

S1 L3 T1

Prerequisites: MATH2120, PHYS2011, PHYS2021

Canonical distribution, paramagnetism, Einstein solid, ideal gas, equipartition, grand canonical ensemble, chemical potential, phase equilibria, Fermi and Bose statistics, Bose condensation, blackbody radiation. Crystal structure, bonding, lattice dynamics, phonons, free-electron models of metals, band theory, point defects, dislocations.

PHYS3030 Electromagnetism

Staff Contact: Executive Assistant

S1 L1.5 T.5

Prerequisites: MATH2100, MATH2120, PHYS2011

Electromagnetic fields; Maxwell's equations, Poynting theorem, electromagnetic potentials, electromagnetic waves. Reflection and transmission, Fresnel equations, waveguides, radiation fields, dipoles and antenna theory.

PHYS3041

Experimental Physics A

Staff Contact: Executive Assistant

FT4

Prerequisite: PHYS2031

Basic experimental techniques and analysis of results in the following areas: electricity, magnetism, diffraction optics including X-ray and electron diffraction, solid state physics. nuclear physics, atomic physics and spectroscopy, vacuum systems.

Town Planning

Town Planning is a school in the Faculty of Architecture.

PLAN9111 Town Planning

Staff Contact: Ms S. Thompson

S1 L2 T1

Introduction to the purpose, scope and application of planning. The urban planning process. Objectives and means of planning environmental policies, regional environmental plans, local environmental plans. Problems in planning: equitable distribution of resources. Environment and environmental impact statements. Planning law and administration. Future of cities, housing and transportation.

Polymer Science

Polymer Science is a department in the School of Chemical Engineering and Industrial Chemistry, Faculty of Applied Science.

POLY3010

Polymer Science

Staff Contact: A/Prof R. Burford

S1 L2 S2 Lab.4

Prerequisites: CHEM2011, CHEM2021, MATH2021,

MATH2819

Co- or prerequisites: INDC3090

Polymerization chemistry and processes. Step and radical chain polymerization. Ionic (including stereoregular) polymerization. Methods including bulk, suspension, emulsion, solution and gas phase polymerization. Industrially important polymers and their manufacture. Principles of analysis. Molecular weight distribution. Thermodynamics of polymer solutions. Polymer chain conformation. Viscoelasticity. Mechanical behaviour. Polymer morphology. Thermal behaviour and analysis. Chemistry and physics of elastomers. Elements of polymer compounding and fabrication. New polymers.

Safety Science is a department in the Faculty of Applied Science.

SAFE9213

Introduction to Safety Engineering M

Staff Contact: Dr R. Rosen

C3

Prerequisite: Assumed knowledge SAFE9011 or

PHYS1022

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, 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

Staff Contact: Dr K. Kothiyal

C3

Prerequisite: Assumed knowledge SAFE9011 or

PHYS1022

Note/s: A project forms a substantial proportion of the assessment for this subject.

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.

SAFE9232

Introduction to Occupational Health and Safety Law Staff Contact: Head of School

72

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

Effective Behaviour in Organisations

Staff Contact: Ms Dianne Gardner

Ċ3

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

Staff Contact: Prof Jean Cross

C

Effects of current flow and magnetic and electric fields; elementary circuit representation, typical supply situations; likely dangerous conditions; static electricity; hazardous locations; standards and codes of practice; treatment of electric shock. Electrical causes of fire and explosion; prevention of electrical accidents.

SAFE9543

Management of Dangerous Materials

Staff Contact: Dr C. Winder

C3

Prerequisite: Assumed knowledge 1st year Chemistry

Chemical legislation, regulatory assessment of chemicals, chemical information (labels/MSDs), workplace management of chemical safety (workplace assessment, exposure control, storage of chemicals, personal protection monitoring), emergency preparedness, pollution, management of hazardous wastes and disposal.

Conditions for the Award of Degrees

First Degrees

Rules, regulations and conditions for the award of *first degrees* are set out in the appropriate Faculty Handbooks.

For the full list of undergraduate courses and degrees offered see *Table of Courses by Faculty* (Undergraduate Study) in the Calendar.

The following is the list of higher degrees, graduate diplomas and graduate certificates of UNSW together with the publication in which the conditions for the award appear.

Higher Degrees

For details of graduate degrees by research and course work, arranged in faculty order, see UNSW Courses (by faculty) in the Calendar.

Title	Abbreviation	Calendar/Handbook
Higher Degrees		
Doctor of Science	DSc	Calendar
Doctor of Letters	DLitt	Calendar
Doctor of Laws	LLD	Calendar
Doctor of Education	EdD	Professional Studies
Doctor of Medicine	MD	Medicine
Doctor of Philosophy	PhD	Calendar and all handbooks
Master of Applied Science	MAppSc	Applied Science
Master of Architecture	MArch	Built Environment
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 Arts (Honours)	MA(Hons)	Arts and Social Sciences
Master of Art Theory	MArtTh '	College of Fine Arts
Master of Biomedical Engineering	MBiomedE	Engineering
Master of Building	MBuild	Built Environment
Master of the Built Environment	MBEnv	Built Environment
Master of the Built Environment (Building Conservation)	MBEnv	Built Environment
Master of Business Administration	MBA	AGSM

Title	Abbroviotion	Onlanded to all and
	Abbreviation	Calendar/Handbook
Higher Degrees (continued		•
Master of Business Administration		
(Executive)	MBA(Exec)	AGSM
Master of Business and Technology Master of Chemistry	MBT	Engineering
Master of Clinical Education	MChem MClinEd	Science* Medicine
Master of Cognitive Science	MCogSc	Engineering
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 Course and Earth	MConstMgt	Built Environment
Master of Couple and Family Therapy	MCFT	
Master of Defence Studies	MDefStud	University College
Master of Education	MEd	Professional Studies
Master of Education in Creative Arts	MEdCA	Professional Studies
Master of Education in Teaching	MEdTeach	Professional Studies
Master of Educational Administration		Professional Studies
Master of Engineering	ME	Applied Science
		Engineering University College
Master of Engineering without		Chiversity College
supervision	ME	Applied Science
		Engineering
Master of Engineering Science	MEngSc	Engineering
		Applied Science
Master of Environmental		University College
Engineering Science	MEnvEngSc	Engineering
Master of Environmental Studies	MEnvStudies	Applied Science
Master of Equity and Social		•••
Administration	MEqSocAdmin	_
Master of Fine Arts	MFA	College of Fine Arts
Master of Health Administration Master of Health Personnel	МНА	Professional Studies
Education	MHPEd	Medicine
Master of Health Planning	MHP	Professional Studies
Master of Higher Education	MHEd	Professional Studies
Master of Industrial Design	MID	Built Environment
Master of Information Science	MInfSc	Engineering
Master of International Social Development	MintSocDev	
Master of Medicine	MMed	Medicine
· ·	MLArch	Built Environment
Master of Landscape Planning	MLP	Built Environment
Master of Laws	LLM	Law
Master of Librarianship	MLib	Professional Studies
	MMgtEc	University College
	MMath MMed	Science* Medicine
	MMinMgmt	Applied Science
	MMus	Arts and Social Sciences
Master of Music (Honours)	MMus(Hons)	Arts and Social Sciences
Master of Optometry	MOptom	Science*
Master of Paediatrics	MPaed	Medicine
		Arts and Social Sciences
		Built Environment Medicine
		Medicine Professional Studies
		Medicine
•• •=		Science†

Title	Abbreviation	Calendar/Handbook
Higher Degrees (Continued)		
Master of Psychology (Clinical) Master of Psychotherapy Master of Real Estate	MPsychol MPsychotherapy MRE	Science† Medicine Built Environment
Master of Safety Science Master of Science	MSafetySc MSc	Applied Science Applied Science Built Environment Engineering Medicine Science*† University College
Master of Science without supervision	MSc	Applied Science Built Environment Engineering
Master of Science (Industrial Design) Master of Science and Society Master of Social Work Master of Sports Science Master of Sports Medicine Master of Statistics Master of Surgery Master of Surveying	MSc(IndDes) MScSoc MSW MSpSc MSpMed MStats MS MSurv	Built Environment Arts and Social Sciences Professional Studies Professional Studies Medicine Science* Medicine Engineering
Master of Surveying without supervision Master of Surveying Science Master of Taxation Master of Town Planning Graduate Diplomas	MSurv MSurvSc MtAX MTP	Engineering Engineering ATAX Built Environment
Graduate Diploma	GradDipC/F Therapy GradDipClinEd GradDipHPEd GradDipHEd GradDipHEd	AGSM Applied Science Architecture Arts and Social Sciences Commerce and Economics Engineering Medicine Professional Studies Science*† Professional Studies Medicine Medicine Professional Studies
·	GradDipIndMgt GradDipPaed GradDipSpMed DipEd DipIM-ArchivAdmin DipIM-Lib DipFDA	Engineering Medicine Medicine Professional Studies Professional Studies Professional Studies Science*
Graduate Certificates		
*Faculty of Science.	GradCertPhilT GradCertHEd	Arts and Social Sciences Professional Studies

^{*}Faculty of Science.

[†]Faculty of Biological and Behavioural Sciences.

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 organization 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 and Social Sciences 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;
- (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.

Examination

- 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.
- (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.

Fees

7. A candidate shall pay such fees as may be determined from time to time by the Council. Note: All new PhD candidates in the Faculty of Engineering must complete and pass three subjects as approved by the Head of School, normally in the first year of candidature.

Master of Biomedical Engineering (MBiomedE)

 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.

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 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 at least two calendar months before the commencement of the session in which the enrolment is to begin.
- (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 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

A candidate shall pay such fees as may be determined from time to time by the Council.

Note: All new research masters candidates in the Faculty of Engineering must complete and pass three subjects as approved by the Head of School, normally in the first year of candidature.

Master of Business and Technology (MBT)

1. The degree of Master of Business and Technology by formal course work may be awarded by the Council to a candidate who has satisfactorily completed a pro gram of advanced study.

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 Higher Degree Committee of the Faculty of Engineering (hereinafter referred to as the Committee).
- (2) A candidate for the Master of Business and Technology shall obtain a grade point average of at least credit in the Graduate Diploma in Industrial Management at the first attempt of each of the subjects. Candidates will then be granted advanced standing in the Master of Business and Technology for the subjects already completed in the Graduate Diploma in Industrial Management.
- (3) 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.
- (4) 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 Graduate School of Engineering at least two calendar months before the commencement of the session in which enrolment is to begin.
- (2) A candidate for the degree 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 degree until the lapse of six academic sessions from the date of enrolment. The maximum period of candidature shall be ten academic sessions from the date of enrolment. In special cases a variation to these times may be granted by the Committee.

Fees

4. A candidate shall pay such fees as may be recommended from time to time by the Graduate School of Engineering.

Master of Cognitive Science (MCogSc) at Honours Level

1. The degree of Master of Cognitive Science at Honours level 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. The degree shall be awarded either with the grade of Honours Class 1 or with the grade of Honours Class 2.

Qualifications

- 2. (1) A candidate for the degree shall:
- (a) 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, and
- (b) have completed the requirements for the award of the degree at Pass level.
- (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 to carry out such work as it 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 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 Chair of the Master of Cognitive Science Management Committee (hereinafter referred to as the Chair of the Management Committee) 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 assessment 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 academic 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 Chair of the Management Committee 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 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 or external candidate. 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 four academic sessions from the date of enrolment. A part-time or external candidate for the degree shall present for examination not later than eight 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 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 on 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 theses or 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.

Examination

- 5.(1) There shall be not fewer than two examiners of the thesis, appointed by 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 thesis and shall recommend to the Committee that:
- (a) the candidate be awarded the degree either with Honours Class 1 or with Honours Class 2 without further examination; or
- (b) the candidate be awarded the degree either with Honours Class 1 or with Honours Class 2 without further examination subject to minor corrections as listed being made to the satisfaction of the head of the school*; 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; or
- (c) the candidate be awarded the degree either with Honours Class 1 or with Honours Class 2 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 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 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.

*'School' is used here and elsewhere in these conditions to mean any teaching unit authorized 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 teahcing unit.

Master of Cognitive Science (MCogSc) at Pass Level

1. The degree of Master of Cognitive Science at Pass level 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 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 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 at least two calendar months before the commencement of the session in which enrolment is to begin.
- (2) A candidate for the degree 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 degree until the lapse of four academic sessions from the date of enrolment. The maximum period of candidature shall be eight academic sessions from the date of enrolment. 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.

Master of Computer Science (MCompSc)

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.

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 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

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 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 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.

*'School' is used here and elsewhere in these conditions to mean any teaching unit authorized 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 teahcing unit.

(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 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 '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.; 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;
- (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.

Note: All new Masters research candidates in the Faculty of Engineering must complete and pass three subjects as approved by the Head of School, normally in the first year of candidature.

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 (or department) 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.

Examination

- 5.(1) There shall be not fewer than two examiners of the thesis, appointed by 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 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 department); 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 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).
- (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 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 an 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.
- (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 *Note: There is no 18 Credit Project in Surveying

- 4.(1) A candidate who undertakes an 18 credit project shall carry out the work on an approved topic supervised by a supervisor or supervisors or under other appropriate supervision arrangements approved by the Committee.
- (2) The candidate shall give in writing to the Registrar two months notice of intention to submit a project report.
- (3) The project report 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) 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 and theses for higher degrees.
- *'School' is used here and elsewhere in these conditions to mean any teaching unit authorized 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 teahcing unit.
- (5) It shall be understood that the University retains the three copies of the project report 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 Committee.
- (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 Environmental Engineering Science (MEnvEngSc)

1. The degree of Master of Environmental Engineering 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 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).
- (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 undertake such formal subjects and pass such assessment as prescribed and undertake an approved combination of the above and demonstrate ability to undertake research by submission of a project report embodying the results of an original investigation.
- (3) A candidate's proposed program shall be approved by the head of the School of Civil Engineering prior to enrolment.
- (4) 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) 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.
- (5) 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.

Fees

4. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Information Science (MInfSc)

 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 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 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 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 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.

Note: All new Masters research candidates in the Faculty of Engineering must complete and pass three subjects as approved by the Head of School, normally in the first year of candidature.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

Note: All new research masters candidates in the Faculty of Engineering must complete and pass three subjects as approved by the Head of School, normally in the first year of candidature.

Master of Surveying (MSurv) without supervision

See Master of Engineering.

Master of Surveying Science (MSurvSc)

See Master of Engineering Science.

Graduate Diploma (GradDip)

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.

Graduate Diploma in Industrial Management (GradDip)

1. The Graduate Diploma in Industrial Management 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) A candidate for the Graduate Diploma in Industrial Management shall obtain a grade point average of at least credit in the Industrial Management Qualification at the first attempt of each of the subjects. Candidates will then be granted advanced standing in the Graduate Diploma in Industrial Management for the subjects already completed in the Industrial Management Qualification
- (3) 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

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(4) 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 four sessions from the date of enrolment. The maximum period of candidature shall be six sessions from the date of enrolment. 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 recommended from time to time by the Graduate School of Engineering.

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 scholarships and prizes offered throughout the University. Applicants should note that the awards and conditions are subject to review.

Key: V Value T Year/s of Tenure C Conditions

Scholarships

Undergraduate Scholarships

Listed below is an outline in summary form of undergraduate 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.

General

Australian Development Corporation

- V Tuition fees. Some students may be eligible for airfares and a stipend.
- T Determined by normal course duration
- C Information should be obtained from Australian Diplomatic Posts. Conditions and entitlements vary depending on the home country. The closing date is normally early in the year before the year of study.

Sam Cracknell Memorial

- V Up to \$1500 pa payable in fortnightly instalments
- T 1 year

C 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.

Girls Realm Guild

- V Up to \$1500 pa
- T 1 year with the prospect of renewal subject to satisfactory progress and continued demonstration of need
- C 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

- V Up to \$6500 pa
- T 1 year renewable for the duration of the course subject to satisfactory progress
- C 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. Applications close 30 September each year. Apply directly to PO Box 460 Broken Hill NSW 2880

Alumni Association

- V Up to \$1500 pa
- T 1 year with the possibility of renewal
- C 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 international students.

Sporting Scholarships

- V \$2000 pa
- T 1 year with possibility of renewal
- C 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, The University of New South Wales, Kensington NSW 2052.

General Accident Australian Bicentennial St Andrews Scholarship

- V £Stq4840
- T approximately 12 months
- C Applicants should be Australian citizens who are proceding to Honours in Economics, History, Philosophy, Economic and Social History or Social Anthropology. The awards are for study at St Andrews, United Kingdom.

Engineering

Telecom Scholarship for Women in Electrical Engineering

- V Up to \$1000 pa
- T 1 year
- C Available to female students enrolled in Year 1 of the electrical Engineering degree course. Candidates must be residents of Australia.

Environmental Engineering

Connell Wagner Rankine and Hill

- V \$1500
- T 1 year only

C Available to students enrolled in Year 3 of the degree course in Environmental Engineering

Mechanical and Manufacturing Engineering

Rheem Australia Ltd

- V Up to \$2500 pa
- T 1 year renewable for the duration of the course, subject to satisfactory progress
- C Permanent residence in Australia. Applicants should be in their second-last (penultimate) or final year of the degree course in Mechanical or Manufacturing Engineering

Surveying

The Institution of Surveyors

- V Up to \$1000 pa
- T 1 year renewable for the duration of the course, subject to satisfactory progress
- C 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.

Surveyor Generals Scholarship for Women in Surveying

- V Up to \$2000 pa
- T 1 year
- C 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 \$9600 per annum in the following areas: Accounting (and Economics, Finance, Information Systems or Japanese Studies); Business Information Technology, Aerospace, Bioprocess, Ceramic, Chemical, Civil, Electrical, Environmental, Materials, Mechanical, Metallurgical, Mineral, Mining and Petroleum Engineering; Food Science and Technology, Industrial Chemistry, Manufacturing Management, Textile Management, Textile Technology, and Wool and Pastoral Science.

Graduate Scholarships

Listed below is an outline in summary form of Graduate Scholarships available to students. Application forms and further information are available from the Scholarships Unit and Student Centre, located on the Ground Floor of the Chancellery, unless an alternative contact address is provided. Normally applications become available four to six weeks before the closing date.

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;*

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. Applicants should note that the awards and conditions are subject to review.

*Available for reference in the University Library.

General

Australian Awards for Research in Asia (AARA)

- T 3 to 12 months
- C The awards are for postgraduate study or fieldwork in Cambodia, China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Sri Lanka, Taiwan, Thailand and Vietnam. Applicants must be Australian citizens, or have Permanent Resident status, and have lived in Australia for the 12 months prior to the close of applications on 30 June.

Cattex National Scholarship for Women

- V \$50,000 over two years
- T Up to 2 years
- C Applicants must be Australian citizens or have resided continuously in Australia for 5 years and have completed, or will complete, in 1994 an award from an Australian institution. Applicants may be proposing to undertake study in any discipline overseas. Application to the Honorary Secretary, Caltex National Scholarship, University by 17 September.

Kobe Steel Scholarship for Postgraduate Study at St Catherine's College, Oxford University

- V £14,520
- T Up to 2 years
- C Applicants must be Australian nationals. Applications close on 31 October with Kobe Steel Australia P/L (Level 32 Gateway, 1 Macquarie Place, 2000).

University Postgraduate Research **Scholarships**

- T 1-2 years for a Masters and 3-4 years for a PhD degree
- V Living allowance of \$14,474 pa. Other allowances may also be paid. Tax free.
- C Applicants must be honours graduates or equivalent in the Medicine or Commerce faculties, or the University College, Australian Defence Force Academy. A limited number of scholarships are offered subject to the availbility of funds. Information should be obtained from the Faculty office.

Australian Postgraduate Awards

- T 1-2 years for a Masters and 3-4 years for a PhD degree
- V \$11.687 to \$18.679 (1993 rates). Other allowances may also be paid. Tax free.
- C Applicants must be honours graduates or equivalent or scholars who will graduate in current academic year, and who are domiciled in Australia. Applications to Registrar by 31 October.

John Crawford Scholarship Scheme

- V Tuition fees. Some students may be eligible for air fares and a stipend.
- T Determined by normal course duration
- C Information should be obtained from Australian Diplomatic Posts. Conditions and entitlements vary depending on the home country.

Overseas Postgraduate Research Scholarships

- V Tuition fees only
- T 2 years for a Masters and 3 years for a PhD degree
- C Eligibility is confined to postgraduate research students who are citizens of countries other than Australia or New Zealand, Applications to the Registrar by 30 September.

Australian American Educational Foundation **Fulbright Award**

- V \$11,500 pa and travel expenses
- T 1 year, renewable
- C 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. Application forms are available from the Associate Registrar, University of Sydney, NSW 2006, telephone (02) 692 2222.

Australian Federation of University Women

- Amount varies, depending on award
- T Up to 1 year

C Applicants must be female graduates who are members of the Australian Federation of University Women. Further enquiries may be directed to the Secretary of the Federation, (telephone (02) 232 5629).

Commonwealth Scholarship and Fellowship Plan

- V Varies for each country. Generally covers travel, living, tuition fees, books and equipment, approved medical expenses. Marriage allowance may be payable.
- T Usually 2 years, sometimes 3
- C 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 early October.

The English-Speaking Union (NSW Branch)

- V \$8000
- T 1 year
- C 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, School of Arts, 275c Pitt Street, NSW 2000.

Frank Knox Memorial Stipend of Fellowships

- V \$US11,500 pa plus tuition fees
- T up to 2 years tenable at Harvard University
- C 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

- V Up to \$US 25,000
- T 1 vear
- C 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

- V \$6000 pa. Under special circumstances this may be increased.
- T 2 years
- C 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

V Living and travel allowances, tuition and research expenses, health insurance, book and equipment and other allowances for travel and study in the USA

- T 12 to 21 months
- C 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 35 years of age. Applications close 30 September 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

- V Living and travel allowances, tuition expenses
- T 1-3 years
- C Applicants must be Australian citizens who are honours graduates or equivalent, and under 26 years of age. Applications are available from The Secretary, Cambridge Commonwealth Trust, PO Box 252, Cambridge CB2 ITZ, England. The scholarship closes on 15 October.

The Rhodes Scholarship to Oxford University

- V Approximately \$15,000 pa and fees
- T 2 years, may be extended for a third year.
- C Unmarried Australian citizens aged between 19 and 25 who have an honours degree or equivalent. Applications close in September each year with The Secretary, University of Sydney, NSW 2006.

Engineering

Australian Institute of Nuclear Science and Engineering Studentships

- V To be advised
- T Up to 3 years
- C 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 Scholarships t leit

Energy Research and Development Corporation (ERDC) Postgraduate Awards

- V \$20,000 pa, tax free
- T Up to three years
- C ERDC awards are based on academic excellence or a proven track record of excellence, in research which indicates potential to contribute to the energy industry. Contact ERDC Postgraduate Award (06) 274 4804 for an application. Applications close 30 September

Harold G. Conde Memoriai Fellowship

- V \$5000 pa
- T Maximum of 3 years
- C 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. The scholarship is offered subject to funds.

Sir Robert Menzies Memorial Scholarships in Engineering, Law and Medicine for study in the **United Kingdom**

V Tuition fees and allowances for living, travel and equipment expenses

T Up to 2 years

C Applicants must be between 21 and 35 years of age and domiciled in Australia. Tenable at universities in the United Kingdom. Applications close 31 August with Sir Robert Menzies Memorial Trust, 210 Clarendon Street, East Melbourne, Vic 3002. Applications are available from the Scholarships Unit.

Land and Water Resources Research and **Development Corporation Research Award**

See above under Applied Science

Australian Telecommunications

Shell Scholarship in See below under Science

Prizes

Undergraduate University Prizes

The following information summarizes 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.

General

The Sydney Technical College Union Award

- V \$400.00 and Bronze Medal
- C Leadership in student affairs combined with marked academic proficiency by a graduand

The University of New South Wales Alumni

- V Statuette Association Prize
- C Achievement for community benefit by a student in the final or graduating year

Faculty of Engineering

The Institution of Engineers Australia Award

- V \$500.00 and medal
- C The best performance by a student in the final or equivalent year leading to the award of the BE or BSc(Eng) degrees offered by the Schools of Civil Engineering, Electrical Engineering and Computer Science, Mechanical and Manufacturing Engineering, Chemical Engineering and Industrial Chemistry, and the Departments of Mining Engineering and Textile Technology (Engineering option only)

The John Fraser Memorial Award

- V \$130.00
- C The best performance by a student 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

- V \$225.00
- C 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

- V \$175.00
- C The best performance in CIVL3303 Structural Design in the Bachelor of Engineering degree course in Civil Engineering

The Australian Conservation Foundation Prize

- V \$50.00
- C The best performance in the subjects which develop environmental management concepts for the Civil Engineer

The Australian Institute of Traffic Planning and Management Prize

- V \$150.00
- C The best performance in CiVL4844 Transport major in the Bachelor of Engineering degree course in Civil Engineering

The Baulderstone Hornibrook Prize

- V \$500.00
- C The best performance in Engineering Construction and Management in the Bachelor of Engineering degree course in Civil Engineering

The Computing and Graphics Prize (Donor P W Kneen)

- V \$400.00
- C The best performance in CIVL1106 Computing and Graphics by a student in the Bachelor of Engineering in Civil Engineering or Bachelor of Engineering in Environmental Engineering

The Crawford Munro Memorial Prize

- V \$300.00
- C The best performance in CIVL3705 Water Resources in the Bachelor of Engineering degree course in Civil Engineering

The GAA Engineering Award

V \$500.00

C The best performance in CIVL3303 Structural Design in the Bachelor of Engineering degree course in Civil Engineering

The GAA Engineering Award

- V \$500.00
- C The best essay on a topic relating to galvanising by a student proceeding to the award of the degree of Bachelor of Engineering in Civil Engineering

The Hardie's Pipeline Award

- V \$250.00 and plaque
- C The best performance in CIVL4605 Water Supply and Wastewater Disposal in the Bachelor of Engineering degree course in Civil Engineering

The Institution of Engineers Environmental Engineering Prize

- V \$200.00
- C The best performance in CIVL1007 Engineering Practice in the Bachelor of Engineering in Environmental Engineering course

The James Hardie Co Pty Ltd Prize

- V \$225.00
- C The best performance in CIVL2505 Hydraulics 1 in the Bachelor of Engineering degree course in Civil Engineering

The Jeffery and Katauskas Prize

- V \$500.00
- C The best performance in CIVL4822 Geotechnical Major in the Bachelor of Engineering degree course

The Welding Technology Institute of Australia Prize

- V Books to the value of \$200.00, 1 year membership of the Institute
- C 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

School of Computer Science and Engineering

The Logica Pty Limited Prize

- V \$1000.00
- C The best performance by a graduand in a Computer Science degree course at honours level

School of Electrical Engineering

The Electricity Supply Engineers' Association of New South Wales Prize

V \$100.00

C 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 Engineering

The Institution of Electrical Engineers NSW International Centre Prize

V \$100.00

C The best performance in Year 3 studies of the Bachelor of Engineering degree course in Electrical Engineeering

The Institution of Electrical Engineers UK Prize

V £75.00 and Certificate

C The best performance in the final year thesis/project by a student proceeding to the award of the degree of Bachelor of Engineering in Electrical Engineering

The J. Douglas Maclurcan Prize

V \$60.00 book order

C Outstanding performance in the field of Control Systems in the final year of the Bachelor of Engineering degree course in Electrical Engineering

The Telecom Australia Prize

V \$300.00

C 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

Photovoltaic Devices and Systems

The Photovoltaics Prize (Applied Photovoltaics)

V \$500.00

C The best performance in ELEC4540 Applied Photovoltaics in the Bachelor of Engineering degree course

The Photovoltaics Thesis Prize

V \$500.00

C The best performance for an undergraduate thesis in the area of photovoltaics in the Bachelor of Engineering degree course

The Photovoltaics Prize (Advanced Photovoltaics)

V \$500.00

C 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

School of Mechanical and **Manufacturing Engineering**

The Ansett Australia Prize

V \$200.00 and bronze medal

C The best overall performance in the Bachelor of Engineering degree course in Aerospace Engineering

The Atlas Copco Prize

V \$125.00

C The best overall performance in the Bachelor of Engineering degree course in Mechanical Engineering

The ABB Power Plants Prize

V Books to the value of \$100.00

The best performance in a subject selected by the Head of School

The Carrier Air Conditioning Pty Limited Prize

V \$250.00

C The best performance in a subject selected by the Head of School

The Computer-based Engineering Design Prize

V \$100.00

C The best undergraduate or postgraduate thesis making a contribution to computer-based Engineering design in the School of Mechanical and Manufacturing Engineering

The David Carment Memorial Prize

V \$500.00 and Bronze Medal

C The best overall performance in the final year of the Bachelor of Engineering degree course in Naval Architecture

The Pacific Power Award

V \$250.00

C The best performance in MECH4740 Thermal Power **Plants**

The Jeremy Hirschhorn Prize in Mechanical Engineering

V \$100.00

C The best performance by a final year student in Mechanics of Machines

The John Harrison Prize

- V \$100.00
- C The best performance in a subject selected by the Head of School

The R.A.A. Bryant Prize

- V \$1,000.00 (indexed per year since 1989)
- C A student graduating with first class honours and the University Medal in Mechanical Engineering

The R.E. Jeffries Memorial Prize

- V \$500.00
- C The best overall performance in the final year of the Bachelor of Engineering degree course in Manufacturing Management

The Royal Institution of Naval Architects (Australian Division) Prize

- V \$250.00
- C 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

- V \$100.00
- C 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

- V \$100.00
- C 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

- V \$100.00
- C The best performance in the subject MANF3400 Engineering Economics by a student in the Bachelor of Engineering degree course

The Shell Refining (Australia) Pty Ltd Prize

- V \$100.00
- C The best performance in a subject selected by the Head of School

The Spruson and Ferguson Prize

- V \$250.00
- C The best performance in MECH3100 Mechanical Engineering Design 3 by a student in the Bachelor of Engineering degree course in Mechanical Engineering

The Staedtler (Pacific) Pty Ltd Prize

- V Products to the value of \$350.00
- C 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

- V \$1000.00
- C The best overall performance in the Bachelor of Engineering degree course in Manufacturing Management

School of Surveying

The School of Surveying Prize

- V \$2000.00
- C The best overall performance by a first year woman student proceeding to second year in the Bachelor of Surveying course.

The Surveying and Mapping Industry Prize

- V \$2000.00
- C The best overall performance by a second year student proceeding to third year in the Bachelor of Surveying course.

The B.H.P. Engineering Prize in Surveying

- V \$2000.00
- C The best overall performance by a student in year 3 of the Bachelor of Surveying course proceeding to year 4.

The R. S. Mather Memorial Prize

- V \$250.00
- C The best performance in Geodesy subjects in the Bachelor of Surveying course.

The Australian Photogrammetric and Remote Sensing Society (NSW) prize

- V \$150.00
- C The best performance in Photogrammetric subjects in the Bachelor of Surveying course.

The Institution of Surveyors N.S.W. Incorporated Prizes

- V An inscribed plaque and books to the value of \$100
- C The best performance in the graduating year of the Bachelor of Surveying course.

The Board of Surveyor's Medal

- V Medal
- C The best performance in the final year of the Bachelor of Surveying course.

Graduate University Prizes

The following information summarizes graduate prizes awarded by the University.

School of Chemical Engineering and Industrial Chemistry

The Clean Air Society of Australia and New **Zealand Prize in Atmospheric Pollution Control**

V \$100.00

C 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

V \$50.00

C The best performance in Traffic Planning and Control

The Maunsells Project Report Prize

V \$500.00

C The best performance in CIVL8909 or CIVL9909 Project Report (9 credits) or GEOL9504 or GEOL9604 Project Report (9 credits) by a student in the Master of Engineering Science or Master of Applied Science degree courses

The Maunsells Waste Management Prize

V \$500.00

The best aggregate score

- CIVL8872/9872 Solid Waste Management
- CIVL8881/9881 Hazardous Waste Management

School of Mechanical and **Manufacturing Engineering**

The Computer-based Engineering Design Prize

V \$100.00

C The best undergraduate or graduate thesis making a contribution to computer-based Engineering design in the School of Mechanical and Industrial Engineering

Notes

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** lo Myers Studio D9 Keith Burrows Theatre J14 Mathews Theatres D23 Parade Theatre E3 Quadrangle Theatre E15 Macaulev Theatre (Main Building) K14 Rex Vowels Theatre F17 Science Theatre F13 Sir John Clancy Auditorium C24 Webster Theatre G15

Buildings

Applied Science F10 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 Colléges (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 Parking Station N18 Philip Baxter College (Kensington) D14 Quadrangle E15 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) E15 Accounting E15 Admissions C22 Adviser for Prospective Students C22 Alumni Relations: Pindari, 76 Wentworth St. Randwick Anatomy C27 Applied Bioscience D26 Applied Economic Research Centre F20 Applied Geology F10 Applied Science (Faculty Office) F10 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 E15 Biochemistry and Molecular Genetics D26 Biological and Behavioural Sciences (Faculty Office) D26 Biomedical Engineering F25 Biomedical Library F23 Biotechnology F25 Built Environment (Faculty Office) H14 Campus Services C22 Cashier's Office C22 Chaplains E4 Chemical Engineering and Industrial Chemistry F10 Chemistry E12 Civil Engineering H20 Co-op Bookshop E15 Commerce and Economics (Faculty Office) E15

Communications Law Centre C15 Community Medicine D26 Computer Science and Engineering G17 Computing Services Department F25 Cornea and Contact Lens Research Unit: 22-32 King St, Randwick Economics F20 Education Studies G2 Educational Testing Centre E4 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 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 Human Resources C22 Industrial Design G14 Industrial Relations and Organizational Behaviour F20 Information, Library & Archives Studies F23 Information Systems E15 Institute of Languages: 4 Francis St, Randwick International Student Centre F9 IPACE Institute F23 Japanese Economic and Management Studies E15 Kanga's House (Child Care) 014 Landscape Architecture K15 Law (Faculty Office) F21 Law Library F21 Legal Studies & Taxation F20 Liberal and General Studies C20 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 Music and Music Education B11 News Service C22 Optometry J12 Pathology C27 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 C22 Psychology F23 Publications Section C22 Remote Sensing K17 Safety Science B9 Science (Faculty Office) E12 Science and Technology Studies C20 Social Science and Policy C20 Social Policy Research Centre F25 Social Work G2 Sociology C20 Spanish and Latin American Studies C20 Sport and Recreation Centre B6 Squash Courts B7 Student Centre (off Library Lawn) C22 Student Services: Careers, Loans, Accommodation etc E15 Counselling E15 Students' Guild E15 Students' Union E15 Surveying K17 Swimming Pool **B4** Textile Technology G14 Theatre and Film Studies B10 Town Planning K15 UNSW Press: 22-32 King St, Randwick WHO Regional Training Centre C27 Wool and Animal Sciences G14 Works and Maintenance B14A